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Does the J-Curve Phenomenon apply to the U.S. Agricultural Trade Balance? “A Cointegration Approach"

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This article replicates and extends the study that investigated the effects of exchange rate changes on the bilateral trade balance of U.S. agriculture with its 15 major trading partners, specifically testing the applicability of the J-curve hypothesis to the U.S. agricultural trade balance. The replication covers eight of the original fifteen countries, while the extension includes three BRICS countries. The analysis employs the ARDL approach using quarterly data from the USDA and IMF websites, spanning from 1989Q1 to 2007Q4 for the replication and from 1996Q1 to 2023Q1 for the extension. Results from both the replication and extension reveal that exchange rate fluctuations significantly affect the U.S. agricultural bilateral trade balance with certain countries. Specifically, while dollar depreciation improves the U.S. agricultural trade balance with some countries, it worsens it with others. The direct implication of these results is that the policy of dollar depreciation will, in the long term, enhance the U.S. agricultural trade balance with some countries while worsening it with others. However, no evidence supporting the J-curve phenomenon is found.

Key words: J-curve, trade balance, exchange rate fluctuation, cointegration, replication and extension.

INTRODUCTION

The collapse of the Bretton Woods system in March 1973, which marked the end of fixed exchange rates, raised concerns about the potential repercussions of the new floating exchange rate system on international trade. The prevailing assumption was that this new system might adversely impact trade due to its volatility, as trade actors are assumed to display a certain degree of risk aversion. This prompted numerous theoretical and empirical investigations, leading to ambiguous research findings.

While some studies (Ethier, 1973; Clark, 1973; Baron, 1976; Thursby and Thursby, 1987; Frankel and Wei, 1993; Eichengreen and Irwin, 1995; Frankel et al., 1997; Arize, 1998) observed a negative effect on international trade, others (Franke, 1991; Sercu and Vanhulle, 1992; McKenzie and Brooks, 1997; Tenreyro, 2007; Baum and Caglayan, 2010) reported positive, ambiguous, or insignificant effects on trade flows.

In examining the effect of exchange rate volatility on the trade balance in the short run, Magee (1973) identified a pattern resembling the letter J, leading to the formulation

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of the J-Curve theory. This theory posits that in the short run, currency depreciation initially worsens the trade balance before eventually improving it, provided the Marshall-Lerner condition is met, where the sum of the absolute values of domestic and foreign price elasticities of demand exceeds one. Since the introduction of this phenomenon, several studies have tested it using different methodological approaches, resulting in conflicting results.

Bahmani-Oskooee and Ratha (2004b) provided a comprehensive review of related empirical studies and classified them into two groups: those employing aggregate trade data and those using bilateral trade data. In the first group, studies conducted by Bahmani-Oskooee (1985), Haynes and Stone (1982), Wassink and Carbaugh (1989), and Mahdavi and Sohrabian (1993) revealed the existence of the J-Curve in trade balance, while others, including Koch and Rosensweig (1988), Felmingham (1988), Moffett (1989), and Duru et al. (2022), did not observe this phenomenon. These aggregate studies have been criticized for suffering from aggregate bias. Maskus (1986) argued that exchange rate risk might impact industries differently, either because some industries are more exposed to risk or react to it differently, or because industries have varying degrees of openness to trade.

The second category of research, which employed a bilateral approach, produced similar results. While some studies, such as those by Rose and Yellen (1989) and Bahmani-Oskooee and Brooks (1999), found no evidence of the J-Curve, others, such as those by Arora et al. (2003), Upadhyaya et al. (2022), and Jain and Das (2023), reported its presence. Additionally, other studies, including those by Bahmani-Oskooee et al. (2020), Bahmani-Oskooee and Nouira (2021), Ramzan (2021), Mwito et al. (2021), and Arthur et al. (2022), have observed mixed results.

Most of these studies have been conducted outside of the agricultural sector. Limited research testing the J-Curve hypothesis in agriculture includes Carter and Pick (1989), Doroodian et al. (1999), Baek et al. (2009), and Gong and Kinnucan (2015). Carter and Pick (1989) observed the presence of the initial segment of the J-Curve, while Doroodian et al. (1999) found evidence supporting the J-Curve. In contrast, Baek et al. (2009) and Gong and Kinnucan (2015) reported no evidence of the J-Curve. Three of these studies used aggregate data between the US and the rest of the world, while Baek et al. (2009) focused on bilateral trade balance data between the US and its 15 major trading partners.

