

SOUTH AFRICA'S IMPORT DEMAND FUNCTION WITH CHINA: A COINTEGRATION APPROACH

Russell E. Triplett, University of North Florida
Ranjini L. Thaver, Stetson University

ABSTRACT

During the past decade China has emerged as South Africa's largest trade partner. In an effort to understand this important and remarkable trend, we estimate South Africa's import demand function with China over the period 1993-2012. Specifying an error-correction model, we use the bounds testing approach of Pesaran, Shin and Smith (2001) and find evidence of long-run cointegration among the variables. Our long-run elasticity estimates suggest that income is the most important factor in the determination of South Africa's imports from China. Interestingly, the effect of the real relative price is positive, but this counterintuitive result is consistent with evidence from other middle-income countries. These combined factors imply that the South African trade deficit with China will continue to widen despite a real depreciation of the rand.

JEL: F10, F14

KEYWORDS: South Africa, China, Bilateral Trade, Elasticities, Cointegration

INTRODUCTION

In October 2000 South Africa, China and forty-three other African countries launched the Forum on China-Africa Cooperation (FOCAC), marking the beginning of modern China's turn towards Africa. During that year South Africa's imports from China, in real dollars, were valued at \$1.24 billion, representing 3.68% of all imports. By 2012 imports from China increased more than tenfold to \$13.9 billion, representing 15% of all imports (IMF, 2013; Çakir and Kabundi, 2013). This remarkable growth in the bilateral trade relationship between South Africa and China is but one of many indicators of China's increasing economic commitment to trade and invest in African countries, and it is emblematic of the emergence of significant "South-South" trade within the global trade pattern (Nayyar, 2008; Hanson, 2012).

China formalized its approach to "go global" as part of its tenth five-year plan in 2001, the same year it joined the World Trade Organization (WTO). Although the subject of continued debate, China's engagement with the economies of Sub-Saharan Africa (SSA) is informed by its own development experience, and it is characterized by a belief in mutual benefits and noninterference in countries' domestic policies (Ncube and Fairbanks, 2012; Aguillar, 2009; Brautigam, 2008, Taylor, 2006). These relationships are multifaceted, involving and affecting investment (Cheung, Haan, Qian and Yu, 2013; Sanfilippo, 2010; Kaplinsky and Morris, 2009), aid (Brautigam, 2008), migration (Mohan and Tan-Mullins, 2009), politics (Flores-Macias and Kreps, 2012; Hanusch, 2012), economic growth (Diaw and Lessona, 2013; Balamoune-Lutz, 2011) and trade (Tran, Diaw and Rieber, 2012; De Grauwe, 2012, Montinari and Prodi, 2011; Ademola, Bankole and Adewayi, 2009; Giovanni and Sanfilippo, 2009).

Yet Sub-Saharan Africa constitutes a diverse collection of economies, with distinct resources, populations, histories and economic structures. Consequentially, country-level studies provide an important level of detail and specificity that undermines sweeping generalizations. South Africa is SSA's largest and most

diversified economy, is China's largest African trading partner, and has joined China in the increasingly relevant BRICS (Brazil, Russia, India, China, South Africa) group of nations. This underscores the necessity of studying the drivers of the South Africa-China trade relationship to provide important insights into the effectiveness of trade and currency policies between the two countries. Using quarterly data from 1993Q1 to 2012Q4, we adopt an autoregressive distributed lag (ARDL) framework and test for a cointegrating relationship using the bounds test of Pesaran, Shin and Smith (2001) and Pesaran and Shin (1999). The estimation results indicate that the dramatic increase in South African imports from China is strongly associated with economic growth over the past decade and has persisted despite adverse relative price movements.

The paper is organized as follows. The next section reviews the existing literature, after which we present our modeling strategy and empirical methodology. We then discuss the estimation results and end the paper with concluding comments.

LITERATURE REVIEW

There is a voluminous literature devoted to estimating import and export demand functions and their associated elasticities. Early contributions (Marquez, 1990, Giovannetti, 1989, Thursby, 1988, Goldstein and Khan, 1985) provided important advances in understanding the functional relationship among relevant variables, but because they assumed stationarity of variables in time-series data, they yielded potentially spurious results and may have contributed to problematic policies. With the development and widespread adoption of cointegration techniques, researchers have been able to estimate long-run and short-run elasticities using standard reduced-form import and export demand functions.

