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Article

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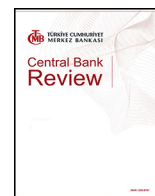
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The asymmetric J-curve phenomenon: Kenya versus her trading partners

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ABSTRACT

This paper examines asymmetries in the J-curve effects of real exchange rate on Kenya's trade balance by using panel data for bilateral trade with 30 trading partners. The data covers the period from 2006q1 to 2018q4 and the Pooled Mean Group (PMG) estimation technique, under both the linear and nonlinear ARDL frameworks, is applied. This paper departs from previous studies by using a modified version of the standard trade balance model, which is more suited for bilateral trade analyses, and by incorporating nonlinearities. The findings of the PMG estimation based on the assumption of symmetric exchange rate effects reveal J-curve effects in only 7 bilateral trade relations. However, when the estimation is performed assuming asymmetric effects, the J-curve effects are evident in 13 cases. Long-run and short-run asymmetries are also confirmed and it is established that a simultaneous bilateral real depreciation of the exchange rate boosts the long-run trade balance. The implication of these findings is that a devaluation policy can be used to raise competitiveness of Kenya's exports in the long-run.

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1. Introduction

Conventional economic theory postulates that devaluing a domestic currency can improve a country's trade balance. This occurs through adjustments in demand that are induced by shifts in relative prices. If the export and import demand functions are elastic, then a devaluation lowers the relative prices of exports and raises those of imports. Given that the Marshall-Lerner condition¹ is satisfied, the trade balance improves. In the short-run, however, the effects of exchange rate devaluation on the trade balance are delayed, thanks to several adjustment lags² (Junz and Rhomberg, 1973). As a consequence, the volume effect is overpowered by the price effect which forces the trade balance to deteriorate. However, in the long-run, the trade balance recovers thereby curving out a letter "J" time path (Magee, 1973).

Despite the empirical research associated with the J-curve phenomena evolving from the use of aggregated trade data to the use of bilateral trade data and even to the use of commodity and industry-level data, a consensus on the existence of the J-curve phenomena in different countries has not been reached yet. Most recently, however, Bahmani-Oskooee and Fariditavana (2015) have attributed the mixed findings to the treatment of the effects of exchange rate movements on the trade balance as symmetric. They criticize this assumption as incorrect and introduce asymmetries³ by modelling nonlinearities into the error-correction and cointegration processes.

This paper, therefore, contributes to the extant literature by examining whether asymmetries in the J-curve effects exist for Kenya's bilateral trade engagements with 30 trade partners. This is important in providing insights into how economic agents react to currency appreciations and depreciations (or currency devaluations and revaluations), both in the long-run and in the short-run. Additionally, it is important in determining whether a real devaluation can be used to improve Kenya's trade balance and promote economic growth. This is essential in the application of exchange rate policies. This paper differs from the previous studies by adopting the modifications to the bilateral trade balance model, as proposed by Khan and Hossain (2010), in a panel data

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¹ The Marshall-Lerner condition simply asserts that devaluing or depreciating a real exchange rate will not boost the trade balance unless the absolute summation of the price elasticities of export and import demands exceed 1 (Mwito et al., 2015).

² The lags are due to market participants taking time to soak-in the relative price changes, taking time to adjust to changes in real variables, taking time to replace inventories, taking time to deliver newly priced goods, and the production process taking time to align itself with the new prices.

³ This asymmetric behavior arises largely from traders reacting differently to currency appreciations as compared to depreciations. The responses of the prices of exports and imports to changes in exchange rates are also asymmetric (Bussiere, 2013).

analysis. Khan and Hossain (2010) criticized the use of the absolute factors such as the exporter and importer gross domestic products (GDPs) in bilateral trade balance models and instead proposed the use of relative factors such as relative GDP and relative per capita gross national incomes.

The paper is structured as follows; the second section offers a short overview of Kenya's trade trends and policies. The third section explores empirical literature and lays out the theoretical framework while section four sets out the methodology. Section five discusses the findings after which the sixth section concludes.

2. Trade balance trends and trade policy changes in Kenya

Kenya's trade participation index⁴ (TPI) averaged 0.1 from 2000 to 2018 indicating that Kenya is marginalized in international trade. In addition to this poor performance, Kenya's imports have consistently surpassed exports both in volume and monetary terms since 1970s. The resultant trade deficits have persistently expanded every year and have hindered achievement of the country's growth targets. For example, the World Bank (2013) reported that trade deficits reduced Kenya's economic growth by 4.1 per cent in 2012. With a balanced trade account, Kenya's GDP growth rate would have reached 8% that year. Furthermore, the World Bank (2012) warned of impending macroeconomic instabilities if the country ignored the growing trade deficits.

After independence in 1963, Kenya adopted inward-looking trade policies that had previously been employed by the colonial administration. The domestic currency was fixed to the US Dollar as the economy sought stability. These import substitution strategies (ISS) produced trade surpluses each year from 1964 to 1970 and they also seemed to favor the Kenyan economy as it achieved an average growth rate of 6.6% from 1964 to 1973 (Were et al., 2002). However, the country was hit by balance of payments and oil crises in 1971 and 1974, which also contributed to trade deficits, but the government avoided devaluing the exchange rate and resorted to tighter regulatory measures (Gertz, 2008).

Kenya's exports performed strongly from 1975 to 1977 as the global coffee prices soared but these achievements were dealt a blow when the East African Community collapsed in 1977 (Were et al., 2009). This was quickly followed by the fall in coffee prices and the balance of payments crisis of 1979 that was attributed to high oil prices even as the exchange rate experienced a 14% devaluation effected by the government to stabilize the economy. As the economic growth slowed dramatically, these economic problems effectively underlined the inefficiency of the ISS strategy (Wagacha, 2000; Swamy, 1994).

Kenya yielded to insistence from the multilateral financial institutions and pledged to effect outward-looking economic reforms under the Structural Adjustment Programs in the early 1980s. This saw the exchange rate devalued by 20% against the Special Drawing Rights after which a crawling peg exchange rate regime was then adopted (Ndung'u, 1999). According to Bigsten and Kalinda-Mkenda (2002), as from 1985, the Kenyan authorities were very committed to economic transformation and this led to improved growth levels. This also saw the government introduce a number of export promotion schemes. In 1990, the government introduced a dual exchange rate regime in a bid to adopt a market-based economy. The year 1993 was an important one in Kenya's reform process as the authorities removed the current and capital account constraints and also introduced a flexible exchange rate regime after conducting a sizeable devaluation (Gertz, 2000). Exports and imports responded quickly by growing at 7% and

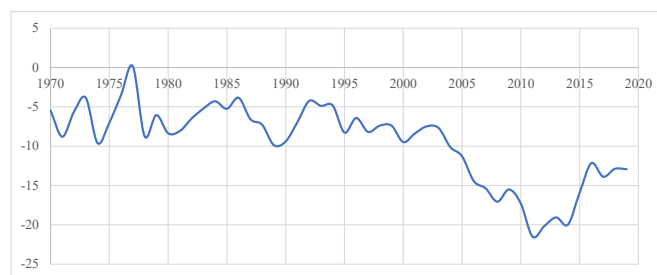


Fig. 1. Aggregate Trade Balance-to-GDP ratio for Kenya (1970–2018)

Source: Own computation using data from the United Nations Comtrade database.

6% of the GDP, respectively, resulting in a slight improvement in the trade balance.

The domestic exchange rate continued to depreciate after implementation of the trade liberalization policies and an adoption of a managed float exchange rate regime was executed in 1998. However, despite these developments, agricultural products still accounted for about 50% of Kenya's commodity exports in 2000 (Mkenda, 2002). As shown in Fig. 1, importations of capital goods for the development of infrastructure caused the trade deficit to rise from 7.68% of GDP in 2003 to 17.67% in 2008 to 21.52% in 2012. This trend resulted in the sounding of an alarm, by the World Bank, over the “ballooning trade deficit” which had to be financed by both short and long-term debts.

