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REVISITING NEW ZEALAND TRADE BALANCE AND EXCHANGE RATE: EVIDENCE FROM ASYMMETRY ANALYSIS

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Abstract

Recent trends on empirical studies of trade balance and exchange rates, focusing on a non-linear approach, supply new insight in the case of New Zealand. The earlier empirical study is limited and unsuccessful in providing dedicated support for J-curve in the long run. This paper adds a new case study between New Zealand and its 13 trading partners. Following an innovative approach using the non-linear method supply rewarding results. The results show that the short-run effects of exchange rate changes are asymmetric in all models, but they also lasted into the long-run significant asymmetric effects in the cases of China, Hong Kong, Indonesia, and Switzerland.

Keywords: J-Curve, Non-linear ARDL approach, Asymmetry effects, New Zealand, trading partners.

JEL Classification F31, F32, F42, C10

I. Introduction

One of the significant pieces of literature in international economics has focused on the outcomes of the trade balance to currency depreciation or appreciations. For New Zealand, this question is consequential since its dollar has experienced has continual depreciation since 2000.[1] If the trade balance adapts to real exchange rate changes, it is expected to improve with the continuous depreciation of the N.Z. dollar. Magee (1973) saw this experience in the U.S when the dollar was devalued in 1971 and started the study of J-curve to describe a nation's trade balance's behavior from exchange rate devaluation in the short run. Reviews by Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee and Hegerty (2010) revealed that studies of "J-curve" have progressed overtime with mixed results. For example, early studies are focused on Marshall-Lerner (ML) conditions.

[1] Refer to figure 1.

This condition states that currency devaluation will improve the trade balance only if the sum of import and export demand price elasticities is more significant than one. However, one qualification for this approach is dependent on aggregate trade data[2]. Miles (1979), using pooled cross-section and time-series, observed 14 countries, including New Zealand, from 1956 to 1972 and found that devaluations do not improve the trade balance, but they improve the balance of payments through the capital account. Rose and Yellen (1989) argue that this approach may run into an aggregation bias. This empirical shift focuses on applying aggregate data towards bilateral data. For example, Bahmani-Oskooee and Ratha (2003) used cointegration and error-correction modeling to study the J-Curve phenomenon between the USA and 14 of its trading partners, including New Zealand. They found no specific short-run pattern and the long-run effects of real depreciation are favorable in the trade between the USA and Argentina, Chile, Israel, Korea, Mexico, Singapore, and South Africa. The latest published empirical research for the existence of J-curve for New Zealand appears to be the paper by Narayan (2004). He employed the Granger causality framework and the impulse response analysis, whether a J-curve pattern exists for New Zealand over the 1970–2000 period. His research, however, is focused on aggregate data on industrial countries and found that there is no long-run relationship among the variables.

Bahmani-Oskooee and Fariditavana (2016) further contend Rose and Yellen's (1989) approach, arguing that Rose and Yellen (1989) assume the effects of exchange rate changes on trade balance to be symmetric. They support traders' expectations, and behavior responds dissimilar to currency depreciation as compared to currency appreciation, exchange rate changes may have asymmetric effects on the trade balance. Moreover, Bussiere (2013) shows evidence import and export prices react to exchange rate changes asymmetrically. This paper expects to import and export quantities, so the trade balance also reacts to exchange rate changes asymmetrically.

This paper aims to disaggregate New Zealand's bilateral trade balance models with 13 trading partners. Australia, Canada, China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Switzerland, Thailand, and United States while focusing above developments. These 13 partners engage in more than 68% of New Zealand's overall trade. This paper is divided into three sections in the next section: models and methods, results, and a summary. The definitions of variables and data sources are cited below in Appendix I.