Much of the literature focuses on income and price elasticities because of their power in providing precise quantitative analyses of changes in income and prices on the demand for tradable goods. Equipped with such analyses, producers are able to determine pricing strategies in the short and long runs. For example, if demand is inelastic, higher prices yield greater returns, and when demand is elastic, it is fortuitous to lower prices, *ceteris paribus*. At the macroeconomic level, trade policies such as tariffs and quotas are based in part on these estimated elasticities. For example, subsidies are granted to industries that face relatively elastic demand. Similarly, forecasters are able to explain the impact of a change in national income on the demand for tradable goods. If these tradable goods have domestic substitutes and complements, domestic policy is also affected.

Until recently, the focus of the trade literature has been on developed economies because of the lack of accurate data among developing countries. For example, Konno and Fukushige (2002) consider trade between the U.S. and Canada, while Fullerton and Sprinkle (2005) examine U.S. trade with Mexico, and Bahmani-Oskooee and Ratha (2008) and Walter, Baek and Koo (2012) investigate U.S. bilateral trade with multiple trade partners. Ketenci and Uz (2011) estimate bilateral elasticities for the European Union, Irandoust, Ekblad and Parmier (2006) explore the bilateral trade of Sweden, and Tang (2003) and Bahmani-Oskooee and Goswami (2004) examine the trade elasticities of Japan. Though the estimates vary across these different studies, most income elasticities are positive and near unit elastic or relatively elastic, while most price elasticities are negative and relatively inelastic.

With greater availability of data and increasing integration into the global economy, there is growing emphasis in the literature on estimating the income and price elasticities of developing-country trade. For example, Ozturk and Acaravci (2009) estimate trade elasticities for several countries in Latin America, Arize, Malindretos and Grivoyannis (2004) explore Pakistan's trade function, and Dutta and Ahmed examine Bangladesh's (1999) and India's (2004) trade functions with different partners. Razafimahefa and Hamori (2005) examine trade between Mauritius and Madagascar, and Reinhart (1995), Senhadji (1998) and Harb (2005) estimate trade elasticities for large cross-sections of developing countries. These estimates

also vary across different studies, but income elasticities are generally positive and relatively inelastic, while the price elasticities lack any specific pattern.

This configuration of trade elasticities is broadly consistent with theoretical expectations and reflects what was, until recently, the predominant structure of the global economy. High-income countries accounted for the vast majority of trade flows, while low-income developing countries existed largely on the periphery of international trade. Yet recent research on the trade flows of the emerging middle-income economies has uncovered important departures from this pattern. Using data that extends into the post-2000 trade boom, Arize and Nippani (2010) and Zhou and Dube (2011) estimate income elasticities of trade that are positive, significantly greater than previous studies of developing countries, and slightly higher than previous studies of developed economies. And in the case of Zhou and Dube (2011), their reported price elasticities of trade also defy conventional wisdom, being slightly positive or statistically insignificant. These results appear to reflect the emergence of “southern engines of economic growth,” (Zhou and Dube, 2011: 91), with demand for imports closely resembling that observed in developed economies.

Using pre-2000 aggregate trade data, early estimates of South Africa’s income and price elasticities of imports included, respectively, 0.43 and -0.53 (Bahman-Oskooee and Niroomand, 1998), 0.67 and -1.00 (Senhadji, 1998), and 1.06 and -1.56 (Gumede, 2000). Using more recent aggregate trade data, the income and price elasticities are, respectively, 1.85 and -0.78 (Arize and Nippani, 2010), 1.65 and -1.00 (Narayan and Narayan, 2010), 1.07 and -0.08 (Thaver and Ekanayake, 2010) and 1.36 and -0.57 (Zhou and Dube, 2011). However, estimates of income and price elasticities of aggregate trade flows may mask important variation across trade partners. Only a few studies, among them Thaver (2013), and Thaver, Ekanayake and Plante (2012), investigate South Africa’s trade on a bilateral basis, and none model trade with China. This paper contributes to the literature in three important ways. First, we estimate South Africa’s import demand function with China for the period 1993 to 2012. Second, we augment the traditional import demand equation to include the level of foreign reserves and exchange rate volatility as regressors, and we control for advanced-economy industrial production and China’s entry into the WTO. Finally, we use the most recent data available and the most appropriate empirical methodology for small-sample cointegration tests, namely the bounds testing procedure of Pesaran, Shin and Smith (2001).