2.1. Bilateral trade relations

Around 55% of Kenya's exports are primary commodities like tea, coffee and horticultural produce. These products are shipped mainly to the European and Asian markets. As shown in Table A1 for instance, 12.41% of all the primary commodities were exported to Pakistan in 2018. During the same year, Netherlands absorbed 12.06% while the United Kingdom and the United Arab Emirates accounted for 5.59% and 9.69% of all primary commodity exports respectively. The manufactured exports, which accounted for 27.65% of the total exports in 2018, are exported to East African Community member countries and to the Common Market for East and Southern Africa (COMESA). Around 17.49% of all the manufactured exports in 2018 went to Uganda while Tanzania, the Democratic Republic of Congo (DRC) and Rwanda absorbed 12.91%, 5.99% and 6.66% respectively. On the other hand, Kenya imports highly valuable products which include machinery and transportation equipment, oil and petroleum products, chemical products and medicaments, and manufactured goods. Together, these products accounted for 69.11% of Kenya's total imports in 2018 as shown in Table A2. The data also shows that 32.91% of all the manufactured goods imported into Kenya were from China. India was the source of 19.34% of all chemical imports while 10.77% was sourced from Saudi Arabia and another 14.04% from China. Saudi Arabia and the UAE were the sources of 43.97% and 22.42%, respectively, of all the oil and petroleum products imported into Kenya.

The top 30 trading partners for the period 2006 to 2018 are shown in Table A3 in the appendix and it is clear that Kenya has, on average, had bilateral trade deficits with 22 of them. Kenya has bilateral trade surpluses with countries where it majorly exports manufactured commodities. Large trade deficits are recorded for trade with China, India and the United Arab Emirates (UAE). On average, the bilateral trade deficits with the three trade partners collectively account for 53.64% of the overall trade deficit from 2006 to 2018. These deficits result from importing highly valued manufactured commodities and machinery from the partner countries while exporting lowly valued primary goods (Kennedy, 2013).

3. Literature review and theoretical framework

3.1. Empirical literature review

Empirical findings on the J-curve phenomena have largely differed

⁴ This index was developed by Mkenda (2002) and it is used to determine how much a country engages in foreign trade while taking population and natural resources into consideration. The index is constructed by dividing the ratio of an economy's total trade over aggregate global trade by the ratio of a country's population over global population. If the TPI is less than unity, a country is marginalized in international trade.

depending on the level of data aggregation and the estimation techniques used. Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hagerty (2010) provide an exhaustive review of literature on these studies. Earlier studies used aggregated trade data and they include studies by Moura and Da Silva (2005), Akbostanci (2004) and Singh (2004) who find no J-curve effects for Brazil, Turkey and India respectively. However, similar studies such as Duasa (2007), Rahman and Islam (2006), Gomes and Paz (2005), Narayan and Narayan (2004) and Rehman and Afzal (2003) found evidence of the J-curve phenomena in Malaysia, Bangladesh, Brazil, Fiji and Pakistan respectively. However, according to Dash (2013), Mohsen and Brooks (1999), and Rose and Yellen (1989), studies that use aggregated trade data suffer from the problem of aggregation bias. They, therefore, recommend the use of bilateral data and studies such as Bahmani-Oskooee and Cheema (2009), Halicioglu (2007), Bahmani-Oskooee and Wang (2006), Bahmani-Oskooee et al. (2006), Bahmani-Oskooee et al. (2008), Bahmani-Oskooee and Harvey (2009) adopt this approach but establish mixed findings.

The failure to reach a consensus led to further evolution and emergence of a subcategory of both the bilateral data and aggregate data studies that investigates the J-curve phenomena at industry or commodity level. Studies by Bahmani-Oskooee and Wang (2008) and Ardalani and Bahmani-Oskooee (2007) fall under this category, just to mention a few. Nevertheless, the findings have still remained mixed. The most recent studies led by Bahmani-Oskooee and Fariditavana (2015), Bahmani-Oskooee and Baek (2016), Bahmani-Oskooee et al. (2016)⁵, Bahmani-Oskooee et al. (2018), Bahmani-Oskooee and Nasir (2020) have modelled the trade balance model in a nonlinear ARDL framework in order to examine whether appreciations and depreciations of the exchange rate have asymmetric effects on the trade balance. Most of these studies have compared the outcomes of a linear ARDL analysis and that of the nonlinear counterpart and have reported more evidence of J-curve effects within the nonlinear framework.

A review of the literature, however, shows that few studies on the J-curve have been conducted in the African context. Amusa and Fadiran (2019) investigate the bilateral between South Africa and USA industry-level data from 23 industries using industry-level data and the ARDL approach. They find that the J-curve phenomena exists in 8 industries out of 23. In another study, Hussain and Haque (2014) investigate whether the J-curve phenomena exists in a sample of 49 African countries. The study uses aggregate trade data and applies random effects panel data estimation as well as error correction modelling (ECM) and it establishes the presence of J-curve effects in African countries.

In the case of Kenya, empirical studies investigating the J-curve phenomena are even more scarce and the few studies investigating the effect of exchange rate movements on Kenya's trade bear conflicting findings. Kiptui (2018) uses the nonlinear ARDL model to investigate the J-curve effects for bilateral trade between Kenya and 5 trade partners. The author establishes that economic agents respond more to exchange rate depreciations than appreciations. However, exchange rate depreciations are found to worsen Kenya's bilateral trade balances even in the long-run therefore failing to find any evidence of the J-curve effects. In another study, Caporale et al. (2015) investigate the existence of the Marshall-Lerner condition in Kenya. The authors employ fractional integration and cointegration techniques on aggregated quarterly trade data and their findings confirm that the Marshall-Lerner condition was satisfied.

In another aggregate data study, Bahmani-Oskooee and Gelan (2012) make use of Autoregressive Distributed Lag (ARDL) modelling to investigate how exchange rate changes affect 9 African economies whereby one of them is Kenya. They find J-curve effects for three

countries but Kenya is not among them. In yet another study examining the effect of exchange rate on Kenya's trade balance, Kennedy (2013) uses aggregate annual data for 1963–2012 to examine the determinants of Kenya's trade balance. The author employs the Johansen cointegration technique and error correction modelling and the findings indicate that real effective exchange rate depreciation has long-run positive effects on the trade balance. Finally, Kiptui (2007) uses monthly data to examine whether Kenya's sectoral exports are responsive to exchange rate movements. By applying the ARDL approach, the author determines the existence of a long-run relationship between real effective exchange rate and the trade balance.

3.2. Theoretical framework

Goldstein and Khan (1985) formulates the trade balance model as follows;

$$TB_{ij} = TB_{ij}(REER_{ij}, GDP_i, GDP_j) \quad (1)$$

Where, TB_{ij} is the trade balance between country i and the rest of the world, j . It is the dependent variable (measured as exports minus imports) while the real effective exchange rate ($REER_{ij}$), Domestic country's real GDP (GDP_i), and proxy for the world's real GDP (GDP_j) are the explanatory variables. The variable $REER_{ij}$ is constructed by averaging the bilateral exchange rates between the domestic currency and a basket of other currencies and then weighing it by applying the trade allocations for the partners. It is also defined in such a way that increases would imply depreciations.