To the best of current knowledge, very few studies have investigated the validity of the J-Curve phenomenon in the US agricultural sector using a bilateral approach. This study's main contribution lies not only in replicating Baek et al. (2009) but also in extending the analysis to three BRICS countries to determine whether similar conclusions apply to nations outside the US's 15 major trading partners. The study successfully replicated the analysis for 8 out of the 15 countries considered in the original article. The findings from both the replication and extension confirm the results of the original study, revealing no evidence of the J-Curve phenomenon in the US agricultural trade balance.

This article is divided into five different parts. Following the introduction, a review of relevant literature is presented, followed by an introduction to the empirical model and a description of the dataset. Subsequently, the results of the replication and extension are discussed, and the article concludes with the final parts of the study.

LITERATURE REVIEW

A range of studies has explored the impact of exchange rates on trade flows, particularly focusing on the J-curve phenomenon introduced by Magee in 1973. Bahmani-Oskooee and Ratha (2004b) investigated the J-curve phenomenon, with one study using aggregate trade data (trade between one country and the rest of the world) and the other applying bilateral trade data. This review concentrates on the latter category, which is relevant to the study.

In 1989, Rose and Yellen examined the J-curve phenomenon using US bilateral quarterly data from 1963 to 1988. They employed the cointegration approach of Engle and Granger (1987) and found that exchange rate fluctuations had no significant effect on the US bilateral trade balance, providing no evidence to support the phenomenon. Similarly, Rose (1991) applied a VAR model approach to investigate the impact of the real effective exchange rate on the real aggregate trade balance of five major OECD countries (the United Kingdom, Canada, Germany, Japan, and the United States). The results indicated that the exchange rate did not have a significant effect on the trade balance. Shirvani and Wilbratte (1997) used the multivariate cointegration method developed by Johansen and Juselius (1990) to investigate the impact of real exchange rate changes on the U.S. bilateral trade balance. Using monthly trade data from January 1973 to August 1990, they focused on major U.S. trading partners, including Canada, France, Germany, Italy, Japan, and the UK. Their findings suggested, except for Italy, that the exchange rate significantly affects the U.S. trade balance not in the short term (1 to 6 months) but over the longer term (1 to 24 months). Instead of observing a J-Curve, they identified a horizontally reversed L-Curve effect.

Bahmani-Oskooee and Talukdar (2005) examined the short-run and long-run effects of real exchange rate depreciation on the trade balance between Australia and its 23 trading partners. They analyzed quarterly data from 1973 to 2001 using the Autoregressive Distributed Lag (ARDL) approach, and their results did not support the existence of the J-Curve phenomenon.

Bahmani-Oskooee and Brooks (1999) employed a model similar to that of Rose and Yellen (1989) but applied the Autoregressive Distributed Lag (ARDL) approach.

Using US bilateral trade data from 1973Q1 to 1996Q2, they found that in the short run, there is no clear pattern supporting the J-curve phenomenon. However, in the long run, their results validated the phenomenon, suggesting that real exchange rate depreciation has a favorable long-term effect on the US trade balance with its six trading partners. Bahmani-Oskooee and Ratha (2004a) obtained similar results when they expanded the analysis to include almost all industrial countries among the US's trading partners. Bahmani-Oskooee and Brooks (1999) employed a similar model to Rose and Yellen (1989) but applied the Autoregressive Distributed Lag (ARDL) approach. They used US bilateral trade quarterly data from 1973Q1 to 1996Q2 and observed that in the short run, there is no specific pattern supporting the J-curve phenomenon. However, in the long run, the results validated the phenomenon, suggesting that real exchange rate depreciation has a favorable long-run effect on US trade balance with its six trading partners. Similar results were found by Bahmani-Oskooee and Ratha (2004a) when they expanded the list of US trading partners to include almost all industrial countries. In contrast, Wilson (2001) analyzed the J-curve effect for Singapore, Malaysia, and Korea with their trade partners using a VAR approach and found evidence of a J-curve only in the case of Korea. Similarly, Bahmani-Oskooee and Goswami (2003) applied the ARDL approach to investigate the J-curve between Japan and its trading partners (Australia, Canada, France, Germany, Italy, Netherlands, Switzerland, the UK, and the USA), finding evidence of the J-curve only in the cases of Germany and Italy. In Ghana, Arthur et al. (2022) investigated the presence of the J-curve in Ghana's bilateral trade with China and Switzerland. Using the ARDL method with quarterly data from 1995Q1 to 2018Q4, their findings suggest that while exchange rate fluctuations impact Ghana's trade balance with both countries, evidence of the J-curve was observed only in trade with China. Similarly, Mwito et al. (2020) conducted a study in Kenya with its 30 trading partners. The findings from the linear ARDL approach indicated the existence of a J-curve pattern in 7 bilateral trades, while the nonlinear ARDL approach revealed its presence in 13 cases. Upadhyaya et al. (2022) examined the validity of the J-curve phenomenon in bilateral trade between the US and China. Their Error Correction analysis supports the presence of the J-Curve in the US-China trade balance. Jain and Das (2023) conducted a similar study using a vector autoregression (VAR) model with quarterly data from 2000Q1 to 2021Q4 and confirmed the results of Upadhyaya et al. (2022).