MODELING STRATEGY AND EMPIRICAL METHODOLOGY

We adopt a standard reduced-form representation of the import demand function (Goldstein and Khan, 1985; Carone, 1996), which can be derived within a representative-agent, general equilibrium framework (Clarida, 1994; Reinhart, 1995). Let M_t represent bilateral real imports such that $M_t = f(Y_t, RP_t, Z_t^M)$, where Y_t is real national income of South Africa, RP_t is the real relative aggregate price level, and Z_t^M is a vector of other factors that affect imports. Following Tang (2003) and Bahmani-Oskooee and Goswami (2004), the functional relationship is given as

$$m_t = a_0 + a_1 y_t + a_2 rp_t + a_3 fer_t + a_4 vol_t + a_5 ip_t + a_6 D_t \quad (1)$$

In this equation, lowercase variables represent the logarithmic transformation of their uppercase counterparts, e.g., $m_t = \ln(M_t)$, while a_0 to a_6 are parameters. y_t is the real GDP of South Africa. Economic theory suggests that domestic income is a major determinant of a country’s imports and so has a positive impact on demand. We therefore expect that a_1 will be positive. Bilateral import price indices are unavailable, so the relative price effect is modeled using rp_t , calculated as the ratio of the aggregate consumer price indices. While standard economic theory predicts an inverse relationship between imports and rp_t , as indicated in the literature review empirical studies of developing countries lack any specific pattern. Hence a_2 may be either negative or positive.

The availability of foreign exchange has been shown to stimulate import demand (Emran and Shilpi, 2010; Arize and Nippani, 2010), so we include South Africa’s stock of real foreign exchange reserves, fer_t , and we expect that $a_3 > 0$. Exchange rate volatility may introduce risk and affect expectations (Ekanayake and Thaver, 2011), so we include it as a control variable. To ensure robustness vol_t is calculated using two different methods. The first method (VOL1) uses the moving average of the standard deviation of the growth rate of the bilateral real exchange rate defined over the previous four periods. The second method (VOL2) uses a GARCH (1,1) representation of the bilateral real exchange rate. Bredin, et al. (2003) showed that the effects of exchange rate volatility on imports are theoretically ambiguous, so a_4 could be either positive or negative. ip_t is the industrial production index of “advanced” economies as defined by the IMF, included here to capture and control for any spillover effects from the global economy onto South African imports from China. We expect $a_5 > 0$ insofar as this trade flow mirrors the global business cycle. On the other hand, if Chinese exporters are turning to South Africa during U.S. and European economic downturns, then this effect may be negative. Finally, D_t is a dummy variable that takes the value of 1 for all periods following China’s accession to the WTO, and we expect $a_6 > 0$. All variables are measured quarterly for the period 1993Q1 to 2012Q4 and are taken from the International Monetary Fund’s International Financial Statistics and Direction of Trade Statistics databases. All nominal values were deflated using consumer price indices with 2005=100 as the base year.

Table 1: Descriptive Statistics and Correlation Matrix

Variable	Mean	Std. Dev.	M	Y	FER	VOL1	VOL2	RP
Imports (M)	\$5.93b	\$5.43b	1.00					
GDP S.A. (Y)	\$138.5b	\$78.4b	0.96***	1.00				
Reserves (FER)	\$8.41b	\$5.44b	0.91***	0.91***	1.00			
Volatility (VOL1)	0.031	0.022	0.01	-0.02	-0.07	1.00		
Volatility (VOL2)	0.073	0.011	-0.01	0.01	-0.04	0.04	1.00	
Real Relative Price (RP)	1.105	0.217	-0.87***	-0.90***	-0.76***	-0.13	-0.06	1.00
Industrial Productivity (IP)	95.12	7.241	0.54***	0.71***	0.80***	-0.07	-0.15	0.65***

*This table reports the mean and standard deviation of each variable used in the final specification. The sample runs from 1993Q1-2012Q4. The correlation matrix shows the pairwise correlations among all variables. *** indicates significance at the 1 % level.*

Economic theory suggests that equation (1) should hold in a long-run equilibrium. We adopt a cointegration methodology to model departures from, and adjustment to, the long-run equilibrium, and to distinguish between long-run and short-run effects. Specifically, we employ Pesaran’s bounds testing procedure to estimate the model (Pesaran, Shin and Smith, 2001; Pesaran and Shinn, 1999). It has the advantage of being applicable in the presence of I(0) variables, I(1) variables, or any mix of the two. Thus, the bounds testing results are not dependent upon unit-root pretesting. In addition, the bounds testing procedure has been shown to be more efficient in small samples than either the Engle-Granger (Engle and Granger, 1987) or the Johansen (Johansen and Juselius, 1990) tests for cointegration.