Together, the three explanatory variables embody factors that affect the trade balance in line with the postulations of the elasticity and absorption approaches. $REER_{ij}$ depreciations should positively affect TB_{ij} in accordance with theory, while increases in GDP_i and GDP_j can have either negative or positive effects on TB_{ij} . This ambiguity depends on whether they reflect the production or absorption capacity of the economies in question. Khan and Hossain (2010) augment the model by Goldstein and Khan (1985) so as to get rid of the ambiguities surrounding the effects of GDP_i and GDP_j variables. Khan and Hossain (2010) added per capita Gross National Income (PGNI) variables for the trading pair into the model. The PGNI's reflect the absorption capacity whereas the GDP variables capture the production capacity of the two trade partners. According to Dash (2013) and Rose and Yellen (1989), the use of weighted averages in constructing real effective exchange rates ($REER_{ij}$) overlooks major bilateral exchange rate changes thereby producing an inaccurate link between the exchange rates and the trade balances. Therefore, Khan and Hossain (2010) use bilateral real exchange rates ($BRER_{ij}$) instead. The $BRER_{ij}$ is constructed as bilateral nominal exchange rate between country i and j (NER_{ij}) (defined in a price quotation format) multiplied by the ratio of the consumer price indices of the domestic country i relative to trading partner j (CPI_i/CPI_j). In this definition of bilateral real exchange rates, an increase in $BRER_{ij}$ implies a depreciation. By adding the three new variables they reformulate the model in Eq. (1) to reflect bilateral trade relations as follows;

$$BTB_{ij} = BTB_{ij}(BRER_{ij}, GDP_i, GDP_j, PGNI_i, PGNI_j) \quad (2)$$

Where; $BRER_{ij}$ is the bilateral real exchange rate, and BTB_{ij} is the bilateral trade balance (which they define as exports over imports). Furthermore, Khan and Hossain (2010) argue that in bilateral trade analyses, the absolute size of GDPs and PGNI's no longer make sense because it is the relativity of factors between economies that determine their bilateral trading patterns. This necessitates tweaking of the model in Eq. (2) in such a way that the GDP ratio of the bilateral trade partners (GDP_j/GDP_i) reflects the relative production capacity of partner country in terms of the home country. Similarly, the ratio of per capita incomes ($PGNI_j/PGNI_i$) is generated to represent the relative capacity to absorb imports by the foreign

⁵ Bahmani-Oskooee et al. (2016) has used industry-level data to examine the J-curve effects in a nonlinear ARDL framework for the trade between Malaysia and Singapore. The nonlinear model is found to offer more evidence of J-curve effects. Bahmani-Oskooee and Nasir (2020) investigate the asymmetric J-curve using industry level data for United States of America and United Kingdom. Evidence of short-run asymmetric effects is found and J-curve effects are established for 18 industries.

country such that the extended model becomes;

$$BTB_{ij} = BTB_{ij}(BRER_{ij}, RGDP_{ji}, RPGNP_{ji}) \quad (3)$$

Where; $RGDP_{ji}$ – stands for the relative GDP $\left(\frac{GDP_j}{GDP_i}\right)$.

$RPGNP_{ji}$ – stands for the relative per capita GNI $\left(\frac{PGNI_j}{PGNI_i}\right)$

4. The models and the method

Selection of the most relevant functional form is a crucial decision in regression analyses. While theoretical literature provides us with endogenous and exogenous variables, it lets the researcher decide on the appropriate functional form. The log-log functional form is preferred in our case since it enables the interpretation of coefficients as elasticities (see; [Amusa and Fadiran, 2019](#); [Dash, 2013](#)). Therefore, by introducing natural logs on both sides of Eq. (3), adding a time subscript, t , and an error term, ϵ_{jt} , our econometric model in log-log form is as shown in Eq. (4)⁶;

$$\ln(BTB_{ij})_t = \alpha_0 + \alpha_1 \ln(BRER_{ij})_t + \alpha_2 \ln(RGDP_{ji})_t + \alpha_3 \ln(RPGNI_{ji})_t + \epsilon_{jt} \quad (4)$$

The next step is to choose the appropriate estimation technique while taking into account the characteristics of the data and theoretical postulations. We should note that analysis of Eq. (4) by any estimation technique would yield the long-run coefficients ([Bahmani-Oskooee and Fariditavana, 2016](#)). However, analysis of the J-curve phenomena must involve an examination of the short-run dynamic adjustment processes. We also note here that previous literature on bilateral J-curve effects made use of country-by-country single equation estimations. The problem with such an approaches is that they use very few observations. They also fail to control for biases due to omitted variables and missing data as well as being subject to functional form misspecifications. As a result, such analyses may produce coefficients with unexpected signs or even coefficients that are insignificant at all levels of significance ([Goswami and Junayed, 2006](#)). These challenges can be tackled through the pooling of data across time for every trading partner in the sample ([Goswami and Junayed, 2006](#)). The use of panel data estimation techniques also controls for unobserved heterogeneities among the bilateral trading relations that may impact the outcome.

Several panel data techniques can be applied in this case but given that our dataset consists of both large time series observations (T) and large cross-sectional units (N), it necessitates the use of a technique that can handle nonstationary heterogeneous dynamic panels. Following [Comunale and Hessel \(2014\)](#), we explored three approaches grounded on the panel ARDL framework. These techniques include; the Pooled Mean Group (PMG) estimation, the Mean Group (MG) estimation, and the Dynamic Fixed Effects estimation (DFE). These techniques only differ in their treatment of the coefficients. Whereas the MG approach allows the coefficients to differ by cross-sectional units both in the short-run and the long-run, the DFE on the other hand forces restrictions on the coefficients and renders them homogenous across the cross-sectional units. The PMG incorporates features of the MG and DFE approaches by equalizing the long-run elasticities for all the cross-sections and allowing the short-run elasticities to vary with each cross-sectional unit. We therefore rewrite Eq. (4) into a panel ARDL ($p; q_1, \dots, q_k$) dynamic formulation as follows;

$$\ln BTB_{jt} = \sum_{m=1}^p \beta_{jm} \ln BTB_{j,t-m} + \sum_{m=0}^q \alpha'_{jm} \ln X_{j,t-m} + \mu_j + \epsilon_{jt} \quad (5)$$

Where; $j = 1, 2, \dots, N$ are the trade partners, $t = 1, 2, \dots, T$ are the time periods, X_{it} represents the $k \times 1$ vector of regressors, α_j is a $k \times 1$ vector of coefficients, β_i are scalars, μ_i represents the trading-pair-specific effects, $\epsilon_{j,t}$ represents the error term at time t .

Eq. (5) presumes that $BRER$ appreciations and depreciations would symmetrically impact the BTB . That is to say, provided that a depreciation results in improvement of the trade balance, then an appreciation should deteriorate it by an equal magnitude. However, this assumption has been challenged by [Bahmani-Oskooee and Fariditavana \(2016\)](#) who have shown that it is inappropriate through the use of a procedure introduced by [Shin et al. \(2014\)](#) to model nonlinear adjustments of the trade balance in response to exchange rate changes. By decomposing the effects of $BRER_i$ appreciation and depreciation using the partial sum process, we follow [Bahmani-Oskooee and Fariditavana \(2016\)](#) and generate a variable $\Delta \ln BRER_i$ that bears two variables obtained as shown in Eq. (6) and Eq. (7);

$$POS_{jt} = \sum_{j=1}^t \Delta \ln BRER_j^+ = \sum_{j=1}^t \max(\Delta \ln BRER_j, 0) \quad (6)$$

$$NEG_{jt} = \sum_{j=1}^t \Delta \ln BRER_j^- = \sum_{j=1}^t \min(\Delta \ln BRER_j, 0) \quad (7)$$

POS —represents partial sum variables of the positive values which are bilateral real exchange rate depreciations, while the NEG variable indicates the negative values which are the bilateral real exchange rate appreciations. The two newly created variables, POS_{jt} and NEG_{jt} , are then inserted in Eq. (5) to replace $\ln BRER_i$. This, according to [Shin et al. \(2014\)](#), makes the model nonlinear and therefore we proceed to reparametrize Eq. (5) into an error correction model in Eq. (8). This will enable us to determine the responsiveness of the variables to any deviations from the equilibrium in the short-run.

$$\Delta \ln BTB_{jt} = \varphi_j (\ln BTB_{j,t-1} - \theta'_j X_{jt}) + \sum_{m=1}^{p-1} \alpha_{jm}^* \Delta \ln BTB_{j,t-1} + \sum_{m=0}^{q-1} \beta_{jm}^* \Delta \ln X_{j,t-m} + \mu_j + \epsilon_{jt} \quad (8)$$

Where; φ_j is the error-correction parameter that measures how quickly equilibrium-reverting adjustments occur. The vector θ'_j bears the long-run parameters of the model. Estimation techniques anchored in the ARDL framework are preferred due to their suitability in handling fractionally integrated data. The techniques also give robust estimates even in the presence of endogenous variables as well as being suited in controlling for serial correlation ([Beck and Katz, 1995](#)).