Bilateral studies have faced criticism for suffering from aggregate bias. One argument is that such research often overlooks the possibility that the effects of exchange rates may differ across sectors and specific goods. To address this critique, some studies have focused on sectoral or commodity levels.

Bahmani-Oskooee et al. (2020) examined the validity of the J-Curve in the trade balance between Pakistan and the US across 41 industries. The results from the linear ARDL model revealed the existence of a J-Curve pattern in only 10 out of the 41 industries, while the nonlinear ARDL model suggested the presence of the J-Curve in 19 industries.

Similarly, in 2021, Bahmani-Oskooee and Nouira investigated the J-Curve effect in bilateral trade between the US and Italy, focusing on 58 industries. Using a nonlinear model, they observed evidence of the J-Curve effect in 12 out of 58 industries. In Turkey, Ramzan (2021) tested the J-Curve phenomenon in the bilateral trade balance between Turkey and the US across 23 industries. The results from the linear ARDL model showed evidence of the J-Curve effect in only 3 industries: Transportation, Metals, and Textiles-Clothing and Ores.

In the agricultural sector, few studies have examined the J-Curve phenomenon. Carter and Pick (1989) investigated this phenomenon using a polynomial distributed lag model and found evidence suggesting that the initial segment of the J-Curve does exist for the US agricultural trade balance. Doroodian et al. (1999) also explored the J-Curve effect, focusing on US agricultural and manufactured commodities. They found evidence of the J-Curve in the US agricultural trade balance but not in the manufacturing sector. In 2015, Gong and Kinnusen examined the J-Curve in the US agricultural trade balance and found no evidence of the phenomenon. In Southeast Asia, Trofimov (2024) investigated the J-Curve hypothesis in the agricultural sectors of four countries: Indonesia, Malaysia, the Philippines, and Thailand.

He employed both linear and nonlinear ARDL models with data spanning from 1980 to 2017. His findings suggested that while exchange rate changes impact the agricultural trade balance, there is no evidence of a J-Curve in the agricultural trade balances of these countries, except in Malaysia, where the J-Curve effect was observed. However, a main issue inherent in these studies is the use of aggregate agricultural data in relation to the rest of the world, rather than bilateral agricultural data.

Baek et al. (2009) explored the dynamic consequences of exchange rate volatility on bilateral trade in agricultural products between the United States and its 15 primary trading partners. This study specifically examined the short-term J-Curve effect using an autoregressive distributed lag (ARDL) approach with quarterly data from 1989 to 2007. Their findings indicated that exchange rate volatility significantly affected the agricultural trade balance in both the short and long run, but there was no evidence of a J-Curve phenomenon.

These studies show varying outcomes regarding the J-Curve phenomenon, with some indicating no significant short-term effects and others finding long-term validation.

Empirical framework

The main goal of this study is to assess the impact of exchange rate volatility on the US agricultural trade balance with a focus on the J-curve phenomenon. The model is based on the trade balance framework developed by Rose and Yellen in 1989. Equation 1 for the trade balance is specified as follows:

$$TB = f\,(Y, Y^*, ER) \tag{1}$$

where: -TB: Trade Balance,-Y: real income of the home country,-Y*: real income of the foreign country, -ER is the real exchange rate.