[2] For example, some of the aggregate data approaches are Goldstein and Khan (1976), Wilson and Takacs (1979) Haynes and Stones (1982), Warner and Kreinin (1983), and Gylfason and Risager (1984)

International Journal of Business and Economics
Vol. 7, No. 1, 2022, pp. 114-127

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Appendix 1(Data Definition and Sources)

Empirical analysis using quarterly data: 1990I-2019QIV.
The sources are *IMF e-Library – DATA*.

a. Direction of Trade Statistics (DOT)
b. International Financial Statistics (IFS)

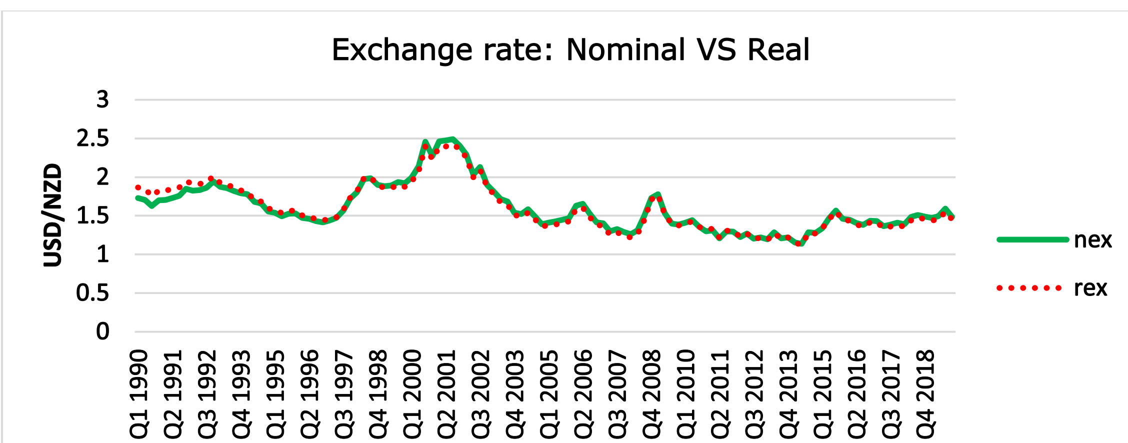
II. Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org
III. Stats NZ Tatauranga Aotearoa, https://www.stats.govt.nz/

There are 13 Countries: Australia, Canada, China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Switzerland, Thailand, and United States.

Variables

TB_i = New Zealand trade balance with partner i is defined as New Zealand imports from partner i over exports to partner i. The data come from a source I(a).
Y_{NZ} = Measure of New Zealand's income. It is proxied by an index of real GDP. The data come from source II (a).
Y_i = Trading partner i's income. This is also proxied by the index of real GDP in country i, and the data come from source I (b).
REX_i = The real bilateral exchange rate of the New Zealand Dollar (NZD) against the currency of partner i. It is defined as $REX_i = (P_{NZ.} * NEXi_{/}P_{i)}$ where NEX_i is the nominal exchange rate defined as a number of units of partner i's currency per NZD, P_{NZ} is the price level in New Zealand, measured by CPI, and P_i is the price level in country i (also measured by CPI). Thus, a decline in REX reflects a real depreciation of the New Zealand Dollar. All nominal exchange rates and price levels data come from source I (a, b).

Figure 1



Source: IMF, International Financial Statistics (IFS)

Table 1

Trading partners	Total exports	Total imports	Trade balance	% Of total Trade
China, People's Republic of	20,111	13,323	6,787	19.7%
Australia	14,041	13,113	927	16.0%
United States of America	9,583	9,391	192	11.2%
Japan	4,543	4,209	334	5.2%
Singapore	1,637	4,127	-2,490	3.4%
Korea, Republic of	2,237	2,535	-298	2.8%
Thailand	1,259	2,801	-1,542	2.4%
Malaysia	1,315	2,070	-756	2.0%
Indonesia	1,203	1,137	66	1.4%
Canada	1,202	959	243	1.3%
Hong Kong (Special Administrative Region)	1,752	382	1,370	1.3%
Switzerland	400	1,046	-647	0.9%
Philippines	1,125	304	821	0.8%
Total*	**85,973**	**83,382**	**2,592**	**100%**