5. Empirical results

5.1. Unit root test

Despite the suitability of PMG, MG and DFE estimation techniques in analysing nonstationary dynamic panels, we conduct unit root tests to examine whether or not the variables are integrated of an order greater than 1. We use the [Im et al. \(2003\)](#) panel unit root test, popularly abbreviated as the IPS, whose choice is due to its less restrictive features such as its ability to perform in unbalanced panels and its relaxed assumptions on the autoregressive parameters, which are allowed to differ across the cross-sectional units. The test's null hypothesis is a

⁶ The subscript i was dropped since it is always representing the same domestic country.

statement of unit roots being present in all the panels against an alternative hypothesis which claims stationarity across the cross-sectional units.

The test is conducted on all the variables while including a linear time trend and demeaning the cross-sections to eliminate effects of cross-sectional dependence (Levin et al., 2002). The findings in Table A4 show that only one variable (LnRPGNI) is stationary while the remaining variables are subjected to a single differencing and tested again after which they are found to be stationary.

5.2. Hausman Test

The sensitivity of the estimates of the panel ARDL-based techniques to the size of the lag-length begs careful selection of the information criterion. However, Pesaran and Shin (1998) recommend the use of the Schwarz-Bayesian Information Criteria (SBIC) due to its consistency. We therefore applied the SBIC to each variable for each bilateral trading pair while restricting the maximum number of lags to 3. The lag-length that occurs most commonly for each variable across the bilateral trading pairs is selected leading to a panel ARDL-SBIC (1,0,0,0) model.

Next, we conduct a Hausman Test⁷ to determine the most appropriate estimation technique between the PMG and the MG estimation methods. The DFE technique is abandoned on theoretical grounds since different bilateral trading-pairs cannot have homogenous coefficients in the long-run and in the short-run. The findings in Table 1 indicate that the null hypothesis was not rejected, thus favouring selection of the PMG technique over the MG technique.

A PMG estimation to examine the bilateral J-curve effects for Kenya's trade with the 30 trade partners is then performed. The first estimation is performed on a linear panel ARDL-SBIC (1,0,0,0) framework and the overall results are shown in panel A of Table 2. The findings show that the long-run coefficient of the BRER is significantly positive at 1% level of significance implying that if the shilling depreciates in real terms by 1% against the currencies of the 30 trade partners, then the trade balance improves by 1.013%. Consequently, by symmetry, these findings indicate that a 1% appreciation worsens the trade balance by 1.013%. This, therefore, confirms that the Marshall-Lerner condition is satisfied. These findings also show conformity to economic theory and are in agreement with Caporale et al. (2015) who also look into the Marshall-Lerner condition for the Kenyan case. However, these results disagree with Kiptui (2018) who establishes that depreciations would lead to a deterioration of Kenya's trade balance in the long-run. Our findings also differ with Bahmani-Oskooee and Gelan (2012) as well as Olofin and Babatunde (2007) who establish that the depreciations have no impact on trade balances in different countries of the SSA region.

Next, estimation on a nonlinear ARDL-SBIC (1,0,0,0) framework was conducted and the findings in Panel B of Table 2 show that a 1% BRER depreciation against the 30 trading partners improves the trade balance by 1.124%. Conversely, a 1% BRER appreciation does not worsen the trade balance by a magnitude equal to the effect of depreciation. This points to asymmetries in the long-run effects of exchange rates adjustments.

In both the linear model and the nonlinear panel ARDL models, the changes in the relative GDPs of the 30 trading partners significantly influence the trade balance by worsening it in the long-run. The linear and nonlinear PMG estimations show that a 1% increase in the productive capacities of the trade partners relative to that of Kenya deteriorate the trade balance by 0.315% (at 5% significance level, in the linear model) and 0.448% (at 1% significance level, in the nonlinear model) respectively. These findings are in agreement with that of Khan and

Table 1

Results of the hausman test.

Chi-square	p-value	
Degrees of freedom	Statistics	
3	4.09	0.252

Ho: coefficients do not differ systematically.

Hossain (2010) who establish that small open economies are adversely affected by growth in productive capacities of other countries. This is because the trading partners⁸ develop more sophisticated production capabilities that may render them self-sufficient thereby reducing their demand for products from the developing economies. This could also imply that the increased production capacities relative to that of Kenya increase the trading partners' exporting capacities which serve as imports to Kenya thus worsening the trade balance.

The coefficients of the relative per capita GNI (LnRPGNI) variable are also significant (at 1% significance level) but negatively signed under the both models. This finding, which differs from expectations, implies that a 1% rise in the per capita incomes in the trade partners relative to Kenya increases the purchasing power of the households which in turn decreases the demand for the Kenyan exports by 1.467% and 1.311% as indicated by the findings of the linear and nonlinear models respectively. The consequence is therefore a deterioration of the trade balance. This result differs from Mettwally (2013) and Khan and Hossain (2012) which are both based on developing countries and establish a significant positive relationship. The finding of our study may signify that the Linder effect⁹ has dominated the Heckscher-Ohlin effect¹⁰ in the Kenyan case. Such a result has also been found by various other studies that include Batra (2006), Erdey and Pöstényi (2017) and Shahriar et al. (2019). The high concentration of primary products with low income elasticities due to low value-addition in Kenya's exports structure could also be the cause of this finding.

From both models, the error correction terms are significantly and negatively signed and lie between −1 and 0. The coefficient values of −0.176% and −0.183% denote that around 18% of the fluctuations from the long-run equilibriums, are corrected within three months. This is also a confirmation of cointegration (Banerjee et al., 1998). However, the small-sized coefficients indicate relatively low adjustment speeds. Our results also show that in the short-run, the BRER is negatively signed and significant at 5% significance level in the linear model. In the nonlinear model, only the depreciation variable (POS) is significant in the short-run and is negatively signed as anticipated. These results from both the linear and nonlinear panel ARDL models in the long-run and short-run indicate a general presence of the J-curve phenomena following a simultaneous depreciation of the Kenya's BRER with the 30 trade partners.

In the next step, we sort the results by each bilateral trading relationship and they confirm heterogenous effects of bilateral exchange rate changes on the trade balances in both the linear and nonlinear panel ARDL models. In the linear model, the results in panel A of Table 3 indicate that in the short-run, BRER bears significant negative signs for 7 trading partners, namely; China, Egypt, India, Japan, Netherlands, South Africa and United Arab Emirates (UAE). This implies that a depreciation/devaluation adversely affects Kenya's bilateral trade balances in the short-run. The real depreciations on bilateral terms results in a fall in relative prices of exports but the volume effect is constrained by the low elasticities in the short-run. The relative prices of imports on the other

⁷ In this case, the Hausman Test examines the possibility of the long-run coefficients being equal across the cross-sectional units (Comunale and Hessel, 2014).

