The J-curve Effect in Agricultural Commodity Trade: An Empirical Study of South East Asian Economies

Trofimov, Ivan D.

Kolej Yayasan Saad (KYS) Business School

10 December 2020

The J-curve Effect in Agricultural Commodity Trade: An Empirical Study of South East Asian Economies

Ivan D. Trofimov*

Abstract

The previous research tended to examine the effects of the real exchange rate changes on the agricultural trade balance and specifically the J-curve effect (deterioration of the trade balance followed by its improvement) in the developed economies and rarely in the developing ones. In this paper we address this omission and consider the J-curve hypothesis in four South East Asian economies (Indonesia, Malaysia, Philippines and Thailand) over the 1980-2017 period. We employ the linear autoregressive distributed lags (ARDL) model that captures the dynamic relationships between the variables, and additionally use the non-linear ARDL model that considers the asymmetric effects of the real exchange rate changes. The estimated models were diagnostically sound and the variables were found to be cointegrated. However, with the exceptions of Malaysia, the short- and long-run relationships did not attest to the presence of J-curve effect. The trade flows were affected asymmetrically in Malaysia and the Philippines, suggesting the appropriateness of non-linear ARDL in these countries.

Keywords: J-curve; agriculture; non-linear ARDL; cointegration

JEL Code: Q17, C22, F14

Introduction

Agriculture remains a major sector across the developing economies both in terms of output, employment and export earnings. In most South-East Asian economies (with the exception of highly urbanised Singapore and Brunei Darussalam), that are the subject of research in this paper, the contribution of agriculture to GDP and total employment has been significant in recent decades. The ASEAN Secretariat publication (ASEAN, 2019) indicates that the agricultural production share of GDP ranged from 6.2% in Thailand to 12.5% in Indonesia and 24.6% in Myanmar as of 2018 and for the average of ASEAN economies stood at 12% and 10.3% in 2010 and 2018 respectively. Regarding the share of agriculture in total employment, the sector likewise remained significant employer (the share of agriculture in total employment ranging from 13.3% in Malaysia to 28.3% in the Philippines and over 50% in Cambodia and Laos). The shares undoubtedly declined as part of industrialisation and technical substitution processes, but in absolute numbers the SEA economies witnessed a rapid increase in land and labour productivity, mechanization and use of fertilizers, adoption rates of improved commodity varieties, and ultimately the growth of output and exports, particularly of rice and palm oil (USDA, 2017; World Bank, 2018; FAO, 2018; Takeshima, Joshi, 2019).

As far as international trade aspect of agricultural development is concerned, the literature examined a number of effects and tendencies, such as: volatility of agricultural commodity prices, the possible deterioration of agricultural terms of trade, the influence of the fluctuations in the exchange rates, among other issues. However, the Marshall-Lerner condition and the J-curve effect hypothesis that describe the relationship between the fluctuation of exchange rate and the country's balance in agricultural trade (as opposed to the aggregate trade) received limited consideration in the literature, the works by Kim et al (2004), Baek and Koo (2008), Baek et al (2009), Gong and Kinnucan (2015), and Chebbi and Olarreaga (2019) being the notable exception.

The purpose of this paper is to address this shortcoming. In contrast to previous studies that focused, due to data availability issues, on a limited number of economies (most commonly the USA), we examine five South-East Asian economies: Malaysia, Indonesia, the Philippines and Thailand and consider the presence (absence) of the J-curve effect using the annual data for the 1980-2013 period.

* Kolej Yayasan Saad (KYS) Business School, Melaka, Malaysia. E-mail: ivan.trofimov1@gmail.com

A multivariate autoregressive distributed lag (ARDL) model is employed that has trade balance as a dependent variable and real exchange rate, domestic and 'rest of the world' income as regressors.

The use of aggregate trade data to establish J-curve effect may likely result in the rejection of the hypothesis or obfuscate the presence of the curve, particularly when the country in question is industrialised and principally trades in manufactured goods (that tend to have higher import and export elasticities). In this regard, the focus on the developing countries' trade and consideration of the agricultural trade alone (as opposed to the aggregate trade) may be warranted. Methodologically, the use of ARDL model is justified to capture delayed effects of the exchange rate on the trade balance, and the switch from initially negative to positive effects of the former variable on the latter, as well as to address the possible asymmetric effects (when depreciation and appreciation of the currency deliver changes in the trade balance that are different not only in sign but also in size). We therefore use linear and non-linear version of ARDL for each individual economy, an approach that has been previously taken to examine the J-curve in the aggregate trade of the country (Bahmani-Oskooee, Gelan, 2012; Nusair, 2017)

The choice of the study period and the sample of economies is warranted due to the following considerations. The economies in question differ in many respects: the countries that were net exporters of agricultural products throughout the period (Indonesia, Malaysia and Thailand), and the economy that switched between two states during the period (Philippines). The economies also differed in terms of foreign exchange management policies and the pace of moving to more flexible exchange rates (independent floating in the Philippines, managed floating in Thailand and Indonesia versus fixed peg in Malaysia; IMF, 2005), the dominance of agricultural exports in the total exports or the proportion of food imports in the total imports, the overall level of development (Malaysia versus Indonesia). The study period includes a number of salient macroeconomic events: Third World debt crisis of the early 1980s, the Asian Financial crisis of 1997-8, the Global Financial crisis of 2008-08, the period of low agricultural commodity prices in the 1980s, and conversely the commodity boom of the 2000s. In addition, in line with the remark of Rose and Yellen (1989: 58) about the particular equilibrium nature of the J-curve phenomenon that necessitates higher disaggregation of trade data and consideration of the trade of the sector or industry to obtain more reliable results, we focus on a specific economic sector (agriculture) rather than on aggregate trade of the country.

The outline of the paper is as follows. Section 2 reviews the existing literature on the J-curve effect in the aggregate and agricultural trade. Section 3 describes the data, the model and the econometric method. Section 4 presents the empirical results, while Section 5 provides conclusion alongside the discussion of the findings.

Literature review

The hypothesis that underpins J-curve effect is the deterioration of the trade balance of the country immediately after depreciation (devaluation) of its currency followed by the balance improvement as economic agents adjust to changed foreign currency conditions.

The adjustment processes that constitute the J-curve effect are explained with reference to the Bickerdike-Robinson-Metzler (BRM) and Marshall-Lerner (ML) conditions (the latter as a special case of the former). The exposition of the conditions follows Baek et al (2006: 5-7). The trade balance is defined as:

$$TB = P_x Q_x - E P_x^* Q_m \qquad (1)$$

,where TB is the trade balance of country A that experiences its currency devaluation (depreciation), P_x is the domestic price of the good in country A bound for exports to country B, P_x^* is the foreign price of the good in country B bound for exports to country A (or equivalently the good imported by country A), E is a nominal exchange rate, Q_x and Q_m are export and import volumes. The effect of the exchange rate on country A's trade balance is obtained from the differentiation of the above trade balance equation with respect to E (BRM condition):

$$\frac{dTB}{dE} = P_x Q_x \left[\frac{(1+\varepsilon)\eta^*}{(\varepsilon+\eta^*)} \right] - EP_x^* Q_m \left[\frac{(1-\eta)\varepsilon^*}{(\varepsilon^*+\eta)} \right] \qquad (2)$$