The first step is to rewrite equation (1) as an unrestricted error-correction model (UECM):

$$\Delta m_t = \alpha_0 + \sum_{k=1}^{m1} \alpha_{1i} \Delta y_{t-k} + \sum_{k=1}^{m2} \alpha_{2i} \Delta rp_{t-k} + \sum_{k=1}^{m3} \alpha_{3i} \Delta fer_{t-k} + \sum_{k=1}^{m4} \alpha_{4i} \Delta vol_{t-k} + \sum_{k=1}^{m5} \alpha_{5i} \Delta ip_{t-k} + \alpha_6 \Delta D_t + \sum_{k=1}^{m7} \alpha_{7i} \Delta m_{t-k} + \gamma_1 y_{t-1} + \gamma_2 rp_{t-1} + \gamma_3 fer_{t-1} + \gamma_4 vol_{t-1} + \gamma_5 ip_{t-1} + \gamma_6 m_{t-1} + \gamma_7 D_t + \varepsilon_t \tag{2}$$

All variables are defined as before, while m_1, m_2, \dots, m_7 are maximum lag lengths, and ε_t is a white noise error term. We employ Hendry’s (1986) approach to settle on the specific lag lengths for each of the variables. Beginning with relatively long lag lengths, we follow an algorithm whereby statistically insignificant lags are dropped in succession until a parsimonious specification is achieved. The resulting version of (2) is then used for all further estimation and statistical inference.

The bounds test of the import demand equation takes the form of a Wald or F -test of the null hypothesis that the variables are not cointegrated, $H_0: \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0$. Given our relatively small sample, we use the critical values of the nonstandard F -distribution provided by Narayan (2005) to form the upper $I(1)$ and lower $I(0)$ bounds. If the F -statistic falls below the lower bound, we cannot reject the no cointegration H_0 , whereas if it exceeds the upper bound, we reject H_0 . An F -statistic between the lower and upper bound leads to an inconclusive test. Once we establish evidence of cointegration, the parameters in equation (2) can then be estimated and interpreted. Specifically, the long-run elasticities are equal to the coefficients on the lagged regressors normalized by the negative of the coefficient on the lagged dependent variable. The short-run elasticities correspond to the coefficients on the first-differenced regressors.

RESULTS AND DISCUSSION

Cointegration Test

The result of the bounds test for cointegration appears in Table 2. The F -statistic for the import demand equation is 14.92, well above the upper bound critical value at the 1% level, leading us to reject the null hypothesis of no cointegration among the variables. That is, there is a unique long term relationship between real imports, domestic income, relative prices, foreign reserves, exchange rate volatility, industrial production, and China’s integration into the WTO. Table 3 presents the results of diagnostic tests for serial correlation, specification errors, normality and stationarity of the residuals. The test statistics and associated p -values are all deemed acceptable. These results allow us to move to our next procedural step, namely, to estimate and interpret the long- and short-run elasticities.

Table 2: Cointegration Test Results – South Africa’s Import Demand Function with China

Critical Value Bounds of the F -Statistic: Intercept and No Trend						
k	10 Percent Level		5 Percent Level		1 Percent Level	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
3	2.50	3.33	2.97	3.90	4.06	5.20
5	2.22	3.22	2.60	3.71	3.50	4.80
Calculated F -Statistic:		$k=5$				
$F_M(M Y, RP, FER, VOL, IP)$		14.92***				

This Table Shows The Results of The ARDL Bounds Test for Cointegration. Critical Values Are Taken from Narayan, (2005), P. 300. k is the number of Regressors. ***, **, * Indicates Significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 3: Diagnostic Test Results

	Statistic	p-value
Durbin Watson Test	2.131	0.61
Breusch-Godfrey Test	0.868	0.49
RESET Test	0.437	0.65
Jacque-Bera Test	2.757	0.25
Augmented Dickey-Fuller	-3.040	0.15
R^2	0.81	-
\bar{R}^2	0.75	-

Long-Run Elasticities

Table 4 contains estimates of the long-run elasticities. The long-run income elasticity estimate of 2.101 is statistically significant at the 1% level, revealing that South Africa's imports increase by more than 2% for every 1% change in GDP in the long run. This income elasticity estimate is considerably larger than those generated by studies of developing economies using earlier data (Bahman-Oskoosee and Niroomand, 1998; Razafimahefa and Hamori, 2005), and more consistent with recent estimates for middle-income countries based on post-2000 trade data (Narayan and Narayan, 2010; Zhou and Dube, 2011). It is also larger in magnitude than recent estimates of South Africa's income elasticity of imports from Nigeria (Thaver, Ekanayake, and Plante, 2012) and from India and Brazil (Thaver, 2013). We expect GDP growth to trigger an increased demand for imports, but our results suggest that this is especially true of imports from China. Consequently, as post-Apartheid South Africa develops and grows, the composition and behavior of its imports resemble that of other middle-income and developed countries.