⁸ This result would mostly apply to the growth in developing countries that are major destinations for Kenya's manufactured exports. These countries would attain the ability to produce their own manufactured goods and therefore reduce the importation of Kenyan products.

⁹ The Linder hypothesis posits that similarities in preferences and demand patterns will only exist for countries that have similarities in per capita incomes. Therefore, these countries will trade in similar but differentiated goods and will trade more amongst themselves.

¹⁰ The Heckscher-Ohlin effect suggests that trade patterns are a supply-side phenomenon and therefore, trading partners who have larger differences in relative factors of production will trade more.

Table 2
Overall PMG estimation results.

Panel A: Linear ARDL-SBIC (1,0,0,0)		Panel B: Nonlinear ARDL-SBIC (1,0,0,0,0)	
Long-Run Estimates		Long-Run Estimates	
<i>LnBRER</i>	1.013 (0.324) ^a	<i>POS</i>	1.124 (0.316) ^a
		<i>NEG</i>	–0.893 (0.423) ^b
<i>LnRGDP</i>	–0.315 (0.148) ^b	<i>LnRGDP</i>	–0.448 (0.219) ^b
<i>LnRPGNI</i>	–1.467 (0.222) ^a	<i>LnRPGNI</i>	–1.311 (0.305) ^a
Short-Run Estimates		Short-Run Estimates	
<i>EC(t-1)</i>	–0.176 (0.048) ^a	<i>EC(t-1)</i>	–0.183 (0.052) ^a
$\Delta \text{LnBTB}_{(t-1)}$	0.281 (0.112) ^b	$\Delta \text{LnBTB}_{(t-1)}$	0.291 (0.103) ^a
ΔLnBRER	–0.679 (0.333) ^b	ΔPOS	–0.540 (0.226) ^b
		ΔNEG	–0.201 (0.404)
ΔLnRGDP	0.289 (0.146) ^b	ΔLnRGDP	0.173 (0.196)
$\Delta \text{LnRPGNI}$	–0.446 (0.574)	$\Delta \text{LnRPGNI}$	0.673 (0.166) ^a
Constant	0.151 (0.077) ^a	Constant	–0.265 (0.128) ^b

^a Significant at 1%.

^b Significant at 5%. The values in parentheses are the standard errors.

Table 3
Selected pooled mean group estimation results for the short-run linear and nonlinear ARDL.

PANEL A			PANEL B			
	Trading Partner	BRER Coefficient		Trading Partner	Δ POS Coefficient	Δ NEG Coefficient
1	Bangladesh	−0.443 (0.871)	1	Bangladesh	0.459 (0.221) ^a	0.530 (0.927)
2	China	−0.629 (0.236) ^a	2	China	−0.429 (0.208) ^b	0.112 (0.456)
3	DRC	0.505 (0.254) ^b	3	DRC	0.663 (0.305) ^b	−0.524 (0.574) ^b
4	Egypt	−0.260 (0.119) ^a	4	Egypt	−0.247 (0.098) ^b	0.883 (1.002)
5	India	−0.782 (0.296) ^a	5	India	−0.680 (0.130) ^b	−5.992 (0.567)
6	Iran	0.381 (0.130) ^a	6	Iran	0.252 (0.125) ^b	0.267 (0.133) ^b
7	Israel	0.283 (0.087) ^a	7	Israel	−0.350 (0.229)	0.680 (0.060) ^b
8	Japan	−0.526 (0.124) ^a	8	Japan	−0.520 (0.192) ^b	−0.111 (0.460)
9	Malawi	0.432 (0.154) ^a	9	Malawi	−0.137 (0.056) ^b	0.448 (0.202) ^b
10	Netherlands	−0.503 (0.211) ^a	10	Netherlands	−0.621 (0.184) ^b	0.396 (0.225)
12	South Africa	−0.407 (0.152) ^b	11	Rwanda	−0.680 (0.306) ^a	0.458 (0.507)
13	UAE	−0.433 (0.202) ^b	12	South Africa	−0.307 (0.130) ^b	0.439 (0.491)
			13	Tanzania	−0.699 (0.234) ^a	0.342 (0.664)
			14	UAE	−0.573 (0.149) ^a	0.404 (0.308)
			15	Uganda	−0.772 (0.233) ^a	0.070 (0.431)
			16	USA	−0.385 (0.144) ^b	0.201 (1.164)

Note: DRC, UAE and USA stand for the Democratic republic of Congo, the United Arab Emirates and the United States of America respectively.

^a Significant at 1%.

^b Significant at 5%. The values in parentheses are the standard errors.

hand rise, resulting in an adverse net effect on the bilateral trade

¹¹ Rose and Yellen (1989) defined the J-curve effect of a depreciation as the deterioration of the trade balance in the short-run after which an improvement follows in the long-run. This long-run improvement should fulfill the Marshall-Lerner condition.

balances. By combining these short-run results and the long-run results in Panel A of Table 2, while taking into account the definition of the J-curve effect according to Rose and Yellen (1989)¹¹, we confirm that the J-curve effects exist in 7 bilateral trading relationships. The short-run results also indicate the presence of statistically significant but perversely-signed coefficients for bilateral trades with the DRC, Iran,

Israel and Malawi.

In the nonlinear model, on the other hand, the findings in panel B of Table 3 indicate statistically significant negative coefficients for the ΔPOS variable in Kenya's bilateral trade with China, Egypt, India, Japan, Malawi, Netherlands, Rwanda, Saudi Arabia, South Africa, Tanzania, UAE, Uganda and USA. The magnitude of the coefficients is especially large for bilateral trade balances with Netherlands, Rwanda, Tanzania and Uganda. This may be due to the fact that these economies are the major destinations for Kenya's manufactured goods and therefore a depreciation of the exchange rate would relatively reduce the earnings from exports in the short-run. This result together with the general positive coefficient of POS in Panel B of Table 3, provides evidence of 13 bilateral J-curves. Therefore, it is clear that the nonlinear model provides more evidence of bilateral J-curve effects, a finding that is in agreement with Bahmani-Oskooee and Fariditavana (2016). However, perverse signs are established for bilateral trade with Bangladesh, DRC and Iran where the coefficient of ΔPOS positively and significantly boosts bilateral trade balances. This implies that the $BREER$ depreciations in the short-run stimulate Kenya's exports and discourage imports. The reasons for this outcome are beyond the scope of this study. In the short-run, for Iran, Israel and Malawi, appreciations of the $BREER$ have positive effects on the bilateral trade balances while in bilateral trade with the DRC, a $BREER$ appreciation is found to have a negative effect on the bilateral trade balance.

5.3. Sensitivity analysis

To check for the robustness of our findings, we repeat the analyses by excluding five bilateral relations that registered the lowest bilateral trade proportions. These countries included; Bangladesh, Malawi, Philippines, Portugal and Romania. We find that the results under the nonlinear ARDL framework, as reported in Table A5 in the appendices, bear similar signs and significance as those in Table 2. However, there are slight changes in the magnitudes. Therefore, it is clear that our findings do not vary regardless of the number of observations. Following Goswami and Junayed (2006), we also decide to select a different lag-length. Using the Akaike Information Criteria (AIC) in this case, we estimate a nonlinear ARDL-AIC (1,1,1,0,0) and find that the results still remain robust. The only slight deviation from the results on Table 2 is that the POS variable is now significant at the 5% level of significance.