,where η and η^* are domestic and foreign price elasticities of demand for imports, and ε and ε^* domestic and foreign elasticities of the supply of exports. Assuming trade balance in initial equilibrium ($TB = 0$) and perfect supply elasticities in both trading countries ($\varepsilon \to \infty$ and $\varepsilon^* \to \infty$), the BRM condition transforms to ML condition as:

$$\eta + \eta^* > 1 \qquad (3)$$

While the sum of elasticities in ML exceeds unity and the devaluation is to improve trade balance in the long-run, the interim adjustments in the short-run are more complex, as illustrated by the J-curve effect. Immediately after devaluation (currency-contract period), the prior contracts are executed none-withstanding devaluation, i.e. while E rises (or falls depending on whether direct or indirect quotation is used for the exchange rate) and there is deterioration in the trade balance, there is no effect on prices or volumes. In a pass-through period that follows, the prices adjust with no changes in Q_x and Q_m . The change in the prices of imported goods initiates the substitution process between imported and domestically-produced goods, but this process is yet incomplete at this stage. The ultimate effect at this stage depends on the values of import demand and export supply elasticites, with multiple outcomes possible (Magee, 1973: 317). For instance, the inelastic demand for the exports of the country that devalues its currency (Country A) and the inelastic demand for the imports of that country would result in trade balance deterioration during the pass-through stage, while the inelastic supply for the country's exports and imports would bring trade balance improvement. In the quantity adjustment period, the Q_x and Q_m start to adjust, thereby completing the substitution process. With both export and import elasticities increasing compared to previous periods, Q_x rises faster in response to the fall in goods prices (in foreign currency), while Q_m falls faster in response to goods price increase (in domestic currency). The trade balance thereby moves into surplus. Given the differential elasticities in currency-contract and pass-through periods and the reactions in the quantity adjustment period, there is no a priori assumption that J-curve pattern will eventuate: Magee noted the possibility of I-, L-, M-, N-, V- and W-curves.

The empirical research on the Marshall-Lerner condition and J-curve effect has been voluminous and extensive, covering both the aggregate trade of the country with the rest of the world, as well as bilateral trade for a pair of economies, including trade at disaggregated level (Bahmani-Oskooee, Kantipong, 2001; Lal, Lowinger, 2002; Onafoworas, 2003; Nusair, 2017; Bahmani-Oskooee, Harvey, 2016; to name a few). The findings were generally mixed, conditional on the sample of the economies in the study, the period considered, the econometric methodology used, the specification of the model, the broader political and macroeconomic context as well as definition of the relevant variables.

The studies focusing on the sectoral trade were limited. Among them is Meade (1998) who examined the J-curve in the capital, consumer industrial supplies sectors in the US, Yazici (2010) who considered the effect in services sector in Turkey, Wijeweera and Dollery (2013) and Prakash and Maiti (2016) who compared J-curve effects in the goods and services sectors in Australia and Fiji respectively, and Cheng (2020) who estimated J-curve for the aggregate services trade and for the trade in particular services categories in the US. The findings were likewise mixed.

As far as the presence of Marshall-Lerner condition and the J-curve effect in agricultural trade is concerned, the empirical work has been rather limited, covering a limited number of economies. The early research on the linkage between foreign exchange and agricultural trade concerned the estimation of the export demand equations with exchange rates as one the regressors (the overview of the relevant literature contained in Carter, Pick, 1989: 714-15). Four studies are prominent in this regard. Konandreas et al (1978) established the sensitivity of the US exports to exchange rate fluctuations during the 1954-72 period, notwithstanding the fact of low statistical significance of the coefficients of the exchange rate. The study of the five export commodities in the US by Chambers and Just (1981) that used US quarterly data generally confirmed the finding, but identified the statistically significant exchange rate coefficients only in the case of corn, but not wheat and soybeans. Batten and Belongia (1986) focused on the exchange rate effects of export volumes and stated that such effects were small and short-lived. A number of authors (Kost, 1976; Henneberry et al, 1987) rejected any significant exchange rate effects, on the grounds of small demand and supply elasticities for agricultural commodities (leading to fluctuation in prices as per cobweb model, but not in export volumes), or higher relative importance of other factors, such as foreign income or terms of trade.

The earliest study of the effects of depreciation on the US agricultural trade balance (as opposed to export prices and volumes alone) by Carter and Pick (1989) established the initially negative effects of depreciation that persisted for a period of nine months, and improvement of the trade balance thereafter (hence, the presence of the J-curve effect). The study was based on a quarterly data from the 1973-85 period period and employed linear regression model with polynomial distributed lags to capture the pass-through effect of the exchange rate depreciation on trade variables. The study disentangled the influence of depreciation on export and import unit values and considered the two components of the trade balance separately (with the pass-through being much faster in the case of import unit values), however the result was likely sensitive to the choice of the most accurate lag structure.

Doroodian et al (1999) considered US trade in agricultural and manufacturing goods, and estimated trade balance equation with Shiller lag structure imposed on the exchange rate variable (the preferred approach when the exact functional form of the distributed lag model is unknown). The findings supported the J-curve effect in agricultural trade and failed to support the hypothesis in the manufacturing trade.

Baek et al (2009) examined the relationship between the exchange rate and the agricultural trade balance in the trade of the US with its 15 principal trading partners over 1989Q1-2007Q4 period, using the autoregressive distributed lags (ARDL) methodology and did not identify any J-curve patterns. Their study, however, did not control for the country-specific factors that could affect the relationship, such as national production and trade structure, macroeconomic and exchange rate policies, and various structural jolts (spikes in commodity prices, financial crises, political disturbances).

Kim et al (2004: 141-2) examined the bilateral agricultural trade between the US and Canada using the quarterly time series for the 1983-2000 period and applying the vector error correction and vector moving average models (VECM and VEM). Exchange rate was found to have significant impact on both US exports to Canada and US imports from Canada in the short-run, while in the long-run the exchange rate effects remained significant only for the US imports, being a major determinant of growing US trade deficit with Canada. On the other hand, the exchange rate was weakly exogenous, I.e. causing deviation of the model from the steady-state, but not affected by other variables (the result consistent with a small size of agricultural sector relative to the total US economy). The effect of exchange rates on the US agricultural prices and agricultural income in the short- and long-run were also significant, albeit marginal in size.

Chebbi and Olarreaga (2019) considered agricultural trade balance in Tunisia during the 1965-2011 period and employed the Johansen-Juselius test of cointegration and VECM model. In contrast to the majority of the literature, the depreciation was found to have no effect on the trade balance in the short-run, and negative effect in the long-run, principally due to the shift in the exchange rate policies that took place at the end of 1980s. Prior to the reform, the devaluations[i] of Tunisian dinar within the fixed exchange rate regime were used to boost the competitiveness of agricultural exports and improve agricultural trade balance, while after the policy change a flexible exchange rate regime was introduced, allowing more stable currency but little positive effects on the trade balance.

Yazici (2006) examined the agricultural trade balance in Turkey using similar methodology to Carter and Pick (1989), i.e. linear regression with polynomial distributed lags. The identified movements in the trade balance appeared to contradict J-curve hypothesis (depreciation leading to deterioration of trade balance in the short-term followed by transient improvement, and by another deterioration). In addition, the sum of the exchange rate coefficients at different lags was negative, indicating the negative effects of devaluation on the trade balance in the long-run.

Methodology

Model

In line with previous research, the empirical model is represented by the following equation:

$$\ln TB_{it} = \alpha + \beta_{1i} \ln Y_{it} + \beta_{2i} \ln YROW_{it} + \beta_{3i} \ln RER_{it} + \varepsilon_t \qquad (4)$$

,where $\ln TB_{it}$, $\ln Y_{it}$, $\ln YROW_{it}$, and $\ln RER_{it}$ indicate respectively the logarithms of the trade balance of country i with the rest of the world, income (GDP) of this country, income (GDP) of the 'rest of the world' economies, and real or real effective exchange rate (RER or REER) of the country at period t .