Table 4: Long-run Elasticities - South African Imports from China, 1993-2012

Regressors	Elasticity	t-statistic
Constant	-43.323	7.844***
FER	0.045	0.880
RP	1.668	4.848***
VOL1	0.070	1.911*
Y	2.101	7.740***
IP	1.286	4.072***
D	0.196	3.024***

*This table shows the estimated long-run elasticities of South Africa's import demand function with China. The long-run elasticities are equal to the estimated coefficients on the lagged regressors normalized by the negative of the estimated coefficient on the lagged dependent variable. *** and * indicate statistical significance at the 1% and 10% level, respectively.*

The long-run price elasticity estimate is 1.668 and it is statistically significant at the 1% level. While the positive sign is theoretically counterintuitive, studies of developing and middle-income countries have yielded similar positive results (Zhou and Dube, 2011). Indeed, estimates of South Africa's long-run price elasticity of bilateral imports from Nigeria and India are also significantly positive (Thaver, Ekanayake, and Plante, 2012; Thaver, 2013). One explanation for this result is that South Africa's economic growth is fueled by imports of intermediate inputs and capital goods that cannot be substituted for easily. It is also possible that this estimate is a consequence of the lack of good data on bilateral import prices.

Neither the stock of foreign reserves nor exchange rate volatility has appreciable long-run effects. The results in Tables 4 and 5 correspond to the specification including VOL1. An alternative specification using VOL2 produced qualitatively similar results and is not reported here. However, industrial productivity in the advanced economies has a considerable positive long-run impact on South Africa's imports from China. This result appears to refute the decoupling hypothesis that China has turned to South Africa as a substitute for developed-country markets. Rather, it suggests that growth in this bilateral trading relationship is pro-

cyclical and closely connected to the overall growth strategies in South Africa and in China (Aguillar, 2009). Finally, as expected, the dummy variable for China’s WTO membership is positive and statistically significant.

Short-Run Elasticities

The short-run dynamics of the model are captured by the parameters of the Error Correction Model (ECM). In the ECM the movement of any of the independent variables in time t is related to the gap of that same variable in time $t-1$ from its long-run equilibrium. This step recognizes that although tending towards long run equilibrium, import demand functions seldom stay in equilibrium because of fluctuations of economic and political forces affecting trade. The lagged error correction term (ECM_{t-1}) is important for the cointegrated system as it allows for adjustment back to long-run equilibrium after a shock to the system. Table 5 reveals that the ECM_{t-1} of -0.995 is statistically significant at the 1% level. That is, 99.5% of a shock to imports is erased within the first quarter. This estimate is further evidence of long-run cointegration among the variables, and it indicates a very strong long-run trend that may be due to recent trade liberalization policies aimed at reducing transaction costs (Saayman, 2010; Kabundi, 2009; Lesufi, 2004).

The estimates of the short-run elasticities of imports with respect to each independent variable are also presented in Table 5. As expected, national income and the WTO dummy have positive impacts on imports. A change in foreign reserves has a negative impact on trade during the short run adjustment process, while the effect of a change in the relative price resembles the J -curve, where initially imports rise then fall. The short-run effect of industrial productivity in advanced economies is negative, suggesting that the South African market may serve as a substitute for developed economy markets only temporarily. The short-run effect of exchange-rate volatility is negative, indicating that the corresponding uncertainty and pessimism dampens import demand. However, as noted in Table 4, this effect dissipates in the long run.

Table 5: Short-run Elasticities - South African Imports from China, 1993-2012

Regressors	Elasticity	t -statistic
Δm_{t-1}	0.271	3.411***
Δm_{t-4}	0.024	3.035***
Δfer_{t-1}	-0.236	-3.529***
Δvol_{t-2}	-0.092	-3.181***
Δvol_{t-3}	-0.069	-2.327**
Δvol_{t-4}	-0.144	-4.923***
Δrp_{t-1}	-3.518	-3.564***
Δrp_{t-2}	3.489	3.926***
Δy_t	3.647	3.581***
Δip_{t-1}	-2.277	-4.837***
ΔD_t	0.195	6.090***
ECM_{t-1}	-0.995	-9.867***

*This table shows the estimated short-run elasticities of South Africa’s import demand function with China. The short-run elasticities correspond to the estimated coefficients on the first-differenced regressors. ***, **, * indicates significance at the 1 %, 5 %, and 10 % levels, respectively.*

CONCLUDING COMMENTS AND SUGGESTIONS FOR FUTURE RESEARCH

China’s emergence as a global economic power is by now well documented, and its importance as a trade partner and source of foreign investment for Sub-Saharan Africa is increasingly evident. This is especially true for South Africa, which has witnessed China become its top source of imports and its top destination for exports during the past decade. This paper offers an examination of the dramatic growth in this bilateral trading relationship. Employing cointegration analysis, we estimate South Africa’s import demand function and distinguish between long-run and short-run determinants. Most importantly, we find that South Africa’s imports from China are driven overwhelmingly by the growth and development of South Africa’s

economy as measured by GDP. In the long-run, this effect far outweighs any influence of the real relative price level, volatility in the real exchange rate, or the availability of foreign exchange reserves. Moreover, this effect is strong enough to absorb shocks and very quickly return to trend. One important implication of this study is that South Africa's trade deficit with China will continue to widen despite a real depreciation of the rand.