The analysis aims to measure both the short- and long-run effects of exchange rate volatility on the US agricultural trade balance. ARDL model, developed by Pesaran et al. (2001), provides an analytical framework for incorporating both effects. According to the literature, the ARDL model offers several advantages over the Engel and Granger (1987) and Johansen (1995) approaches. It accommodates variables of different integration orders—whether purely I(0), purely I(1), or a combination of both—eliminating the need to determine the integration order among variables and conduct unit root tests (Pesaran et al., 2001). Additionally, a simple linear transformation enables the derivation of a dynamic Error Correction Model (ECM). The ARDL bounds approach reveals both long- and short-run relationships without losing information on long-run relationships. Finally, ARDL is more robust and performs better with small sample sizes compared to other cointegration techniques (Pesaran and Shin, 1999). In this study, the ARDL model in Equation 2 is expressed in log-linear form as follows:

$$lnTB_{it} = a + \beta_1 lnY_{US,t} + \beta_2 lnY_{i,t} + \beta_3 lnER_{i,t} + \varepsilon_i \tag{2}$$

In equation 2, TB_{it} represents the real value of the U.S. agricultural trade balance, defined as the ratio of the real value of U.S. imports from country iii to the real value of U.S. exports to country i. $Y_{US,t}$ denotes the real U.S. income, $Y_{i,t}$ represents the real income of trading partners, and $ER_{i,t}$ is the real exchange rate. Since Equation 2 does not account for short-run effects, and given that the primary objective of the study is to examine both short- and long-run effects of the exchange rate with a focus on the J-curve, it is imperative to incorporate short-run dynamics into Equation 3. This requires estimating the error correction version of the ARDL model for the variables under consideration as follows:

$$\Delta lnTB_{it} = \alpha + \sum_{K=1}^{P} \rho_k \Delta lnTB_{i,t-k} + \sum_{k=0}^{p} \lambda_k \Delta lnY_{us,t-k} + \sum_{k=0}^{p} \gamma_k \Delta lnY_{i,t-k} + \sum_{k=0}^{p} \delta_K \Delta lnER_{t-k}$$
$$+ \phi_1 lnY_{US,t-1} + \phi_2 lnY_{i,t-1} + \phi_3 lnER_{i,t-1} + \mu_t, \tag{3}$$

Δ is the difference operator, p, denotes the lag order, and μ_t represents the residual term, assumed to be serially uncorrelated. Øs are the estimated coefficients of the long-run, while the coefficients following the summation signs (Σ) represent the short-run dynamics. It should be noted that the ARDL model, being based on a single-equation approach, may not effectively address potential endogeneity issues with the independent variables, potentially leading to inefficient estimates of the short- and long-run relationships (Pesaran and Shin, 1999). However, in this study, given that the agricultural sector's size is relatively small compared to the overall economy in the United States and its trading partners, it is expected that the exchange rate and income would behave exogenously in the agricultural sector. Consequently, this economic rationale supports the use of a single-equation procedure to estimate the equation.

Data

To empirically examine the impact of exchange rates on the agricultural trade balance of the United States, the original study identified the 15 largest trade partners. Due to unavailability or incompleteness of data, this study replicates the original analysis using 8 of these 15 countries. The key variables include agricultural exports and imports between the United States and these trade partners, along with their GDP and exchange rates. The quarterly data used spans from the first quarter of 1989 to the fourth quarter of 2007, a period selected due to the significant depreciation of the U.S. dollar between 2002 and 2007. During this period, the value of the U.S. dollar declined by approximately 31, 30, and 6% against the euro, the Canadian dollar, and the Japanese yen, respectively. This scenario presents a unique opportunity to explore the validity of the J-curve hypothesis in the agricultural trade balance.

The total values of agricultural exports and imports between the United States and its major partners were sourced from the Foreign Agricultural Trade of the United States (FATUS) database of the U.S. Department of Agriculture (USDA). The real gross domestic product (GDP) index (2000=100), used as a proxy for real income, was obtained from the International Financial Statistics (IFS) database published by the International Monetary Fund (IMF). Additionally, the GDP deflator (2000=100), used to derive the real values of exports and imports, was sourced from the same database. Real bilateral exchange rates between the U.S. and the partners were extracted from the Economic Research Service (ERS) of the U.S. Department of Agriculture. The trade balance defined as the ratio of the real value of U.S. imports to the real value of U.S. exports with the trade partners, is unit-independent and can be effectively interpreted as representing the real trade balance.