Source: Stats NZ Tatauranga Aotearoa
*Inclusive smaller trading partners

II. The models and Methods

Utilizing quarterly data, 1990I-2019QIV, between New Zealand and 13 of her trading partners, this paper's method uses the error-correction and cointegration structures where empirical economists verified from reduced form trade balance model. The accepted fundamentals[3] are (i)a country's trade balance with its trading partners is influenced by its economic growth at home; (ii) economic growth of its trading partners; and (iii) real bilateral exchange rate.[4] Based on these principles, Bahmani-Oskooee and Fariditavana (2016), Bahmani-Oskooee, Harvey and Hosny (2018), and Harvey (2019) used a generic symmetric and asymmetric approach to outlines exchange rate changes between a nation and its trading partners. Following their techniques, this model is specified as follows:

$$Ln\, TB_{i,t} = \alpha + \beta lnY_{NZ,t} + \delta\, Y_{i,t} + \eta REX_{i,t} + \theta\varepsilon_t (1)$$

T.B. signifies New Zealand's trade balance (import/export) with its trading partners i. The essential variables that affect T.B. are New Zealand economic activity (Y_{NZ}), trading partners 'economic endeavor (Y_i), and real exchange rate (REX_i). REX_i exhibits a decline that signifies a real depreciation of the New Zealand dollar against partner i's currency.

[3] Refer to Rose and Yellen (1989) for hypothetical explanation.
[4] Refer to Appendix.

International Journal of Business and Economics
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It is expected that Y_{NZ} to be positively correlated with T.B. since economic growth in New Zealand will stimulate import.[5] Yi, however, is expected to be negative since its trading partners' economic growth will prop New Zealand's export. To investigate the short run, equation (1) will be incorporated with an error-correction model (2), a method introduced by Pesaran et al. (2001).

$$\Delta TB_{i,t} = \sigma' + \sum_{k=1}^{n} \beta_k' \Delta LnTB_{i,t-k} + \sum_{k=0}^{n} \gamma_k' \Delta LnY_{NZ,k} + \sum_{k=0}^{n} \pi_k' \Delta LnY_{i,t-k} + \sum_{k=0}^{n} \eta_k' \Delta LnREX_{i,t-k}$$
$$+\chi_1 LnTB_{i,t-1} + \chi_2 LnY_{NZ,t-1} + \chi_3 LnY_{i,t-1} + \chi_4 LnREX_{i,t-1} + \phi \qquad (2)$$

Equation (2), both long and short run, is completed using the OLS method. Additionally, (2) short-run effects of REX is observed via η' while estimates of the long run are discerned by the estimate of χ_2 - χ_4- normalized on χ_1.[6] Following Pesaran Shin and Smith (2011), they propose applying their critical F-test to verify that this model is cointegrated. Besides, both short-run and long-run effects are estimated in one step by applying OLS to (2), their critical F-test has a unique integrating property.[7] Indeed, a proper characterization of "J-curve" will be seen from equation (2). Shin, Yu, and Greenwood-Nimmo (2014) further support that equation (2) will be revised to evaluate asymmetric effects of exchange rate changes on the bilateral trade balance since equation (2) assumes the relationship between variables is symmetric.

Furthermore, Bahmani-Oskooee and Fariditavana (2015) reasoned that agents' expectations and responses are separate from appreciation and depreciation. As a result, exchange rate deviations will have asymmetric effects. The exchange rate series will be separated into two series, one being only appreciation of New Zealand (N.Z.) dollar while another depreciation of N.Z. dollar. As recommended by Bahmani-Oskooee and Fariditavana (2015), their method is applied to generate two new times series variables as:

$$PSC = \sum_{j=1}^{t} \max(\Delta LnREX_j, 0) \text{ and } NSC = \sum_{j=1}^{t} \min(\Delta LnREX_j, 0) \qquad (3)$$

where PSC is the partial sum of positive changes reflecting only currency appreciation, and NSC is the partial sum of negative changes that reflect only currency depreciation. Shin, Yu, and Greenwood-Nimmo (2014) suggested by substituting *Ln REX* in equation (2) with PSC and NSC variables and will develop as follow:

[5] Y_{NZ} can be negative. Refer to Bahmani-Oskooee, (1986), he argues that this may possibly be due to an increase in production of import substitute goods.
[6] In addition, χ_1 measure the adjustment speed in each model and must be negative.
[7] One of the advantages of using Pesaran et. al (2001) is that there is no pre-testing of unit root. Moreover, these variables are I (0) or I (I) which matches macroeconomic variables.

International Journal of Business and Economics
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$$\Delta LnTB_{i,t} = \sigma^{'} + \sum_{k=1}^{n1} \beta_k^{'} \Delta LnTB_{i,t-k} \sum_{k=0}^{n2} \gamma_k^{'} \Delta LnY_{t-k}^{NZ} + \sum_{k=0}^{n3} \pi_k^{'} \Delta LnY_{t-k}^{i} + \sum_{k=0}^{n4} \eta_k^{'} \Delta PSC_{t-k}$$
$$\sum_{k=0}^{n5} \psi_k^{'} NSC_{t-k} + \phi_0 LnTB_{i,t-1} + \phi_1 LnY_{t-1}^{NZ} + \phi_2 LnY_{t-1}^{i} + \phi_3 PSC_{t-1} + \phi_4 NSC_{t-1} + \rho_t \ (4)$$

The inclusion of both PSC and NSC presents nonlinearity into equation (4), and it can be found with the same process as in equation (2). Likewise, cointegration is recognized by applying the same F-test and critical values. However, Shin et al. (2014) recommended treating the PSC and NSC variables as a single entry into the model in critical values. Once more, the short-run effect is estimated from the coefficients to first-differenced variables. First-differenced variables reflect short-run effects estimates of ϕ_1–$\phi_4$and normalized on ϕ_0 specify long-run effects. One of the hypotheses to show asymmetric effects of exchange rate changes on the trade balance is that both ΔPSC and ΔNSC variables have different lag orders when a benchmark is applied to choose the best lags. In addition, in the case of the short run, the assessment is $\sum \hat{\eta}_K^{'} \neq \sum \hat{\psi}_K^{'}$ prove asymmetry if the Wald test rejects the null.For the same reason, long-run asymmetric effects of appreciation versus depreciation will be proven if the Wald test rejects the null

of $-\frac{\hat{\phi}_3}{\hat{\phi}_0} \neq -\frac{\hat{\phi}_4}{\hat{\phi}_0}$.[8]

III. The Results

This section shows the estimate of both the linear model (2) and the non-linear model (4) between New Zealand and 13 of its trading partners. The empirical estimates focus on quarterly data 1990I-2019QIV and the imposition of four lags on each first differenced variable. The Akaike's Information Criterion (AIC) procedure is applied to select the best model. In addition, dummy variables are included to account for the Asian financial crisis 1997 and the Global Financial Crisis of 2008. The results from each table are named ARDL (linear models) and NARDL (non-linear models) inclusive diagnostic test (group C). Both models are presented as short-run, group A and long-run, group B.

[8] Other application of applying similar models is: Apergis and Miller (2006), Halicioglu (2007), Hajilee et al. (2017), Nusair (2017), Arize et al. (2017), Istiak and Alam (2019), and Hajilee and Niroomand (2019)