South African imports from China represent but one side of this bilateral trading relationship, however. South African exports to China have also increased markedly during this period, from \$378.5 million (1.96% of all exports) in 2000 to \$9 billion (13.68% of all exports) in 2012 (IMF, 2013; Çakir and Kabundi, 2013). A comprehensive appreciation of the new economic relationship between these two countries requires a better understanding of the determinants and dynamics of trade in both directions. We estimated export demand functions using many of the same variables discussed in this paper, but the results were disappointing and the overall fit of the model was poor. Our conclusion is that the determinants of South Africa's exports to China are notably different from standard explanations of export demand. Further analysis of this trade pattern appears to be a fruitful area for future research.

REFERENCES

- Ademola, O., A. Bankole and A. Adewuyi (2009) "China-Africa Trade Relations: Insights from AERC Scoping Studies," *European Journal of Development Research*, vol. 21, p. 485-505
- Aguilar, R., & Goldstein, A. (2009). "The Chinisation of Africa: The Case of Angola," *World Economy*, vol. 32(11), p.1543-1562
- Arize, A. and S. Nippani (2010) "Import Demand Behavior in Africa: Some New Evidence," *The Quarterly Review of Economics and Finance*, vol. 50, p. 254-263
- Arize, A., J. Malindretos and E. Grivoyannis (2004) "Foreign Exchange Reserves and Import Demand in a Developing Country: The Case of Pakistan," *International Economic Journal*, vol. 18(2), p. 259-274
- Baliamoune-Lutz, M. (2011) "Growth by Destination (Where You Export Matters): Trade with China and Growth in African Countries," *African Development Review*, vol. 23(2), p. 202-218
- Bahmani-Oskooee, M. and F. Niroomand (1998) "Long-run Price Elasticities and the Marshall-Lerner Condition Revisited," *Economics Letters*, vol. 61, p. 101-109
- Bahmani-Oskooee, M. and A. Ratha (2008) "Exchange Rate Sensitivity of US Bilateral Trade Flows," *Economic Systems*, vol. 32, p. 129-141
- Bahmani-Oskooee, M. and G. Goswami (2004) "Exchange Rate Sensitivity of Japan's Bilateral Trade Flows," *Japan and the World Economy*, vol. 16, p. 1-15
- Brautigam, D. (2009) *The Dragon's Gift: The Real Story of China in Africa*, New York: Oxford University Press
- Bredin, D., Fountas, S., and E. Murphy. (2003). "An Empirical Analysis of Short-run and Long-run Irish Export Functions: Does Exchange Rate Volatility Matter?" *International Review of Applied Economics*, vol. 17(2), p. 193-208
- Çakir, M. and A. Kabundi (2013) "Trade Shocks from BRIC to South Africa: A Global VAR Analysis," *Economic Modeling*, vol. 32, p. 190-202

Carone, G. (1996) "Modeling the U.S. Demand for Imports Through Cointegration and Error Correction," *Journal of Policy Modelling*, vol. 18(1), p. 1-48

Cheung, Y., J. Haan, X. Qian and S. Yu (2012) "China's Outward Direct Investment in Africa," *Review of International Economics*, vol. 20(2), p. 201-220

Clarida, R. (1994) "Cointegration, Aggregate Consumption, and the Demand for Imports: A Structural Econometric Investigation," *The American Economic Review*, vol. 84, p. 298-304

De Grauwe, P., R. Houssa and G. Piccillo (2012) "African Trade Dynamics: Is China a Different Trading Partner?" *Journal of Chinese Economic & Business Studies*, vol. 10(1), p. 15-45

Diaw, D. and A. Lessoua (2013) "Natural Resources Exports, Diversification and Economic Growth of CEMAC Countries: On the Impact of Trade with China," *African Development Review*, vol. 25(2), p. 18-202

Dutta, D. (2004) "An Aggregate Import Demand Function for India: A Cointegration Approach," *Applied Economics*, vol. 11, p. 607-613