The eight countries used for the replication are Canada, France, Germany, New Zealand, South Korea, Mexico, the UK, and Australia. Since the GDP deflator index (2000=100) used in the original study was unavailable, the GDP deflator index (2010=100) from the IFS was used to determine the real values of exports, imports, and GDP for these countries.

For the extension, the methodology of the original article was adapted to focus on the bilateral agricultural trade between the United States and the original BRICS member countries. The BRICS group represents major emerging economies with a significant role in the global economy. In 2018, the BRICS countries accounted for over 50% of the world's gross agricultural production and 15.77% of global agricultural trade volume (Ren et al., 2020). However, due to data unavailability for some BRICS countries, this study focuses on three of them: Brazil, India, and South Africa. The data for this extension is sourced from similar databases as the original study and covers the period from 1996Q1 to 2023Q1. This timeframe was chosen because the U.S. exchange rate relative to these countries experienced a significant decline from approximately 2002 to around 2011, as depicted in Figure 1.

The focus of the study is to explore how fluctuations in the real exchange rate affect bilateral agricultural trade balances. To provide an initial understanding, both variables were plotted. Figure 2 displays the real exchange rates of U.S. bilateral agricultural trade with India, Brazil, and South Africa. The graphs for all three countries show consistent patterns. It was observed that as the real exchange rate increases, the agricultural trade balance (the ratio of imports to exports) also tends to rise, and conversely, when the real exchange rate declines, the trade balance follows suit. This implies that when the exchange rate rises (falls), U.S. imports increase (decline). This trend is particularly pronounced with Brazil. While this observation offers valuable insights, it is insufficient for drawing any definitive conclusions.

Testing procedure for the ARDL

For the ARDL model, EViews was used to conduct the analysis. Unlike the original study, the optimal lag was not selected manually; instead, the default lag proposed by EViews was employed. The unit

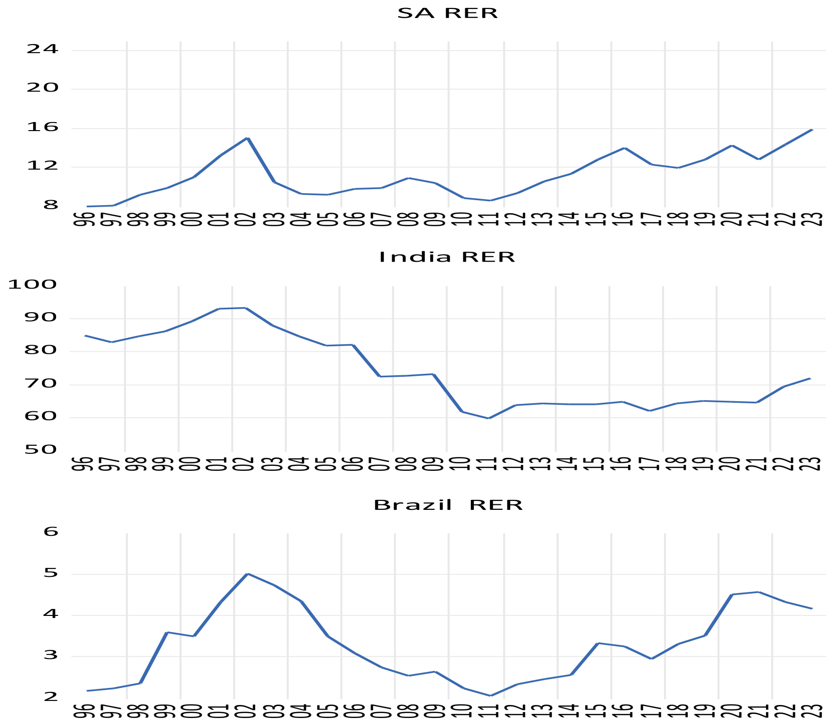

Figure 1. US Real Exchange with South Africa, India, Brazil.

Figure 2. Graph of TB and RER.
Source: Foreign agricultural trade of the United States.

Table 1. Results of F-Test for cointegration among variables.