Concerning the latter variable, we use two alternative exchange rate measures, obtained respectively from the International Monetary Fund (IMF) and the US Department of Agriculture (USDA) databases. The former measure is the real effective exchange rate of the country, defined as $REER = {EP_d}/{P_f}$,where E is the country's nominal exchange rate (units of foreign currency per one unit of domestic currency), P_d and P_f are domestic and foreign prices. The latter is the bilateral RER of the country with the US, defined as $RER = {EP_f}/{P_d}$, where the nominal exchange rate is expressed as units of domestic currency per one unit of foreign currency. In both cases, the foreign currency is the US dollar, the domestic currency is the currency of country in question, and domestic and foreign prices are approximated by the respective consumer price indexes. Following Chebbi and Olarreaga (2019), the use of bilateral exchange rate data for the analysis of agricultural trade of the country with rest of the world is justified, given the absence of the IMF REER data for many economies, and (as shown further) tight correlation of the two measures (bilateral RER and REER).

To allow logarithmic transformation, the trade balance was defined as ratio of the value of nominal exports to the value of nominal imports, making it unnecessary to deflate nominal values of exports and imports by the price index and to calculate the trade balance in absolute terms as the difference between the two.

With USDA version of RER, we hypothesize the existence of the J-curve if the short-run coefficient of RER is negative but its long-run coefficient is positive, while with the IMF version of REER, the relation is the opposite (positive coefficient in the short-run, and negative in the long-run). With regard to other variables we expect the negative effect of GDP of the country on the country's trade balance, given that increase in GDP leads to import growth with imports entering the aggregate demand equation with a negative sign). However, the positive effects of domestic GDP on the trade balance may be experienced, if domestic production of importables grows ahead of their consumption, resulting in the decrease in import volume (Magee, 1973; Yazici, 2010: 169). The growth of GDP in the test of the world will stimulate country's export and have positive influence on the trade balance (hence the sign of the respective coefficient is expected to be positive).

Data

The data on the value of agricultural exports and imports is taken from the Food and Agriculture Organisation (FAO) *FAOSTAT* database.[ii] The agricultural products traded include crops and livestock, with the primary data collected according to the standard *International Merchandise Trade Statistics (MITS)* methodology. The value of exports or imports is defined as the export or import quantities (tonnes for crops and thousand units for livestock products) multiplied by the export or import values (reported as free-on-board/FOB or cost-insurance-freight/CIF values). The reported data is in nominal terms; it is not deflated to the real terms, since the trade balance in agricultural products is calculated as the ratio of the nominal values of exports to imports (to double-check, the deflators were used to obtain the real values of exports and imports, but same values of trade balance).

The United States Department of Agriculture Economic Research Service (USDA ERS) agricultural exchange rate data set contains the annual real effective exchange rates (REER) for the relevant countries.[iii] USDA ERS uses IMF *International Financial Statistics* data on nominal exchange rates alongside the IMF data on the consumer price indexes (with 2010 set as a base year). The trade weights for REER calculation were obtained from the USDA ERS *Global Agricultural Trade System (GATS)* 2014-16 data. As an alternative indicator we also used the IMF REER index derived using CPI data with 2010 as a base year.[iv] We note that producer price indexes or GDP deflator may be more appropriate variables for the derivation of REER; these indicators, however, are not available for every country in question. We excluded from consideration the countries that adopted the US dollar as domestic currency as part of currency board mechanism (Ecuador and El Salvador).

The GDP data has likewise been obtained from the USDA ERS *International Macroeconomic Data Set* ('Real GDP, 2010 Dollars, Historical' file).[v] The 'rest of the world GDP' for an individual economy is defined as the world GDP in particular year net of GDP of that individual economy. The data set reports GDP in the constant 2010 US dollars.

Econometric method

Following Bahmani-Oskooee and Harvey (2016: 5), Bahmani-Oskooee and Gelan (2012) and Nusair (2017), among others, we used linear and non-linear version of ARDL model to verify the presence of J-curve effect. In the error-correction form, the linear ARDL is given as:

$$\Delta \ln TB_{it} = \alpha_0 + \sum_{k=1}^{n} \beta_{t-k} \Delta \ln TB_{i,t-k} + \sum_{k=0}^{n} \lambda_{t-k} \Delta \ln Y_{i,t-k} + \sum_{k=0}^{n} \gamma_{t-k} \Delta \ln YROW_{i,t-k} + \\ + \sum_{k=0}^{n} \upsilon_{t-k} \Delta \ln RER_{i,t-k} + \delta_1 \ln TB_{i,t-1} + \delta_2 \ln Y_{i,t-1} + \delta_3 \ln YROW_{i,t-1} + \delta_4 \ln RER_{i,t-1} + \mu_t \quad (5)$$

Firstly, we conduct Pesaran et al (2001) bounds test (test of the joint significance of the lagged variables in levels) to establish the presence of cointegration among the variables. The null hypothesis of the test is of the coefficients of the lagged level variables equal to zero (i.e. $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$), while the alternative hypothesis is of the absence of such equality ($\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$). The test statistics is compared with the critical values at upper and lower bound, with cointegration present when the statistics exceed the upper bound $I(1)$. The absence of cointegration is indicated when the test statistics is below the lower bound $I(0)$, while the indeterminate case when the test statistics is between the bounds. To confirm the finding, the Banerjee-Dolado-Mestre (BDM) cointegration t-test is conducted (Banerjee et al, 1998). The null hypothesis of no cointegration ($H_0 : \delta_1 = 0$ and the respective t-statistics is above the test critical value) is contrasted with an alternative hypothesis of the presence of cointegraton ($H_1 : \delta_1 < 0$ and the t-statistics is smaller than the critical value). Secondly, we ensure that the ARDL model passed the requisite diagnostic tests (normality, heteroskedasticity, stability, functional form, and, importantly, the serial correlation) and that error correction coefficient is significant and falls within $(0,-1)$ range. Thirdly, the long-run relationships are established by normalising the coefficients of the lagged level regressors on the coefficient of the lagged level dependent variable (δ_2 , δ_3 , and δ_4 on δ_1). Respectively, the short-run relationships are indicated by the coefficients of the first-differenced variables.

To ensure the appropriateness of ARDL model that does not envisage any variables that are integrated of order two, $I(2)$, we conducted unit root tests of the first differences of the variables. The stationarity of the variables would indicate the absence of $I(2)$ integration order. To address the possible presence of serial correlation in the ARDL model, the sufficient number of lags of the dependent variable and regressors was allowed: given the use of annual data with 38 observations, the maximum lag for the selection procedure was set at four, and the optimal number of lags was selected using Akaike Information Criterion (AIC) that, as opposed to Schwarz Information Criterion (SIC), is less restrictive in terms of the lag selection.

Within linear ARDL framework, with the ratio of exports to imports as representation of the trade balance, and USDA representation of REER, following depreciation the J-curve effect is indicated if coefficient of the first difference of RER is negative ($\upsilon_t < 0$), but the long-run normalised coefficient of RER is positive ($\delta_4 > 0$). An alternative interpretation, given by Rose and Yellen (1989) is the presence of the J-curve when coefficient of the first difference of RER is negative at lower lags, but positive at higher lags. Conversely, with IMF representation of REER, the J-curve effect holds, when $\upsilon_t > 0$ is positive and $\delta_4 < 0$ is negative, or, in line with Rose-Yellen interpretation, the υ_t at lower lags is positive but at higher lags is negative.