International Journal of Business and Economics
Vol. 7, No. 1, 2022, pp. 114-127

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Table 1: Estimation for Linear ARDL (L-ARDL) and Nonlinear ARDL (NL-ARDL) Models

	i = Australia		i = Canada		i=China	
	L – ARDL[#]	NL – ARDL[#]	L – ARDL[#]	NL – ARDL[#]	L – ARDL[&]	NL – ARDL[&]
Panel A: Short–Run Estimates						
$\Delta lnTBi, t_{-1}$	0.14	0.16	0.45*	0.34*	0.47*	0.52*
$\Delta lnTBi, t_{-2}$	0.18*	0.22*			0.02	
$\Delta lnTBi, t_{-3}$	0.15**				0.03	
$\Delta lnTBi, t_{-4}$					0.29	
$\Delta ln\ Y_{US,t}$	-0.45*	-0.65*	3.51*	4.80*	-1.91	-2.53
$\Delta lnY_{NZ,t-1}$	-0.45**	-0.69*	2.62*	2.47**	0.45	1.53
$\Delta lnY_{NZ,t-2}$	-0.68*	0.64*	-5.78*	-4.24*	1.90	3.08*
$\Delta lnY_{NZ,t-3}$			0.98			
$\Delta lnY_{NZ,t-4}$						
$\Delta lnY_{i,t}$	-1.52	-3.05**	2.35	2.66	0.85	1.28*
$\Delta lnYi, t_{-1}$	4.29*	5.93*	-4.51**	-1.95	-0.25	-0.53
$\Delta lnYi, t_{-2}$	2.17	-4.73*		-1.25	1.67*	-2.40*
$\Delta lnYi, t_{-3}$		2.28		3.05*	1.01*	1.30*
$\Delta lnYi, t_{-4}$						
$\Delta lnREX_{i,t}$	0.34		-0.59		-0.11	
$\Delta lnREXi,\ _{t-1}$	-0.49		1.12**		-0.25	
$\Delta lnREXi, t_{-2}$	-0.22		-1.72*		0.60*	
$\Delta lnREXi, t_{-3}$	0.14		1.54*			
$\Delta lnREXi, t_{-4}$	0.62					
ΔPSC_t		0.35		-0.18		0.23
ΔPSC_{t-1}		-1.19				
ΔPSC_{t-2}		1.15*				
ΔPSC_{t-3}						
ΔPSC_{t-4}						
ΔNSC_t		0.70				0.03
ΔNSC_{t-1}		-0.12		1.23		-0.27
ΔNSC_{t-2}		-1.21*		-1.89		0.98**
ΔNSC_{t-3}		0.26		0.26		
ΔNSC_{t-4}		0.99*		2.23*		
Panel B: Long–Run Estimates						
$ln\ Y_{NZ}$	-0.94	0.21	2.42	4.60*	2.39	4.33*
$ln\ Y_i$	0.83	0.68	-3.94	3.79	-0.38	-0.73
$ln\ REX_i$	0.75*		0.62		1.23**	
PSC		0.49		-0.27		0.49
NSC		1.00*		3.12*		1.53*
Constant	-2.15	-4.06	7.47*	-23.29*		-6.95**
Panel C: Diagnostic Statistics						
F	5.15*	5.36*	9.76*	11.10*	4.05*	6.48*
ECM_{t-1}	-0.52*	-0.62*	-0.55*	-0.66*	-0.19*	-0.48*
LM	0.49	0.54	0.36	0.41	1.31	0.36
RESET	0.35	0.003	0.88	0.36	0.07	0.02
Adjusted $R^{2.}$	0.84	0.84	0.59	0.62	0.86	0.85
CS (CS^2)	S(S)	US(US)	S(S)	S(S)	S(US)	S(US)
WALD – S		0.68		2.12		0.29
WALD – L		0.41		0.97		3.34*

Notes: See notes at the end.