6. Conclusion

Bilateral trade balances have attracted political (if not economic) attention in different countries across the world because authorities see bilateral trade deficits as evidence of unfair trading practices by their partners. This paper, therefore, looked into whether the J-curve effects of the exchange rate are discernible in Kenya's bilateral trade with 30 trading partners while simultaneously testing if the

asymmetric effects also exist. Apart from revealing bilateral-specific heterogeneities in how trade balances with different trade partners respond to exchange rate changes, the PMG estimation results under a linear ARDL framework revealed evidence of the J-curve effect in 7 bilateral trade relations while the same estimation under the nonlinear ARDL framework confirmed 13 cases. Asymmetry in the adjustment of the trade balances to the exchange rate changes was detected in the long-run while it was noticeable in 16 cases in the short-run. This asymmetry was evidenced by differing signs and magnitudes of the depreciation and appreciation variables in the nonlinear ARDL framework.

These findings, therefore, indicate that exchange rate policies can be used to target Kenya's trade balance in the long-run since there is evidence of a stable relationship. However, this has to be conducted bilaterally. The findings also reveal that a devaluation policy does not work immediately and that the bilateral trade balances worsen initially before improving after passage of some time. The study also shows that economic agents respond to depreciations/devaluations more than they respond to appreciations or revaluations. Finally, these findings suggest that while efforts to stabilize the exchange rate are important, maintaining highly overvalued currency against those of the trading partners discourages exportation, promotes importation and widens the trade balance.

We, however, note that our findings still suffer from some degree of aggregation bias and they can be improved by the use of commodity-level or industry-level data which this study was unable to acquire. The findings from such a study would be more detailed and would help identify those sectors that would specifically benefit from exchange rate depreciations or devaluations.

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Declaration of competing interest

We wish to declare no conflict of interest.

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Appendices

Table A1
Proportions of Kenya's Commodity Group Exports and Their Destinations in 2018

Trade Partner	Primary Commodities	Manufactured goods	Machinery and Transport Equipment	Chemical Products	Fuels	Textile and Clothing
Bangladesh	0.029	0.180	0.000	0.092	0.000	0.000
Canada	0.324	0.363	0.149	0.012	3.243	1.061
China	2.596	1.241	1.500	0.432	1.181	1.555
China, Hong Kong SAR	1.235	0.624	0.852	0.069	0.000	0.009
Dem. Rep. of the Congo	1.579	5.989	3.344	4.273	2.477	1.236
Egypt	4.903	0.794	0.894	0.005	0.000	0.435
Germany	2.797	0.386	0.222	0.029	0.467	0.681
India	1.459	2.811	0.748	8.829	0.007	1.013
Iran (Islamic Republic of)	0.425	0.006	0.000	0.012	0.000	0.012
Israel	0.202	0.063	0.094	0.010	0.000	0.054
Italy	0.589	1.176	0.244	0.248	0.868	0.245
Japan	1.145	0.075	0.014	0.033	0.000	0.000

(continued on next page)

Table A1 (continued)

Trade Partner	Primary Commodities	Manufactured goods	Machinery and Transport Equipment	Chemical Products	Fuels	Textile and Clothing
Korea, Republic of	0.891	0.150	0.138	0.006	0.000	0.485
Malawi	0.262	1.201	0.896	2.237	0.045	0.302
Malaysia	0.166	0.080	0.191	0.090	0.000	0.111
Netherlands	12.064	1.111	6.940	0.028	1.594	0.110
Pakistan	12.415	0.669	0.178	1.690	0.000	0.202
Philippines	0.072	0.171	0.032	0.597	0.000	0.669
Portugal	0.129	0.014	0.071	0.001	0.000	0.001
Qatar	0.138	0.022	0.077	0.021	10.109	0.003
Romania	0.094	0.035	0.011	0.000	0.000	0.001
Russian Federation	2.532	0.041	0.065	0.000	0.000	0.047
Rwanda	1.051	6.663	6.916	9.308	5.353	0.569
Saudi Arabia	1.636	0.186	0.609	0.221	8.130	1.573
South Africa	0.196	1.017	4.130	0.619	0.114	0.047
Tanzania	0.999	12.906	21.882	18.442	1.291	1.979
Uganda	4.043	17.493	18.670	22.318	14.297	2.456
United Arab Emirates	5.586	0.465	0.466	0.160	19.264	0.219
United Kingdom	9.689	1.527	5.563	0.305	0.045	0.240
United States of America	3.212	21.223	4.871	2.120	0.363	75.191
Share in Total Exports	54.812	27.652	3.925	7.314	4.420	2.000

Note: Primary commodities (SITC 0 + 1 + 2 + 4 + 68); Manufactured goods (SITC 5 to 8 less 667 and 68); Machinery and Transport Equipment (SITC 7); Chemicals (SITC 5); Fuels (SITC 3); and Textile fibres, yarn, fabrics and clothing (SITC 26 + 65 + 84).

Source: Own computation using data from the World Integrated Trade Solution (WITS) database.

Table A2

Proportions of Kenya's Commodity Group Imports and Their Sources in 2018

Trade Partner	Primary Commodities	Manufactured Goods	Machinery and Transport Equipment	Chemical Products	Fuels	Textile and Clothing
Bangladesh	0.002	0.111	0.003	0.240	0.000	0.686
Canada	1.806	0.301	0.431	0.141	0.000	1.701
China	5.981	32.910	34.759	14.036	0.276	49.848
China, Hong Kong SAR	0.018	0.974	1.643	0.172	0.011	1.192
Dem. Rep. of the Congo	0.218	0.017	0.027	0.004	0.000	0.002
Egypt	2.227	1.958	0.382	2.783	0.086	0.792
Germany	1.393	3.292	4.795	3.533	0.093	0.788
India	4.421	11.343	8.460	19.344	16.187	9.693
Iran	0.202	0.039	0.002	0.033	3.126	0.006
Israel	0.159	0.433	0.429	0.860	0.004	0.083
Italy	0.950	1.740	2.343	1.621	0.703	0.287
Japan	0.311	7.522	13.263	0.735	0.025	1.067
Korea, Republic of	1.271	1.416	0.943	3.034	0.113	2.325
Malawi	0.601	0.007	0.001	0.001	0.000	0.001
Malaysia	5.321	0.508	0.271	0.601	0.034	1.216
Netherlands	1.146	1.589	2.272	1.729	1.231	0.175
Pakistan	5.757	0.585	0.056	0.699	0.000	5.403
Philippines	0.012	0.094	0.061	0.044	0.000	0.100
Portugal	0.109	0.090	0.040	0.054	0.003	0.317
Qatar	0.006	0.318	0.022	1.363	0.002	0.002
Romania	0.272	0.047	0.031	0.129	0.000	0.005
Russian Federation	5.938	0.670	0.143	0.783	0.111	0.009
Rwanda	1.335	0.013	0.008	0.002	0.009	0.005
Saudi Arabia	0.302	2.526	0.052	10.765	43.971	0.084
South Africa	2.589	4.646	2.524	3.741	1.908	1.450
Tanzania	3.722	1.031	0.630	0.698	0.209	1.478
Uganda	15.218	0.477	0.086	0.240	0.524	0.601
United Arab Emirates	2.716	6.455	8.288	4.820	22.419	3.864
United Kingdom	1.778	2.851	4.014	2.506	0.107	1.799
United States of America	1.736	2.370	2.946	2.853	0.165	1.157
Share in Total Imports	16.531	66.413	23.625	5.512	15.786	1.441

Note: Primary commodities (SITC 0 + 1 + 2 + 4 + 68); Manufactured goods (SITC 5 to 8 less 667 and 68); Machinery and Transport Equipment (SITC 7); Chemicals (SITC 5); Fuels (SITC 3); and Textile fibres, yarn, fabrics and clothing (SITC 26 + 65 + 84).

Source: Own computation using data from the World Integrated Trade Solution (WITS) database.