The non-linear version of ARDL (Shin et al, 2013), as an extension of linear ARDL, likewise disentangles short- and long-run impacts, and additionally allows for asymmetric effects of appreciation and depreciation on the trade balance (the necessary feature, if it is assumed that price elasticities and expectations change following exchange rate change). Non-linear ARDL is given as:

$$\begin{aligned}\Delta \ln TB_{it} &= a' + \sum_{k=1}^{n1} b'_k \Delta \ln TB_{i,t-k} + \sum_{k=0}^{n2} c'_k \Delta \ln Y_{i,t-k} + \sum_{k=0}^{n3} d'_k \Delta \ln YROW_{i,t-k} + \\ &+ \sum_{k=0}^{n4} e'_k \Delta \ln RER^{+}_{t-k} + \sum_{k=0}^{n5} f'_k \Delta \ln RER^{-}_{t-k} + \delta_0 \ln TB_{i,t-1} + \delta_1 \ln Y_{i,t-1} + \delta_2 \ln YROW_{i,t-1} + \\ &+ \delta_3 \ln RER^{+}_{t-1} + \delta_4 \ln RER^{-}_{t-1} + \upsilon_t \end{aligned} \quad (6)$$

,where RER^{+}_t and RER^{-}_t represent the partial sums of positive and negative changes in the real exchange rate.

The partial sums are calculated as:

$$RER^{+}_t = \sum_{j=1}^{t} \Delta \ln RER^{+}_j = \sum_{j=1}^{t} \max(\Delta \ln RER_j, 0) \quad (7)$$

$$RER^{-}_t = \sum_{j=1}^{t} \Delta \ln RER^{-}_j = \sum_{j=1}^{t} \min(\Delta \ln RER_j, 0) \quad (8)$$

With USDA representation of REER and trade balance as ratio of exports to imports, in the non-linear ARDL model, the J-curve effect is present following depreciation, when the normalized coefficient of $\ln RER^{-}_{t-1}$ is positive and significant ($\delta_4 > 0$), while the coefficients of $\Delta \ln RER^{-}_{t-k}$ are negative and significant. Conversely, with IMF representation of REER, the J-curve effect is established when $\delta_4 < 0$ and the coefficients of $\Delta \ln RER^{-}_{t-k}$ are positive and significant. The Marshall-Lerner condition is satisfied if $\delta_4 > 0$ and $\delta_4 < 0$ in the long-run for the USDA and IMF representations of REER respectively (in both linear or non-linear ARDL).

The null hypothesis of no cointegration ($H_0 : \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$) is contrasted with a cointegration alternative ($H_A : \delta_0 \neq \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$) and the respective statistics is examined with reference to $I(0)$ and $I(1)$ critical bounds. Additionally, the long-term asymmetry test is conducted to ensure the appropriateness of the non-linear model, assuming the absence of asymmetry under the null, $\gamma^+ = -\delta_3 / \delta_0 = \gamma^- = -\delta_4 / \delta_0$.

Empirical results

To ascertain the appropriateness of applying the ARDL models we performed unit root tests (ADF and KPSS) on the first difference of the variables (Table 1). Given that ARDL cannot be used if any of the variables is $I(2)$, the (trend) stationarity of the first difference of the variable indicates the absence of $I(2)$ integration order. Regarding ADF test (with either constant or constant plus trend deterministic component), the unit root null hypothesis was rejected at 1% significance level for all variables except the logarithms of the GDP in the Philippines and Thailand (where the hypothesis was rejected at the 5% level). For the KPSS test, the null hypothesis of (trend) stationarity was not rejected in the majority of cases. While in most cases, the KPSS statistic was obtained based on automatic selection of the bandwidth, in few instances (logarithm of GDP in the Philippines and the logarithm of the trade balance in Malaysia and the Philippines) the fixed bandwidth was needed to prevent the rejection of the null. In Table 1, these latter KPSS statistics are indicated in bold, while the ADF rejection of the unit root null at 5% level is indicated in italics. Overall, we conclude that neither of the variables is $I(2)$.

Table 1. Unit root tests' results

Country	Test	lnY	lnYROW	lnRER	lnREER	lnTB
Indonesia	ADF (c)	-4.612	-4.733	-6.905		-6.140
	ADF (ct)	-4.541	-4.676	-7.108		-6.060
	KPSS (c)	0.081	0.060	0.226		0.074
	KPSS (ct)	0.079	0.058	0.035		0.064
Malaysia	ADF (c)	-4.937	-4.752	-4.820	-4.612	-7.831
	ADF (ct)	-4.962	-4.693	-4.755	-4.551	-7.774
	KPSS (c)	0.175	0.059	0.115	0.069	**0.146**
	KPSS (ct)	0.072	0.067	0.076	0.063	0.030
Philippines	ADF (c)	*-3.162*	-4.764	-4.870	-5.928	-6.653
	ADF (ct)	-8.541	-4.708	-4.869	-6.047	-6.806
	KPSS (c)	**0.442**	0.060	0.109	0.143	**0.330**
	KPSS (ct)	**0.085**	0.068	0.065	0.059	**0.093**
Thailand	ADF (c)	*-3.205*	-4.756	-4.516		-6.396
	ADF (ct)	*-3.571*	-4.696	-4.561		-6.399
	KPSS (c)	0.320	0.058	0.159		0.099
	KPSS (ct)	0.067	0.068	0.063		0.066

Note. The 'c', 't' and 'ct' subscripts indicate test specifications with constant, trend, and constant plus trend. KPSS test was implemented with quadratic spectral kernel estimation method and bandwidth automatic selection (Andrews bandwidth).

Table 2 contains linear ARDL estimates for the four economies. For Malaysia and the Philippines, the two linear models have been estimated, one with the USDA RER, the other with IMF REER measure (we respectively denoted them as *Models 1 and 2*). The maximum number of lags for the selection purpose varied for each individual economy, and, in the case of the second model for Malaysia, the number of lags was set fixed. The lag selection was driven by the need to eliminate serial correlation in ARDL, and to this end the Akaike Information Criterion was used as the one that tends to select a larger number of lags (as opposed to Schwarz Bayesian Criterion that tends to 'under-fit' the model).

All four models have passed the requisite diagnostic tests: the residuals are normally distributed, as indicated by the Jarque-Bera test, and contain no serial correlation, as demonstrated by the Breusch-Pagan LM test (in the case of Indonesia, the LM statistics only barely exceeds the 5% critical level, however, according to the F-test version of the Breusch-Godfrey test the null hypothesis of no serial correlation is not rejected). All models have also passed Ramsey (RESET) functional misspecification test (with null hypothesis of correct specification not rejected in all models), and the Breusch-Pagan-Godfrey LM test of heteroskedasticity (with the null hypothesis of no heteroskedasticity likewise not rejected). All models were stable, as indicated by the cumulative sum of recursive residuals (squared) tests (CUSUM and CUSUMSQ), however, in the case of Indonesia and in *Model 2* for Malaysia the introduction of dummy variables was required to achieve stability. The overall significance of the models was sufficient with adjusted R^2 ranging from 0.301 to 0.689. According to the bounds F-test, the null hypothesis of no cointegration was rejected at the 5% significance level in Indonesia and Thailand, and at the 1% level in *Model 1* for Malaysia and in both models for the Phillipines. In the *Model 2* for Malaysia, the F-test statistic fell within $I(0)$ and $I(1)$ bounds, however, with reference to the error correction term (ECT), that is negative and highly significant, we conclude that there was cointegration among the variables in this case as well. In other economies the ECT was likewise negative and the speed of adjustment to the long-run equilibrium was substantially high (ranging from approximately 0.426 in Indonesia to as high as 0.908 in Malaysia's *Model 1*, i.e. up to 91% of disequilibrium was corrected in the following period).

In line with theoretical predictions, in Indonesia, Malaysia and Thailand, the long-run coefficient of domestic GDP was significant and negative, while the coefficient of the 'rest of the world' GDP was positive. Domestic economic growth of the three countries was accompanied by the growth of agricultural imports, while economic growth overseas stimulated agricultural exports (manifested, for instance, in a number of vibrant export industries, such as rubber in Thailand, palm oil in Malaysia, and coca and palm oil in Indonesia (David et al, 2007: 4).