	Countries	AIC lag	F statistics			Decision
			F-value	Bound values		
				I(0)	I(1)	
Replication	Australia	4	2.46	2.37	3.2	Inconclusive
	Canada	4	6.29	2.37	3.2	Cointegration
	France	6	2.9	2.37	3.2	Inconclusive
	Germany	6	4.61	2.37	3.2	Cointegration
	New Zealand	4	1.24	2.37	3.2	No cointegration
	South Korea	4	1.46	2.37	3.2	No cointegration
	Mexico	6	13.32	2.37	3.2	Cointegration
	UK	6	1.18	2.37	32	No cointegration
Extension	Brazil	4	3.65	2.37	32	Cointegration
	South Africa	6	3.33	2.37	32	Cointegration
	India	4	6.14	2.37	32	Cointegration

A lag order is chosen by default by Akaike Information Criterion (AIC). F-statistic for 10% critical value bounds is (2.37, 3.32).

root test indicated that the variables are stationary at either I(0) or I(1). An F-test was applied to examine the existence of cointegration among the variables. Cointegration is present when the F-test value exceeds the upper critical bound. Conversely, if the F-test falls below the lower critical bound, no cointegration is present. If the F-test value lies between the two critical bounds, the test results are inconclusive. The cointegration test presented in Table 1 indicates the presence of cointegration for Canada, Mexico, Germany, Brazil, India, and South Africa. In contrast, the test reveals no cointegration for New Zealand, the UK, and South Korea, while the results are inconclusive for Australia and France. When comparing these results to the original study, it was noted that the replication outcome is similar only for Canada and Mexico.

RESULTS AND DISCUSSION

This study presents the short and long run results.

Short run results

Given that the main objective of this article is to evaluate the validity of the J-Curve phenomenon, the focus is placed solely on the estimated coefficients of the real exchange rate for short-run results. The sign of these exchange rate coefficients is crucial in determining the presence of the J-Curve effect. Specifically, an initially negative sign followed by a positive sign on the lagged coefficients would indicate the existence of the J-Curve. The short-run results, presented in Table 2, suggest that the exchange rate significantly impacts the U.S. agricultural trade balance for half of the countries under consideration (France, the UK, Mexico, Germany) at a significance level of at least 10%. Similar results are observed in the extension, except for South Africa, where the exchange rate does not have a significant effect on the U.S. trade balance.

Although the exchange rate significantly affects the U.S. agricultural trade balance with some countries in the short run, there is no clear evidence of the J-Curve phenomenon. In France case, a trend suggesting the potential development of a J-Curve pattern was observed, although some coefficients are not statistically significant. Similarly, for Mexico, there appears to be a tendency toward the initial phase of the J-Curve, but again, some coefficients are insignificant, even at the 10% level.

Based on these findings, it can be concluded that there is no J-Curve effect in the U.S. agricultural trade balance. Therefore, the findings are not consistent with the J-Curve theory. However, the exchange rate does play a significant role in influencing the U.S. agricultural trade balance with most of the countries analyzed. These results corroborate those of Baek et al. (2009) and align with several earlier studies, including Bahmani-Oskooee and Talukdar (2005), Gong and Kinnusen (2015), and Trofimov (2024) for Indonesia, the Philippines, and Thailand. Nevertheless, this conclusion contrasts with the findings of Doroodian et al. (1999), who provided evidence of the J-Curve in the U.S. agricultural trade balance, and Carter and Pick (1989), who suggested that the U.S. agricultural trade balance exhibits the initial phase of the J-Curve. Although the results align with some studies, the absence of a definitive conclusion regarding the J-Curve phenomenon in U.S. bilateral agricultural trade balance persists, as only a few studies have investigated this phenomenon within U.S. agriculture.

Long run results

Table 3 displays the long-run findings exclusively for the countries where the cointegration test is effective.

Table 2. Short run coefficient estimated of exchange rate and error-correction terms of the bilateral trade balance model.

	Lag order of exchange rate							
	0	1	2	3	4	5	6	EC $_{t-1}$
Australia	0.58(0.59)							
South Korea	0.05(0.16)							
France	-0.24(0.15)	-0.122(0.18)	-0.53***(0.19)	-0.35*(0.20)	-0.06(0.21)	0.08(0.20)	0.34**(0.16)	
New Zealand	0.157(0.146)							
UK	0.6*(0.34)	-0.04(0.34)	-0.62*(0.32)					
Canada	0.08(0.10)							-0.40***(0.80)
Mexico	0.68***(0.21)	-0.65(0.3)	-0.19 (0.29)	-0.51*(0.25)	-0.57***(0.2)			-1.9***(0.22)
Germany	0.39***(0.11)							-0.62***(0.12)
Brazil	1.22**(0.50)							-.34***(0.079)
India	1.62(1.09)	4.06***(1.25)	0.73(1.38)	3.02**(1.38)				-0.63***(0.11)
South Africa	0.21(0.24)							-0.56(0.13)

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Parentheses are Std Error.