International Journal of Business and Economics
Vol. 7, No. 1, 2022, pp. 114-127

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Table 2: Estimation for Linear ARDL (L-ARDL) and Nonlinear ARDL (NL-ARDL) Models						
	i = Hong Kong		**i =Indonesia**		**I=Japan**	
	L – ARDL$^{\&}$	**NL – ARDL$^{\&}$**	**L – ARDL**	**NL – ARDL#**	**L – ARDL#**	**NL – ARDL#**
Panel A: Short–Run Estimates						
ΔlnTBi, t_{-1}	0.39*	0.50*	0.37*	0.34*	0.11	0.26*
ΔlnTBi, t_{-2}	0.02		0.30*	0.28*	0.19*	
ΔlnTBi, t_{-3}	0.15				0.16**	
ΔlnTBi, t_{-4}						
Δln $Y_{NZ,t}$	2.23*	2.45*	2.43*	2.89*	2.24*	0.69*
ΔlnNZ $_{NZ,t-1}$	1.14*	0.20	-0.69	-0.19	3.17*	
ΔlnNZ $_{NZ,t-2}$	-3.07*	-3.41*	-2.18*	-2.17*	-1.57*	
ΔlnNZ $_{NZ,t-3}$	-1.11**				-2.01*	
ΔlnNZ $_{NZ,t-4}$					-1.55	
Δln$Y_{i,t}$	0.33	-0.94**	-0.35	-0.49	-0.74	0.15
ΔlnYi, t_{-1}	0.27		0.07	0.11	-1.71*	
ΔlnYi, t_{-2}	0.05		-0.62	-0.78	1.01	
ΔlnYi, t_{-3}	-0.81**		-1.24	-1.00		
ΔlnYi, t_{-4}	0.89*		2.03*	2.16*		
Δln$REX_{i,t}$	0.33		0.60*		0.11	
ΔlnREXi, t_{-1}	0.27		0.12			
ΔlnREXi, t_{-2}	0.05		-0.43*			
ΔlnREXi, t_{-3}	-0.81**					
ΔlnREXi, t_{-4}	0.89*					
ΔPSC_t		0.40		0.02		0.04
ΔPSC_{t-1}		0.42				
ΔPSC_{t-2}		-0.86				
ΔPSC_{t-3}		-1.06				
ΔPSC_{t-4}		1.91*				
ΔNSC_t		0.85*		0.87*		0.13
ΔNSC_{t-1}				0.41		
ΔNSC_{t-2}				-0.85*		
ΔNSC_{t-3}						
ΔNSC_{t-4}						
Panel B: Long–Run Estimates						
ln Y_{NZ}	-1.84	-1.53	-1.37	1.39	0.51**	0.94**
ln Y_i	-1.90*	-1.87**	-0.34	-0.005	2.68**	0.20
ln REX_i	1.67*		0.89**		0.20	
PSC		1.62*		0.04		0.05
NSC		1.70*		1.15		0.17
Constant	9.21*	9.65*	3.25	-2.10	14.72**	-3.47
Panel C: Diagnostic Statistics						
F	7.14*	9.84*	3.82*	6.03	5.97*	11.94*
ECM_{t-1}	-0.44*	-0.49*	-0.32*	-0.38*	-0.54*	-0.73*
LM	0.003	2.25	0.09	1.40	1.18	1.13
RESET	0.55	0.02	0.23	0.06	3.35**	0.16
Adjusted $R^{2.}$	0.90	0.89	0.88	0.89	0.56	0.36
CS (CS^2)	S(S)	S(S)	S(S)	S(S)	S(US)	S(S)
WALD – S		0.08		0.0002		3.57*
WALD – L		30.99*		39.16*		5.73*

Notes: See notes at the end.