In the Philippines the signs of the effects were the opposite: positive effects of domestic GDP and the negative effect of the 'rest of the world' GDP. In the post-1980 period the Philippines had the lowest GDP growth rate in the South East Asia, while the deterioration of the agricultural trade balance (that was particularly drastic in the early 1980s) slowed down to the extent that the balance was rather stable since the mid-1990s. On the other hand, the trade liberalisation initiatives of the early 1980s were reversed a number of times and, since the end of 1980s, have been losing momentum, with import-substitution and protectionist practices and policies, including the most distorting ones, persistent in a large number of agricultural products (David et al, 2007: 8-9). The combined effect of the two developments was a positive effect of domestic GDP on the agricultural trade balance. The 'rest of the world GDP' exercised negative effect on Philippines agricultural trade balance. While the upswings in international commodity prices were experienced during the 1980-2013 period (e.g. 'commodity super cycle' of the 2000s), the Philippines' agricultural exports was sluggish. The problem was manifested in the slowdown of traditional commodities' exports (coconut, tobacco, sugar) and the insufficient growth in the high value-added agricultural exports, while the sector as a whole was constrained by institutional and governance weaknesses, rent seeking, and infrastructural and research bottlenecks (David, 2003).

The definition of the J-curve that relies on the comparison of the long- and short-run RER coefficients, indicates its presence when the long-run normalised coefficient of RER is positive but the short-run coefficient is negative (if USDA measure of RER is used), and conversely positive short-run and negative long-run coefficients (if IMF measure of RER is applied). In the case of Indonesia and Thailand both types of coefficients were negative. In Malaysia, the J-curve hypothesis was supported in the model with USDA measure of RER, as well as with IMF measure, albeit in the latter case the long-run coefficient, while having correct sign, was not significant. In the Philippines, the *Model 1* estimates suggest the presence of J-curve, given that the long-run coefficient is positive but short-run coefficient is negative (and not significant). The *Model 2* rejects J-curve hypothesis in the Philippines, given that both types of coefficients are negative. The definition of the J-curve adopted by Rose and Yellen (1989) examines the change in the signs of RER short-run coefficients. In this paper, this version of the hypothesis could only be verified in Malaysia, where ARDL model selected sufficient number of RER first-difference terms. In *Model 1*, the first lag of the differenced RER was positive and insignificant, while further lags were negative and significant. In *Model 2*, the change of the sign was the opposite (from negative and insignificant to positive and significant). Overall, there is certain evidence supporting the J-curve hypothesis in Malaysia, but not the other three economies.

In Indonesia and Thailand, depreciation did not improve agricultural trade balance in the long-run, while in Malaysia and the Philippines the improvement was witnessed in the models with USDA based RER, but the size of the trade balance elasticities was smaller than one. This empirical result is in line with studies that indicated limited effectiveness of exchange rate adjustments in fixing the external imbalances (Mundell, 1988; Papadimitriou et al, 2008).

Table 3 presents the findings from the non-linear ARDL model. Similarly to the linear ARDL, the two alternative models were estimated for Malaysia and the Philippines (based on the USDA and IMF alternative RER indicators). Additionally, due to inconsistent signs of coefficients and specification issues, we tried for the Philippines a model with a different lag structure (the models are respectively called *Models 1, 2 and 3*). The maximum number of lags varied in each case, the AIC was used for selection purpose, however, no fixed lags were imposed in any of the models. The normality and heteroskedasticity tests were passed in all models (albeit in *Model 2* for the Philippines, the evidence of no heteroskedasticity was somewhat weaker than in other models). The Breusch-Pagan LM test did not reject the null hypothesis of no serial correlation in Indonesia, Thailand and the Philippines (*Models 2 and 3*), but indicated the presence of serial correlation in Malaysia (both models) and the Philippines (*Model 1*). However, the F-test version of the test (as well as the correlogram Q-statistic, not presented here to conserve space), unambiguously gave support to the null hypothesis. All models in question were correctly specified and were stable (in the case of Malaysia and Philippines, following the introduction of time dummies). Wald long-run asymmetry statistic was significant only in the models for Malaysia and the Philippines, hence for interpretation purposed the non-linear ARDL results are more informative for these two economies. The overall significance of the models was adequate, with adjusted R^2 ranging from 0.236 to 0.630. The bounds F-test statistic ranged from 3.126 to 9.177, exceeding the $I(1)$ critical bound in all economies except Malaysia *Model 1* and the Philippines *Model 3*, where it fell within $I(0)$ and $I(1)$ bounds. We therefore conclude that the null hypothesis of no cointegration was rejected in all models (in the latter two cases based on the significance of the error correction term). The speed of adjustment to equilibrium was sufficient to correct between 39.3% and 92.2% of disequilibrium in the period following the shock.

In the non-linear ARDL, the J-curve hypothesis requires that in the model with USDA measure of RER the long-run normalised coefficient of $\ln RER^{-}$ is positive while the short run coefficient $\Delta \ln RER^{-}$ is negative, and conversely, in the model with IMF measure of REER the long- and short-run coefficients are negative and positive.

The estimates are largely in line with the ones from the linear ARDL. In Thailand and in *Model 1* for the Philippines, both $\ln RER^{-}$ and $\Delta \ln RER^{-}$ are negative, and the J-curve hypothesis is not supported. In Indonesia, the negative long-run coefficient is coupled with the short-run coefficient that becomes positive at the second and third lag, i. e. the pattern that is inverse to J-curve is observed. In Malaysia, the long- and short-run coefficients of $\ln RER^{-}$ are respectively positive and negative, and the J-curve is likely to be present (however, in *Model 2* we observe the variation in the short-run coefficient sign, that was initially positive, turning negative at the second and third lag, and finally becoming positive at the fourth lag). The estimates of *Model 2* in the Philippines arguably indicate the J-curve as well (with the short-run $\Delta \ln RER^{-}$ becoming positive at lags two and three, while $\ln RER^{-}$ is negative albeit insignificant). With regard to *Model 3* in the Philippines, both types of coefficients were positive and insignificant, hence no J-curve. Overall, only in two cases (*Model 1* in Malaysia and possibly *Model 2* in the Philippines) the depreciation improves trade balance in the long-run following temporal deterioration in the short-run. In all other cases (where coefficients are significant), the depreciation either exercises negative effect on the trade balance all the way through, or results in the inversion of the J-curve.

As far as the comparative significance of regressors is concerned, in a total of 13 linear or non-linear ARDL models, the GDP variable was significant in all but one case. The 'rest of the world' GDP and exchange rate were insignificant in respectively five and six cases. While the long-run asymmetry was confirmed in four models, the estimation of non-linear ARDL did not deliver greater significance of the regressors (in fact, in the non-linear models, ‘rest of the world’ GDP and exchange rate were insignificant in four cases each).