Table 3. Estimated long-run coefficients of the bilateral trade balance model.

Country	Exchange rate	U.S. income	Foreign income	Constant
Canada	0.18 (0.20)	-5.73***(1.911)	6.23***(1.98)	3.72**(1.63)
Germany	0.63**(0.27)	5.02***(1.61)	-6.65(4.01)	3.62(8.03)
Mexico	0.45***(0.12)	1.71***(0.39)	-1.19**(0.48)	-2.98***(0.65)
Brazil	0.54(0.69)	1.492(3.051)	-1.525(2.563)	-0.870 (10.22)
India	-6.96***(1.21)	8.82***(2.7)	-5.04***(1.08)	-0.58(5.60)
South Africa	0.38(0.42)	1.89(1.59)	-0.68(1.20)	-6.39(2.92)

***, ** and * denote significance at the 1%, 5% and 10%, respectively. Parentheses are Std Error.

The analysis indicates that the exchange rate significantly impacts the U.S. bilateral agricultural trade balance with Germany, Mexico, and India. Specifically, the exchange rate shows a positive and significant effect with Germany and Mexico, while it has a negative effect with India. Conversely, the real exchange rate with Canada, Brazil, and South Africa shows no substantial effect on the U.S. agricultural bilateral trade balance. In essence, the U.S. agricultural bilateral trade balance exhibits a positive long-run relationship with the real exchange rates of Mexico and Germany and a negative long-run relationship with that of India. This suggests that when the U.S. dollar depreciates relative to the euro or the Mexican peso, the U.S. is likely to increase its agricultural exports to those countries, improving its agricultural trade balance over time. However, in the case of India, a weaker dollar worsens the U.S. bilateral agricultural trade balance. This may be due to the depreciation of the dollar boosting imports of other products that are more significant to India than agricultural goods.

Examining the impact of a country's income on the agricultural bilateral trade balance, the results reveal that Canada’s income (real GDP) positively influences the U.S.

agricultural bilateral trade balance. This means that when Canada's economy is performing well, U.S. agricultural exports to Canada rise. In contrast, rising GDP in Mexico and India negatively impacts the U.S. agricultural trade balance with these countries, suggesting that as these countries' economies grow, the U.S. exports fewer agricultural products to them. This could be because agriculture constitutes a significant portion of their economies. The real GDP of Germany, Brazil, and South Africa do not significantly impact the U.S. agricultural bilateral trade balance.

Additionally, the U.S. real GDP significantly affects its agricultural trade balance with most of the countries studied (Canada, Mexico, Germany, and India) except South Africa and Brazil. The impact is negative in the case of Canada, while it is positive for the other countries. This implies that as the U.S. economy grows, it leads to an increase in agricultural imports from Canada, worsening the agricultural trade balance with Canada. In contrast, a stronger U.S. economy increases agricultural exports to Mexico, Germany, and India, improving the agricultural trade balance with these countries.

It is also worth noting that these findings closely align with those of the original article, particularly for Mexico, where all three variables (exchange rate, foreign income, and U.S. income) show similarities. Additionally, similarities are observed regarding the exchange rate and U.S. income for Germany, and U.S. income and foreign income for Canada.

Conclusion

This study replicates and extends the research conducted by Baek et al. (2009). The replication focused on eight out of the fifteen countries from the original study. The findings of this replication closely align with the original research, showing no evidence of the J-Curve phenomenon in the U.S. bilateral agricultural trade balance. Despite this, the exchange rate significantly impacts the U.S. bilateral agricultural trade balance for most of the countries examined.

This conclusion is consistent across both the replication segment and the extension, which includes an analysis of three BRICS countries. The long-run results reveal that the exchange rate between the U.S. and Canada, Brazil, and South Africa does not have a substantial effect on their bilateral agricultural trade balance, unlike with Mexico, India, and Germany. The findings highlight that a policy of dollar depreciation relative to the euro, the Mexican peso, and the Indian rupee boosts agricultural exports to Germany and Mexico but reduces exports to India.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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