Table A3

Kenya's Bilateral Trade Performance (2006–2018).

Trading Partner	Share of Exports in Total Exports	Share of Imports in Total Imports	Trade Balance in Million US Dollars
Bangladesh	0.050	0.047	-4.003
Canada	0.436	0.701	-75.982
China	1.113	15.483	-2255.485
Dem. Rep. of the Congo	3.198	0.070	164.859
Egypt	3.556	1.666	-50.719
Germany	2.092	2.947	-294.496
Hong Kong	0.664	0.623	-46.919
India	1.926	13.181	-1742.773
Iran	0.244	0.406	-40.824
Israel	0.306	0.553	-56.997
Italy	1.035	1.590	-155.267

Table A3 (continued)

Trading Partner	Share of Exports in Total Exports	Share of Imports in Total Imports	Trade Balance in Million US Dollars
Japan	0.670	5.284	-686.683
Malawi	0.729	0.092	-181.954
Malaysia	0.183	0.831	24.927
Netherlands	8.156	1.677	-107.816
Pakistan	5.354	1.209	207.179
Philippines	0.103	0.050	114.703
Portugal	0.107	0.070	-1.024
Qatar	0.170	0.295	-4.533
Romania	0.049	0.164	-33.177
Russian Federation	1.307	1.195	-18.258
Rwanda	2.802	0.195	-103.049
Saudi Arabia	0.787	6.011	123.044
South Africa	0.717	5.013	-831.706
South Korea	0.277	1.474	-611.464
Tanzania	6.710	1.211	189.322
Uganda	11.244	1.436	377.851
United Arab Emirates	4.137	9.162	-970.615
United Kingdom	9.024	3.216	48.666
United States of America	6.925	4.081	-165.982

Source: Own computation using data from the World Integrated Trade Solution (WITS) database.

Table A4

The IPS Panel Unit Root Test Results

	IPS (at Levels)		IPS (at First Difference)	
	Statistic	p-value	Statistic	p-value
LnBTB	2.080	0.9812	-4.0059	0.0000
LnBRER	-0.769	0.221	-18.415	0.000
LnRGDP	-0.867	0.807	-12.883	0.000
LnRPGNI	-3.016	0.000		

Source: Own computation.

Table A5

Results for the Sensitivity Test on the PMG Model under Nonlinear ARDL Framework

Panel A: 25 Trading Partners, Nonlinear ARDL-SBIC (1,0,0,0)			Panel B: 30 Trading Partners, Different Lag-Length, Nonlinear ARDL-AIC (1,1,1,0,0)		
Long-Run Estimates			Long-Run Estimates		
POS	1.007		POS	1.201	
	(0.355) *			(0.470) **	
NEG	-0.862		NEG	-0.618	
	(0.398) **			(0.297) **	
LnRGDP	-0.353		LnRGDP	-0.297	
	(0.152) **			(0.131) **	
LnRPGNI	-1.206		LnRPGNI	-1.030	
	(0.141) *			(0.286) *	
Short-Run Estimates			Short-Run Estimates		
EC(t-1)	-0.168		EC(t-1)	-0.170	
	(0.051) *			(0.063) *	
$\Delta \text{LnBTB}_{(t-1)}$	0.198		$\Delta \text{LnBTB}_{(t-1)}$	0.269	
	(0.095) **			(0.099) *	
ΔLnBRER	-0.823		ΔPOS	-0.378	
	(0.412) **			(0.186) **	
			$\Delta \text{POS}_{(t-1)}$	-0.113	
				(0.356)	
			ΔNEG	-0.340	
				(0.407)	
			$\Delta \text{NEG}_{(t-1)}$	-0.556	
				(0.575)	
ΔLnRGDP	0.260		ΔLnRGDP	0.443	
	(0.129) **			(0.300)	
$\Delta \text{LnRPGNI}$	-0.361		$\Delta \text{LnRPGNI}$	0.522	
	(0.466)			(0.180) *	
Constant	0.139		Constant	-0.345	
	(0.062) *			(0.167) **	

Source: Own computation.

References

- Bahmani-Oskooee, M., Hegerty, S.W., 2010. The J-and S-curves: a survey of the recent literature. *J. Econ. Stud.*
- Bahmani-Oskooee, M., Wang, Y., 2006. The J curve: China versus her trading partners. *Bull. Econ. Res.* 58 (4), 323–343.

- Akbostanci, E., 2004. Dynamics of the trade balance: the Turkish J-curve. *Emerg. Mark. Finance Trade* 40 (5), 57–73.
- Amusa, H., Fadiran, D., 2019. The J-curve phenomenon: evidence from commodity trade between South Africa and the United States. *Econ. Res. South Afr.* 43, 1–19.
- Ardalani, Z., Bahmani-Oskooee, M., 2007. Is there a J-curve at the industry level? *Econ. Bull.* 6 (26), 1–12.
- Bahmani-Oskooee, M., Baek, J., 2016. Do exchange rate changes have symmetric or asymmetric effects on the trade balance? Evidence from US–Korea commodity trade. *J. Asian Econ.* 45, 15–30.
- Bahmani-Oskooee, M., Cheema, J., 2009. Short-run and long-run effects of currency