Table 2. Linear ARDL results

Variable	Indonesia		Thailand		Malaysia (1)		Malaysia (2)		Philippines (1)		Philippines (2)	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
$DlnTB_{-1}$	0.190	(0.173)			0.222	(0.057)						
$DlnTB_{-2}$					-0.164	(0.142)						
DlnY	-0.526	(0.469)	-2.925	(0.000)	-1.224	(0.020)	-1.184	(0.094)	-1.527	(0.089)	-1.589	(0.053)
$DlnY_{-1}$					0.080	(0.875)	-0.452	(0.520)	0.922	(0.352)	0.480	(0.618)
$DlnY_{-2}$					-1.023	(0.039)	-0.603	(0.323)	-2.774	(0.002)	-2.589	(0.005)
$DlnY_{-3}$					0.267	(0.614)						
$DlnY_{-4}$					0.872	(0.064)						
DlnYROW	4.396	(0.006)	1.391	(0.112)	4.036	(0.000)	3.539	(0.016)	1.228	(0.310)	2.078	(0.093)
$DlnYROW_{-1}$							0.258	(0.881)				
$DlnYROW_{-2}$							-1.872	(0.198)				
DlnRER	-0.992	(0.507)	-1.274	(0.000)	0.062	(0.798)	-0.216	(0.541)	-0.123	(0.675)	-0.374	(0.220)
$DlnRER_{-1}$					-0.294	(0.269)	0.405	(0.274)	-0.471	(0.151)		
$DlnRER_{-2}$					-0.929	(0.002)	1.171	(0.004)				
$DlnRER_{-3}$					-1.105	(0.004)						
Constant	-12.806	(0.215)	-7.663	(0.011)	-6.382	(0.145)	-0.612	(0.914)	33.219	(0.000)	40.711	(0.000)
lnY	-2.060	(0.038)	-1.479	(0.000)	-0.924	(0.002)	-0.914	(0.030)	2.896	(0.000)	3.013	(0.001)
lnYROW	4.048	(0.018)	1.665	(0.000)	1.027	(0.052)	0.835	(0.221)	-4.654	(0.000)	-4.669	(0.000)
lnRER	-8.030	(0.002)	-0.292	(0.105)	0.449	(0.077)	-0.651	(0.162)	0.703	(0.065)	-1.132	(0.065)
DUM	1996						2001					
ECT	-0.426	(0.000)	-0.658	(0.000)	-0.908	(0.000)	-0.741	(0.000)	-0.592	(0.000)	-0.520	(0.000)
R^2 adj	0.301		0.390		0.689		0.375		0.356		0.392	
F-test	4.709		5.588		6.464		3.788		5.684		6.212	
J-B	0.263	(0.877)	0.124	(0.940)	1.221	(0.543)	1.884	(0.390)	1.346	(0.510)	0.823	(0.663)
LM (F)	2.368	(0.114)	0.889	(0.422)	0.190	(0.829)	0.332	(0.722)	0.052	(0.949)	0.190	(0.828)
LM	5.734	(0.057)	2.210	(0.331)	0.873	(0.646)	1.245	(0.537)	0.166	(0.921)	0.545	(0.762)
Heterosk	5.739	(0.677)	11.565	(0.072)	13.830	(0.611)	15.114	(0.370)	6.107	(0.806)	4.153	(0.843)
RESET	0.129	(0.898)	0.643	(0.525)	0.379	(0.710)	1.586	(0.129)	0.068	(0.947)	0.213	(0.833)
CUSUM	S		S		S		S		S		S	
CUSUMSQ	S		S		S		S		S		S	

Note. F-test, J-B, LM (F), LM, Heterosk., RESET, CUSUM and CUSUMSQ represent respectively bounds F-test, Jarque-Bera normality test, F-test version of the Breusch-Godfrey test of serial correlation, Breusch-Godfrey LM test of serial correlation, Breusch-Pagan-Godfrey LM test of heteroskedasticity, Ramsey regression equation specification error test, cumulative sum and cumulative sum squared of recursive residuals tests of stability. DUM and ECT indicate time dummy variables and the error correction term. p-values are put in the parentheses. 'S' indicates stability of the model. Formula-wise DlnTB is an equivalent representation of $\Delta \ln TB$ in text (likewise for other variables).

Table 3. Non-linear ARDL results

Variable	Indonesia		Thailand		Malaysia (1)		Malaysia (2)		Philippines (1)		Philippines (2)		Philippines (3)	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
$DlnTB_{-1}$					0.367	(0.006)	0.193	(0.011)						
$DlnTB_{-2}$					-0.087	(0.491)								
DlnY	-2.287	(0.004)	-1.988	(0.002)	-2.080	(0.000)	-1.607	(0.000)	-1.643	(0.046)	-1.618	(0.035)	-1.068	(0.118)
$DlnY_{-1}$			1.143	(0.016)			1.329	(0.003)	0.212	(0.820)	-0.652	(0.476)		
$DlnY_{-2}$							1.765	(0.000)	-2.430	(0.005)	-2.650	(0.005)		
DlnYROW	3.710	(0.033)	-0.273	(0.832)	4.799	(0.000)	4.684	(0.000)	1.434	(0.382)	3.560	(0.061)	5.047	(0.003)
$DlnYROW_{-1}$							0.635	(0.487)						
$DlnYROW_{-2}$							-1.282	(0.176)						
$DlnYROW_{-3}$							7.227	(0.000)						
$DlnRER^{+}$	-2.347	(0.237)	0.118	(0.733)	-0.579	(0.042)	2.721	(0.000)	-0.139	(0.740)	-1.739	(0.041)	-3.186	(0.000)
$DlnRER^{+}_{-1}$							-0.645	(0.168)	-1.390	(0.004)				
$DlnRER^{+}_{-2}$							3.217	(0.000)	-1.057	(0.020)				
$DlnRER^{+}_{-3}$							-3.508	(0.000)						
$DlnRER^{-}$	-1.655	(0.480)	-3.691	(0.000)	-0.995	(0.068)	0.049	(0.809)	-0.022	(0.972)	-0.090	(0.842)	0.495	(0.260)
$DlnRER^{-}_{-1}$	6.689	(0.007)					-0.777	(0.002)			1.240	(0.004)		
$DlnRER^{-}_{-2-}$	5.729	(0.013)					-0.283	(0.208)			0.828	(0.031)		
$DlnRER^{-}_{-3}$							1.277	(0.000)						
Constant	-26.284	(0.108)	9.000	(0.503)	-12.595	(0.012)	13.269	(0.124)	58.050	(0.022)	69.164	(0.364)	-65.643	(0.208)
lnY	-2.515	(0.001)	-1.096	(0.005)	-0.541	(0.011)	-1.909	(0.000)	2.978	(0.001)	4.276	(0.077)	0.024	(0.987)
lnYROW	3.980	(0.042)	-0.235	(0.871)	1.526	(0.005)	-0.635	(0.441)	-6.840	(0.013)	-8.500	(0.313)	6.480	(0.251)
$lnRER^{+}$	-7.494	(0.009)	0.202	(0.628)	-0.718	(0.009)	8.893	(0.005)	1.429	(0.051)	-1.202	(0.668)	-5.643	(0.025)
$lnRER^{-}$	-11.128	(0.000)	-1.293	(0.046)	0.455	(0.235)	-0.729	(0.063)	-0.122	(0.875)	-3.106	(0.290)	2.212	(0.234)
DUM					2003		1995		2012		2013		2013	
ECT	-0.840	(0.000)	-0.706	(0.000)	-0.922	(0.000)	-0.578	(0.000)	-0.749	(0.000)	-0.518	(0.000)	-0.392	(0.002)
R^2 adj	0.532		0.472		0.546		0.630		0.471		0.415		0.236	
F-test	9.177		4.640		3.263		5.486		7.040		5.311		3.162	
J-B	1.090	(0.580)	0.078	(0.962)	0.456	(0.796)	0.278	(0.870)	2.533	(0.282)	0.941	(0.625)	2.225	(0.329)
LM (F)	1.039	(0.371)	0.542	(0.588)	1.767	(0.195)	1.301	(0.324)	0.481	(0.626)	1.452	(0.262)	0.327	(0.724)
LM	2.935	(0.231)	1.497	(0.473)	5.041	(0.080)	8.100	(0.017)	1.725	(0.422)	4.961	(0.084)	0.883	(0.643)
Heterosk.	10.996	(0.276)	9.153	(0.330)	11.438	(0.407)	26.990	(0.212)	9.441	(0.739)	22.121	(0.076)	4.885	(0.674)
RESET	0.407	(0.688)	0.947	(0.353)	1.361	(0.187)	0.812	(0.438)	0.527	(0.605)	0.780	(0.445)	1.690	(0.103)
Wald asymm.	0.122	(0.727)	2.336	(0.126)	12.366	(0.000)	4.356	(0.037)	6.073	(0.014)	0.007	(0.935)	5.068	(0.024)

CUSUM	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	S	S

Note. As per Table 2.