Dutta, D. and N. Ahmed (1999) "An Aggregate Import Function for Bangladesh: A Cointegration Approach," *Applied Economics*, vol. 31, p. 465-472

Emran, M. and F. Shilpi (2010) "Estimating Import Demand Function in Developing Countries: A Structural Econometric Approach with Applications to India and Sri Lanka," *Review of International Economics*, vol. 18(2), p. 307-319

Flores-Macias, G. and S. Kreps (2013) "The Foreign Policy Consequences of Trade: China's Commercial Relations with Africa and Latin America, 1992-2006," *The Journal of Politics*, vol. 75(2), p. 357-371

Engle, R. and C. Granger (1987) "Cointegration and Error Correction: Representation, Estimation and Testing," *Econometrica*, vol. 55, p. 251-276

Fullerton, T. and R. Sprinkle (2005) "An Error Correction Analysis of U.S.-Mexico Trade Flows," *International Trade Journal*, vol. 19(2), p. 179-192

Giovannetti, G. (1989) "Aggregated Imports and Expenditure Components in Italy: An Econometric Analysis," *Applied Economics*, vol. 21, p. 957-971

Giovannetti, G. and M. Sanfilippo (2009) "Do Chinese Exports Crowd-Out African Goods? An Econometric Analysis by Country and Sector," *European Journal of Development Research*, vol. 21, p. 506-530

Goldstein, M. and M. Khan (1985) "Income and Price Effects in Foreign Trade," in *Handbook of International Economics II*, Jones, R. and P. Kenen (eds.), Amsterdam: North Holland

Gumede, V. (2000) "Import Demand Elasticities for South Africa: A Cointegration Analysis," *Journal for Studies in Economics and Econometrics*, vol. 24, p. 21-37

Hanson, G. (2012) "The Rise of Middle Kingdoms: Emerging Economies in Global Trade," *The Journal of Economic Perspectives*, vol. 26(2), p. 41-63

- Hanusch, M. (2012) "African Perspectives on China-Africa: Modeling Popular Perceptions and their Economic and Political Determinants," *Oxford Development Studies*, vol. 40(4), p. 492-516
- Harb, N. (2005) "Import Demand in Heterogeneous Panel Setting," *Applied Economics*, vol. 37, p. 2407-2415
- Hendry, D. F. (1986) "Econometric Modelling with Cointegrated Variables: An Overview." *Oxford Bulletin Of Economics & Statistics*, vol. 48 (3), p. 201-212
- Irاندoust, M., K. Ekblad, and J. Parmler (2006) "Bilateral Trade Flows and Exchange Rate Sensitivity: Evidence from Likelihood-based Panel Cointegration," *Economic Systems*, vol. 30, p. 170-183
- Johansen, S. and K. Juselius (1990) "Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money," *Oxford Bulletin of Economics and Statistics*, vol. 52, p. 169-210
- Kabundi, A. (2009). Synchronization between South Africa and the U.S.: A structural dynamic factor analysis. *South African Journal Of Economics*, vol.77(1), p. 1-27
- Kaplinsky, R. and M. Morris (2009) "Chinese FDI in Sub-Saharan Africa: Engaging with Large Dragons," *European Journal of Development Research*, vol. 21, p. 551-569
- Ketenci, N. and I. Uz (2011) "Bilateral and Regional Trade Elasticities of the EU," *Empirical Economics*, vol. 40, p. 839-854
- Konno, T. and M. Fukushige (2002) "The Canada-United States Bilateral Import Demand Functions: Gradual Switching in Long-Run Relationships," *Applied Economics Letters*, vol. 9, p. 567-570
- Lesufi, I. (2004) South Africa and the rest of the continent: towards a critique of the political economy of NEPAD, *Current Sociology*, vol.52(5), 809-829
- Marquez, J. (1990) "Bilateral Trade Elasticities," *Review of Economic Statistics*, vol. 72, p. 70-77
- Mohan, G. and M. Tan-Mullins (2009) "Chinese Migrants in Africa as New Agents of Development? An Analytical Framework," *European Journal of Development Research*, vol. 21, p. 588-605
- Montinari, L. and G. Prodi (2011) "China's Impact on Intra-African Trade," *The Chinese Economy*, vol. 44(4), p. 75-91
- Nayyar, D. (2008) "China, India, Brazil and South Africa in the World Economy: Engines of Growth?" UNU-WIDER Discussion Paper 08/05, Helsinki, Finland
- Narayan, P. (2005) "The Saving and Investment Nexus for China: Evidence from Cointegration Tests," *Applied Economics*, vol. 37, p. 1979-1990
- Narayan, S. and P. Narayan (2010) "Estimating Import and Export Demand Elasticities for Mauritius and South Africa," *Australian Economic Papers*, (September), p. 241-252
- Ncube, M. and M. Fairbanks (2012) "China in Africa: Myths, Realities and Opportunities," *Harvard International Review*, (Fall), p. 21-25