- depreciation on the bilateral trade balance between Pakistan and her major trading partners. *J. Econ. Dev.* 34 (1), 19.
- Bahmani-Oskooee, M., Fariditavana, H., 2015. Nonlinear ARDL approach, asymmetric effects and the J-curve. *J. Econ. Stud.* 42 (3), 519–530. <https://doi.org/10.1108/JES-03-2015-0042>.
- Bahmani-Oskooee, M., Fariditavana, H., 2016. Nonlinear ARDL approach and the J-curve phenomenon. *Open Econ. Rev.* 27 (1), 51–70.
- Bahmani-Oskooee, M., Gelan, A., 2012. Is there J-Curve effect in Africa? *Int. Rev. Appl. Econ.* 26 (1), 73–81.
- Bahmani-Oskooee, M., Harvey, H., 2009. The J-curve: Indonesia vs. her major trading partners. *J. Econ. Integrat.* 765–777.
- Bahmani-Oskooee, M., Nasir, M.A., 2020. Asymmetric J-curve: evidence from industry trade between US and UK. *Appl. Econ.* 52 (25), 2679–2693.
- Bahmani-Oskooee, M., Ratha, A., 2004. Dynamics of the US trade with developing countries. *J. Develop. Area.* 1–11.
- Bahmani-Oskooee, M., Wang, Y., 2008. The J-curve: evidence from commodity trade between US and China. *Appl. Econ.* 40 (21), 2735–2747.
- Bahmani-Oskooee, M., Economidou, C., Goswami, G.G., 2006. Bilateral J-curve between the UK vis-à-vis her major trading partners. *Appl. Econ.* 38 (8), 879–888.
- Bahmani-Oskooee, M., Goswami, G., Talukdar, B., 2008. The bilateral J-curve: Canada versus her 20 major trading partners. *Int. Rev. Appl. Econ.* 22, 93–104.
- Bahmani-Oskooee, M., Aftab, M., Harvey, H., 2016. Asymmetry cointegration and the J-curve: new evidence from Malaysia-Singapore commodity trade. *J. Econ. Asymmetries* 14, 211–226.
- Bahmani-Oskooee, M., Bose, N., Zhang, Y., 2018. Asymmetric cointegration, nonlinear ARDL, and the J-curve: a bilateral analysis of China and its 21 trading partners. *Emerg. Mark. Finance Trade* 54 (13), 3131–3151.
- Banerjee, A., Dolado, J., Mestre, R., 1998. Error-correction mechanism tests for cointegration in a single-equation framework. *J. Time Anal.* 19 (3), 267–283.
- Batra, A., 2006. India's global trade potential: the gravity model approach. *Global Econ. Rev.* 35 (3), 327–361.
- Beck, N., Katz, J.N., 1995. What to do (and not to do) with time-series cross-section data. *Am. Polit. Sci. Rev.* 89 (3), 634–647.
- Bigsten, A., Kalinda-Mkenda, B., 2002. Kenya and the East African Community: A Report for SIDA.
- Bussiere, M., 2013. Exchange rate pass-through to trade prices: the role of nonlinearities and asymmetries. *Oxf. Bull. Econ. Stat.* 75 (5), 731–758.
- Caporale, G.M., Gil-Alana, L.A., Mudida, R., 2015. Testing the Marshall–Lerner Condition in Kenya. *J. Afr. J. Econ.* 83 (2), 253–268.
- Comunale, M., Hessel, J., 2014. Current Account Imbalances in the Euro Area: Competitiveness and Financial Cycle? *DNB Working paper* No. 443.
- Dash, A.K., 2013. Bilateral j-curve between India and her trading partners: a quantitative perspective. *Econ. Anal. Pol.* 43 (3), 315–338.
- Duasa, J., 2007. Determinants of Malaysian trade balance: an ARDL bound testing approach. *Global Econ. Rev.* 36 (1), 89–102.
- Erdey, L., Pöstényi, A., 2017. Determinants of the exports of Hungary: trade theory and the gravity model. *Acta Oecon.* 67 (1), 77–97.
- Gertz, G., 2008. Kenya's Trade Liberalization of the 1980s and 1990s: Policies, Impacts, and Implications. Background paper on the impact of Doha Round on Kenya.
- Goldstein, M., Khan, M.S., 1985. Income and price effects in foreign trade. *Handbook of international economics*, 2. Elsevier Science Publishers B. V., pp. 1041–1105.
- Gomes, F.A.R., Paz, L.S., 2005. Can real exchange rate devaluation improve the trade balance? The 1990–1998 Brazilian case. *Appl. Econ. Lett.* 12 (9), 525–528. <https://doi.org/10.1108/01443581011086639>.
- Goswami, G.G., Junayed, S.H., 2006. Pooled mean Group estimation of the bilateral trade balance equation: USA vis-à-vis her trading partners. *Int. Rev. Appl. Econ.* 20 (4), 515–526.
- Halicioglu, F., 2007. The J-curve dynamics of Turkish bilateral trade: a cointegration approach. *J. Econ. Stud.* 34 (2), 103–119.
- Hussain, M.E., Haque, M., 2014. Is the J-curve a reality in developing countries? *J. Econ. Polit. Econ.* 1 (2), 231–240.
- Im, K.S., Pesaran, M.H., Shin, Y., 2003. Testing for unit roots in heterogeneous panels. *J. Econom.* 115 (1), 53–74.
- Junz, H.B., Rhomberg, R.R., 1973. Price competitiveness in export trade among industrial countries. *Am. Econ. Rev.* 63 (2), 412–418.
- Kennedy, O., 2013. Kenya's foreign trade balance: an empirical investigation. *Eur. Sci. J.* 9 (19).
- Khan, M., Hossain, M.I., 2010. Model of bilateral trade balance: extensions and empirical tests. *Econ. Anal. Pol.* 40 (3), 377–391.
- Khan, M.Z.S., Hossain, M.I., 2012. Determinants of Trade Balance of Bangladesh: A Dynamic Panel Data Analysis. *The Bangladesh Development Studies*, pp. 45–65.
- Kiptui, M., 2007. July. Does the exchange rate matter for Kenya's exports? A bounds testing approach. In: *African Econometric Society 2007 Conference*, Cape Town.
- Kiptui, M.C., 2018. The dynamics of the exchange rate and bilateral trade balances: evidence from Kenya using nonlinear ARDL approach. *Int. J. Contemp. Res. Rev.* 9 (7), 20832–20849.
- Levin, A., Lin, C.F., Chu, C.S.J., 2002. Unit root tests in panel data: asymptotic and finite-sample properties. *J. Econom.* 108 (1), 1–24.
- Magee, S.P., 1973. Currency contracts, pass-through, and devaluation. *Brookings Pap. Econ. Activ.* 1973 (1), 303–325.
- Mettwally, E.S., 2013. Is the J-curve effect observable for Egypt economy? *J. Econ. Coop. Dev.* 34 (2), 91.
- Mkenda, B.K., 2002. To what Extent Is East Africa Globalised?, vol. 1. Economic and Social Research Foundation.
- Mohsen, B.O., Brooks, T.J., 1999. Cointegration approach to estimating bilateral trade elasticities between US and her trading partners. *Int. Econ. J.* 13 (4), 119–128.
- Moura, G., Da Silva, S., 2005. Is there a Brazilian J-curve. *Econ. Bull.* 6 (10), 1–17.
- Mwito, M.M., Muhia, R.N., Kiprop, S., Kibet, L., 2015. Does the marshall-lerner condition hold for Kenya's bilateral trade? A dynamic panel data approach. *Eur. J. Bus. Soc. Sci.* 4 (6), 40–58.
- Narayan, P.K., Narayan, S., 2004. The J-curve: evidence from Fiji. *Int. Rev. Appl. Econ.* 18 (3), 369–380.
- Ndung'u, N.S., 1999. Monetary and Exchange Rate Policy in Kenya. AERC, Nairobi, KE.
- Olofin, S., Babatunde, M.A., 2007. July. Estimating price and income elasticities of Sub-Saharan African exports. In: *12th Annual Conference on Econometric Modeling for Africa Session*.
- Pesaran, M.H., Shin, Y., 1998. An autoregressive distributed-lag modelling approach to cointegration analysis, 31. *Econometric Society Monographs*, pp. 371–413.
- Rahman, M., Islam, A.M., 2006. Taka-Dollar exchange rate and Bangladesh trade balance: evidence on J-Curve or S-Curve? *Indian J. Econ. Bus.* 5 (2), 279.
- Rehman, H.U., Afzal, M., 2003. The J Curve Phenomenon: an Evidence from Pakistan. *Pakistan economic and social review*, pp. 45–58.
- Rose, A.K., Yellen, J.L., 1989. Is there a J-curve? *J. Monetary Econ.* 24 (1), 53–68.
- Shahriar, S., Qian, L., Kea, S., 2019. Determinants of exports in China's meat industry: a gravity model analysis. *Emerg. Mark. Finance Trade* 55 (11), 2544–2565.
- Shin, Y., Yu, B., Greenwood-Nimmo, M., 2014. Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In: *Festschrift in Honor of Peter Schmidt*. Springer, New York, NY, pp. 281–314.
- Singh, T., 2004. Testing J-curve hypothesis and analysing the effect of exchange rate volatility on the balance of trade in India. *Empir. Econ.* 29 (2), 227–245.
- Swamy, G., 1994. Kenya: Structural Adjustment in the 1980s, vol. 1238. World Bank Publications.
- Wagacha, B.M., 2000. Analysis of Liberalization of the Trade and Exchange Regime in Kenya since 1980, vol. 23. Institute of Policy Analysis and Research.
- Were, M., Ndung'u, N.S., Geda, A., Karingi, S.N., 2002. Analysis of Kenya's Export Performance: an Empirical Evaluation. Kenya Institute for Public Policy Research and Analysis, Nairobi, Kenya.
- Were, M., Sichei, M., Milner, C., 2009. Trade policy in Kenya. In: *Kenya: Policies for Prosperity*. Oxford University Press.
- World Bank, 2012. The state of Kenya's economy special focus: deepening Kenya's integration in the East african community (EAC). World Bank. 6.
- World Bank, 2013. Kenya economic update: walking on a tight rope, rebalancing Kenya's economy with a special focus on regional integration. World Bank. 8.