Conclusion and discussion

The paper examined the effects of the exchange rate, alongside domestic and foreign output, on the agricultural trade balance in four South-East Asian economies (Indonesia, Malaysia, the Philippines and Thailand) during the 1980-2017 period. Two models, linear and non-linear ARDL, were applied and two alternative exchange rate measures were used (real exchange rate, constructed by the USDA, and the real effective exchange rate, constructed by the IMF).

The empirical findings demonstrated negative effects of the domestic GDP and positive effects of the 'rest of the world' GDP in all countries except the Philippines, where the signs of the effects were the opposite (attributed to the persistence of protectionist agricultural policies, difficulties in expanding agricultural exports and certain slowdown in the growth of agricultural trade deficit). The J-curve effect was only observed in Malaysia, but the size of trade balance elasticity coefficient (in those cases where long-run positive effect of depreciation on the trade balance as observed) was smaller than unity. This result is in line with previous research of the J-curve in agricultural and primary products' trade: the study by Yazici (2006) of Turkish agricultural trade balance, the analyses by Baek et al (2009) and Gong and Kinnucan (2015) of the J-curve effect in the US agricultural trade, as well as the analyses of the J-curve in the forestry products trade in Romania (Tutueanu, 2015) and Thailand (Sulaiman et al, 2014). The absence of the J-curve was also documented on numerous occasions in the studies of the non-agricultural trade.

The output variables generally exercised more significant effect on the agricultural trade balance than the real (effective) exchange rate. This finding confirms certain previous studies (e.g. Batten and Belongia, 1984, in the US context, and Chebbi and Olarreaga, 2019, in Tunisian context, among others) and contravenes those analyses that establish statistically significant effects of the exchange rate on exports and trade balance (e.g. Gardner, 1981, Tweeten, 1989, Baek and Koo, 2008, and Gong and Kinnucan, 2015, in the US context). Policy-wise, this finding suggests that fiscal and monetary measures that affect output levels may be more efficient in correction of external imbalances than targeting or tinkering with exchange rates (Noland, 1989: 178).

The findings (the absence of J-curve in the majority of the economies in question) are noteworthy, given that J-curve is more likely to exist in agricultural commodities as opposed to industrial products trade (low export and import elasticities and slow adjustment of quantities to changes in relative prices, due to substantial lags in production, consumption and transaction and the payments that are made after the delivery; Doroodian et al, 1999: 687; Junz, Rhomberg, 1973).

The absence of the J-curve and violation of Marshall-Lerner condition may be attributed to several factors. From methodological point of view, the J-curve could be identified, if the bilateral trade is considered (e.g. J-curve in the trade between two countries, and the curve absence in the trade of the country with the rest of the world, as is the case in this paper), or if reactions of exports and imports to exchange rate fluctuations are examined separately. The use of partial equilibrium framework that does not consider a complete set of the relations in the system (e.g. induced effects of depreciation of domestic output, or an interaction between domestic agricultural and foreign exchange policies) could likewise distort the results. Also, the results could be sensitive to the degree of aggregation and composition of agricultural exports (as noted by Gong and Kinnucan, 2015, the sensitivity of exports and imports of bulk versus high-value added consumer commodities may differ), and to the degree of currency misalignment prior to depreciation (Lal, Lowinger, 2002: 412-3).

The theoretical explanations of missing J-curve are as follows. Firstly, at the currency-contract stage, the requisite assumptions behind the J-curve effect may be violated. For instance, the domestic exports (i.e. exports from the respective South-East Asian economy) may be denominated in foreign currency (e.g. not baths or ringgits), while the imports are denominated in the foreign currency (US dollars), hence unexpected signs of the short run coefficients of REER or RER (Baek et al, 2009: 222). This explanation may nonetheless be implausible, if such effect is mitigated by the existence of futures markets for the exported commodities (e.g. palm oil futures in Bursa Malaysia, sugar futures on various commodity exchanges etc). Secondly, the incomplete pass-through may be observed, where prices of exports in foreign currency rise proportionately to devaluation of domestic currency, while prices of exports in domestic currency remain same, thus improving trade balance at the pass-through stage instead of deteriorating it (Baek et al, 2009: 217). In a related vein, imperfectly competitive markets may cause firms to engage in oligopolistic behaviour (altering profit margins to compensate for exchange rate changes). While such behaviour is more typical for production and exports of differentiated manufactured products, the extent of oligopolistic behaviour in international agricultural markets may be need to be investigated (Noland, 1989: 177).

Thirdly, other factors that affect J-curve and Marshall-Lerner condition include agricultural trade restrictions and protectionism (particularly prior to WTO Uruguay Round) that potentially create downward bias in price elasticities; the trading decisions that are based on the expected future exchange rates rather than actual ones, resulting in low elasticities contra Marshall-Lerner condition; and the relative size of agricultural exporting economy. The latter factor implies that 'small sellers' face perfectly elastic export demand in international markets. Thus, depreciation of domestic currency, will lead to improvement of the domestic trade balance (since export values rise faster than import values). Arguably, this is not the case of the economies in this paper: in the specific export commodities none of them are small exporters, hence trade balance may not improve following depreciation.

Overall, the identification of the J-curve and Marshall-Lerner condition is very much an empirical matter. Both are not 'iron-clad' laws, but are akin to operational concepts for the analysis of temporal effects of devaluation. The empirical research based on these concepts is therefore inherently contextual (affected by the above factors, as well as other issues, such as study period, sample of economies, econometric methodology, price indexes used in the calculation of the real exchange rate, trade policy instruments, the extent of agricultural trade liberalisation etc), and hence it is not expected that economies will necessarily experience J-curve effect or have Marshall-Lerner condition satisfied, or that the curve will necessarily have particular shape.

References

ASEAN Secretariat. (2019). ASEAN Key Figures 2019. Jakarta: The ASEAN Secretariat Community Relations Division.

Baek, J., Mulik, K., Koo, W. (2006). The J-Curve Phenomenon: Myth or Reality? Paper Presented at the Annual Meeting of the American Agricultural Economics Association, Long Beach, 23-26 July 2006.

Baek, J., Koo, W. W. (2008). Identifying Macroeconomic Linkages to US Agricultural Trade Balance. Canadian Journal of Agricultural Economics, 56 (1), pp. 63-77.

Baek, J., Koo, W. W., Mulik, K. (2009). Exchange Rate Dynamics and the Bilateral Trade Balance: The Case of US Agriculture. Agricultural and Resource Economics Review, 38 (2), pp. 213-228.

Bahmani-Oskooee, M., Gelan, A. (2012). Is There J-Curve Effect in Africa? International Review of Applied Economics, 26 (1), pp. 73-81.

Bahmani-Oskooee, M., Harvey, H. (2016). Is There J-Curve Effect in the Commodity Trade of Singapore with Malaysia? An Empirical Study. The Singapore Economic Review, 62 (1), pp. 1-25.

Bahmani-Oskooee, M., Kantipong, T. (2001). Bilateral J-Curve Between Thailand and Her Trading Partners. Journal of Economic Development, 26 (2), pp. 107-117.

Banerjee, A., Dolado, J., Mestre, R. (1998). Error-correction Mechanism Tests for Cointegration in a Single-equation Framework. Journal of Time Series Analysis, 19 (3), pp. 267-283.