Ozturk, I. and A. Acaravci (2009) "An Aggregate Import Demand Function: An Empirical Investigation by Panel Data for Latin American and Caribbean Countries," *The IUP Journal of Applied Economics*, vol. 8, p. 65-72

Pesaran, M., Y. Shin and R. Smith (2001) "Bounds Testing Approaches to the Analysis of Level Relationships," *Journal of Applied Econometrics*, vol. 16, p. 289-326

Pesaran, M. and Y. Shin (1999) "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis," chapter 11 in *Econometrics and Economic Theory in the 20th Century: the Ragnar Frisch Centennial Symposium*, Strom, S. (ed.), Cambridge University Press: Cambridge

Razafimahefa, I. and S. Hamori (2005) "Import Demand Function: Some Evidence from Madagascar and Mauritius," *Journal of African Economies*, vol. 14(3), p. 411-434

Reinhart, C. (1995) "Devaluation, Relative Prices, and International Trade: Evidence from Developing Countries," *IMF Staff Papers* No. 2

Saayman, A. (2010). A panel data approach to the behavioural equilibrium exchange rate of the ZAR. *South African Journal Of Economics*, 78(1), 57-77.

Sanfilippo, M. (2010) "Chinese FDI to Africa: What is the Nexus with Foreign Economic Cooperation?" *African Development Review*, vol. 22(1), p. 599-614

Senhadji, A. (1998) "Time-series estimation of structural import demand equations: A Cross-Country Analysis," *IMF Staff Papers*, vol. 45, p. 236-268

Tang, T. (2003) "Japanese Aggregate Import Demand Function: Reassessment from the 'Bounds' Testing Approach," *Japan and the World Economy*, vol. 15, p. 419-436

Taylor, I. (2006) "China's Oil Diplomacy in Africa," *International Affairs*, vol. 82(5), p. 937-959

Thaver, R. (2013) "South Africa's Trade Functions with India and Brazil: The Relevance of the India-Brazil-South African Dialogue (IBSA)," *forthcoming*

Thaver, R. and E. Ekanayake (2010) "The Impact of Apartheid and International Sanctions on South Africa's Import Demand Function: An Empirical Analysis," *International Journal of Business and Finance Research*, vol. 4(4), p. 11-22

Thaver, R., E. Ekanayake, and D. Plante (2012) "An Estimation of the Impact of GEAR and NEPAD on South Africa's Disaggregated Import Demand Function with Nigeria." *International Journal of Business and Finance Research*, vol. 6(2), p. 69-79

Thursby, J. (1988) "Evaluation of Coefficients in Misspecified Regressions with Application to Import Demand," *The Review of Economics and Statistics*, vol. 70(4), p. 690-695

Tran, T., D. Diaw and A. Rieber (2012) "International Demand Spillovers in South-South Exports: Application to Sub-Saharan Africa and Developing Asia," *Journal of Economic Integration*, vol. 27(3), p. 410-436

Walter, J., J. Baek, and W. Koo (2012) "International Trade and Macroeconomic Dynamics: The Case of U.S. Bilateral Trade with G-7 Countries," *Research in Economics*, vol. 66, p. 398-405

Zhou, Y. and S. Dube (2011) “Import Demand Functions: Evidence from CIBS,” *Journal of Economic Development*, vol. 36(4), p. 73-96

ACKNOWLEDGMENTS

The authors owe special thanks to Dr. Daniel Plante, Professor of Computer Science at Stetson University, for sharing his *R* code and for proofreading the paper.

BIOGRAPHY

Dr. Russell E. Triplett is an Assistant Professor of Economics at the University of North Florida. He earned his Ph.D. in Economics in 2011 from the University of North Carolina at Chapel Hill. Contact information: Coggin College of Business, University of North Florida, 1 UNF Drive, Jacksonville, FL 32224. Phone: (904) 620-5248. E-mail: r.triplett@unf.edu.

Dr. Ranjini Thaver is a Professor of Economics at Stetson University, Deland, Florida. She earned her Ph.D. in Economics in 1995 and an M.A. degree in Economics in 1989 at the Notre Dame University. She is the Director of Center for Holistic Microcredit Initiatives (CHOMI), and the Director of CHOMI Tanzania. Contact information: Department of Economics, Stetson University, Box 8392, Deland, FL 32723, USA. Phone: (386) 822-7573. E-mail: rthaver@stetson.edu.