Batten, D. S., Belongia, M. T. (1986). Monetary Policy, Real Exchange Rates, and US Agricultural Exports. American Journal of Agricultural Economics, 68 (2), pp. 422-427.

Carter, C. A., Pick, D. H. (1989). The J-Curve Effect and the US Agricultural Trade Balance. American Journal of Agricultural Economics, 71 (3), pp. 712-720.

Chambers, R. G., Just, R. E. (1981). Effects of Exchange Rate Changes on US Agriculture: A Dynamic Analysis. American Journal of Agricultural Economics, 63 (1), pp. 32-46.

Chebbi, H., E., Olarreaga, M. (2019). Investigating Exchange Rate Shocks on Agricultural Trade Balance: The Case of Tunisia. The Journal of International Trade and Economic Development, 28 (5), pp. 628-647.

Cheng, K. M. (2020). Currency Devaluation and Trade Balance: Evidence from the US Services Trade. Journal of Policy Modeling, 42 (1), pp. 20-37.

David, C. (2003). Agriculture. In Balisacan, A., Hill, H. (Eds.) The Philippine Economy: Development, Policies, and challenges. New York: Oxford University Press.

David, C., Intal, P., Balisacan, A. (2007). Distortions to Agricultural Incentives in the Philippines. World Bank Agricultural Distortions Working Paper No. 28.

Dean J. M., Desai, S., Reifel, N. (1994). Trade Policy Reform in Developing Countries Since 1985. World Bank Discussion Paper No. 267.

Doroodian, K., Jung, C., Boyd, R. (1999). The J-Curve Effect and US Agricultural and Industrial Trade. Applied Economics, 31 (6), pp. 687-695.

Food and Agricultural Organisation/FAO (2018). State of Food and Agriculture in Asia and the Pacific Region, Including Future Prospects and Emerging Issues. FAO Regional Conference for Asia and the Pacific, 34th Session, Nadi, Fiji, 9-13 April 2018.

Gardner, B. (1981). On the Power of Macroeconomic Linkages to Explain Events in US Agriculture. American Journal of Agricultural Economics, 63 (5), pp. 872-878.

Gong, L., Kinnucan, H. (2015). Effects of Recession and Dollar Weakening on the US Agricultural Trade Balance. Paper Presented at Southern Agricultural Economics Association Annual Meeting, 31 January - 3 February 2015, Atlanta, Georgia.

Henneberry, D., Drabenstott, M., Henneberry, S. (1987). A Weaker Dollar and US Farm Exports. Federal Reserve Bank of Kansas City Economic Review, 72, May, pp. 22-36.

International Monetary Fund / IMF (2005). The Annual Report on Exchange Rate Arrangements and Exchange Restrictions. Washington, DC: IMF Publications.

Junz, H., Rhomberg, R. (1973). Price Competitiveness in Export Trade among Industrial Countries. American Economic Review, 63, pp. 412-418.

Kim, M., Cho, G. D., Koo, W. W. (2004). Does the Exchange Rate Matter to Agricultural Bilateral Trade between Canada and the US? Canadian Journal of Agricultural Economics, 52 (1), pp. 127-145.

Konandreas, P., Bushnell, P., Green, R. (1978). Estimation of Export Demand Functions for US Wheat. Western Journal of Agricultural Economics, 3 (1), pp. 39-49.

Kost, W. (1976). Effects of Exchange Rate Change on Agricultural Trade. Agricultural Economics Research, 28 (3), pp. 99-106.

Lal, A., Lowinger, T. (2002). The J-Curve: Evidence from East Asia. Journal of Economic Integration, 17 (2), pp. 397-415.

Magee, S. P. (1973). Currency Contracts, Pass-Through, and Devaluation. Brookings Papers on Economic Activity, 1, pp. 303-325.

Meade, E. (1988). Exchange Rates, Adjustment, and the J-Curve. Federal Reserve Bank of St. Louis Bulletin, October, pp. 633-644.

Mundell, R. (1988). New Deal on Exchange Rates. Tokyo: Research Institute of International Trade and Industry.

Noland, M. (1989). Japanese Trade Elasticities and the J-Curve. The Review of Economics and Statistics, 71 (1), pp. 175-179.

Nusair, S. (2017). The J-Curve Phenomenon in European Transition Economies: A Nonlinear ARDL Approach. International Review of Applied Economics, 31 (1), pp. 1-27.

Onafowora, O. (2003). Exchange Rate and Trade Balance in East Asia: Is There a J-Curve? Economics Bulletin, 5 (18), pp. 1-13.

Papadimitriou, D., Hannsgen, G., Zezza, G. (2008). The Buffet Plan for Reducing the Trade Deficit. The Levy Economics Institute of Bard College, Working Paper No. 538.

Pesaran, M. H., Shin, Y., Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationship. Journal of Applied Econometrics, 16 (3), pp. 289-326.

Prakash, K., Maiti, D. (2016). Does Devaluation Improve Trade Balance in Small Island Economies? The Case of Fiji. Economic Modelling, 55 (C), pp. 382-393.

Rose, A., Yellen, J. (1989). Is There a J-Curve? Journal of Monetary Economics, 24, pp. 53-68.

Shin, Y., Yu, B., Greenwood-Nimmo, M. (2013). Modelling Asymmetric Co-integration and Dynamic Multipliers in a Nonlinear ARDL Framework. In Sickels, R., Horrace, W. (Eds.) Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications. New York: Springer, pp. 281-314.

Sulaiman, C., Abdul Samad, A. R. (2014). J-Curve and Thailand’s Trade in Forest Products: ARDL Bounds Testing. World Applied Sciences Journal, 29 (1), pp. 150-155.

Takeshima, H., Joshi, P. (2019). Overview of the Agricultural Modernization in Southeast Asia. International Food Policy Research Institute (IFPRI) Discussion Paper No. 01819.

Tutueanu, G. (2015). Measuring the Influence of the J-Curve Effect on Trade in Romanian Forest Products. Ecoforum, 4 (1), pp. 276-283.

Tweeten, L. (1989). Farm Policy Analysis. Boulder: Westview Press.

United States Department of Agriculture/USDA (2017). Agricultural Productivity Project. Washington: USDA Economic Research Service.

Wijeweera, A., Dollery, B. (2013). J-curve Disparity between the Goods Sector and the Services Sector: Evidence from Australia.

World Bank (2018). World Development Indicators. Washington, DC: World Bank Publications.

Yazici, M. (2006). Is the J-Curve Effect Observable in Turkish Agricultural Sector? Journal of Central European Agriculture, 7 (2), pp. 319-322.

Yazici, M. (2010). Is There a J-Curve Effect in Turkish Services? Quality and Quantity, 44 (1), pp. 167-172.

[i] The devaluations of the currency in the fixed exchange rate regime are distinguished from currency depreciation in flexible regime. For the purpose of discussion in this paper, we consider the issue immaterial and use two terms interchangeably.

[ii] The data is available under the heading 'Crops and Livestock Products' and sub-heading 'Items Aggregated: Total Agricultural Products': http://www.fao.org/faostat/en/#data/TP. The data has been accessed on 10 August 2020.

[iii] The data ('Real Annual Country Average Exchange Rates, Local Currency per USD' spreadsheet) is available at https://www.ers.usda.gov/data-products/agricultural-exchange-rate-data-set/. The data has been accessed on 10 August 2020.

[iv] The data is available at https://data.imf.org/regular.aspx?key=61545862. The data has been accessed on 10 August 2020.

[v] The data is available at https://www.ers.usda.gov/data-products/international-macroeconomic-data-set/.The data has been accessed on 10 August 2020.