Table 3: Estimation forLinear ARDL (L-ARDL) and Nonlinear ARDL (NL-ARDL) Models

	i =South Korea		i =Malaysia		I=Philippines	
	L – ARDL&	NL – ARDL&	L – ARDL&	NL – ARDL&	L – ARDL#	NL – ARDL
Panel A: Short–Run Estimate4						
ΔlnTBi, t_{-1}	0.21*	0.19*	0.34*	0.32*	0.17**	0.19*
ΔlnTBi, t_{-2}	-0.18*				0.18**	0.18**
ΔlnTBi, t_{-3}						
ΔlnTBi, t_{-4}						
Δln $Y_{NZ,t}$	1.89*	2.14*	0.33	0.55	2.16*	1.73
Δln$Y_{NZ,t-1}$			-0.95	-0.71		
Δln$Y_{NZ,t-2}$			-2.31*	-2.07*		
Δln$Y_{NZ,t-3}$			1.44**	1.55**		
Δln$Y_{NZ,t-4}$						
Δln$Y_{i,t}$	-0.42**	-0.29	1.74*		0.15	0.15
ΔlnYi, t_{-1}				1.74*	-0.21	-0.48
ΔlnYi, t_{-2}					-1.45*	-1.51*
ΔlnYi, t_{-3}						
ΔlnYi, t_{-4}						
Δln$REX_{i,t}$	0.44*		-0.93**		-0.40	
ΔlnREXi, t_{-1}			0.72		0.62	
ΔlnREXi, t_{-2}						
ΔlnREXi, t_{-3}						
ΔlnREXi, t_{-4}						
ΔPSC_t		0.32**		-0.36		0.37
ΔPSC_{t-1}						
ΔPSC_{t-2}						
ΔPSC_{t-3}						
ΔPSC_{t-4}						
ΔNSC_t		0.53*		-1.50**		-1.14
ΔNSC_{t-1}				1.41**		1.19**
ΔNSC_{t-2}						
ΔNSC_{t-3}						
ΔNSC_{t-4}						
Panel B: Long–Run Estimates						
ln Y_{NZ}	1.98*	2.65*	-2.25**	-0.99	3.35*	6.37
ln Y_i	-0.44**	-0.37	2.63*	2.58*	-2.26*	-6.77*
ln REX_i	0.46*		-0.31		0.33	
PSC		0.40*		-0.53		1.38
NSC		0.67*		-0.12		0.15
Constant	-3.70*	-4.44*	-2.29	-5.14	-0.02	10.35
Panel C: Diagnostic Statistics						
F	16.18*	15.48*	11.93*	9.90*	7.88*	6.57*
ECM_{t-1}	-0.95*	-0.81*	-0.66*	-0.68*	-0.64*	-0.62*
LM	0.58	0.41	0.11	0.28	0.11	0.002
RESET	1.34	0.16	1.59	1.65	1.15	0.58
Adjusted R2.	0.89	0.88	0.78	0.78	0.24	0.25
CS (CS^2)	S(S)	S(S)	S(S)	US(S)	S(US)	S(US)
WALD – S		5.93*		0.63		0.42
WALD – L		35.53*		0.26		0.52

Notes: See notes at the end.

International Journal of Business and Economics
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Table 4: Estimation forLinear ARDL (L-ARDL) and Nonlinear ARDL (NL-ARDL) Models

	i = Singapore		i =Switzerland		I=Thailand		I=USA	
	L – ARDL[&]	NL – ARDL[&]	L – ARDL[&]	NL – ARDL[&]	L – ARDL[+]	NL – ARDL#	L – ARDL#	NL – ARDL#
Panel A: Short–Run Estimates								
ΔlnTBi, t_{-1}	0.20*	0.18**	0.38*	0.38*	0.22*	0.21*	0.22*	0.24*
ΔlnTBi, t_{-2}	0.20*	0.19**					-0.02	0.02
ΔlnTBi, t_{-3}							0.15	0.15
ΔlnTBi, t_{-4}							0.36*	0.28*
Δln $Y_{NZ,t}$	1.18	-1.24	1.04	0.86	0.79	0.71	0.72	1.24
Δln$Y_{NZ,t-1}$	-0.74	-1.96*	1.48	1.42				
Δln$Y_{NZ,t-2}$	-1.68**		-3.24	-3.31*				
Δln$Y_{NZ,t-3}$			-2.53*	-2.61*				
Δln$Y_{NZ,t-4}$			2.69**	2.84				
Δln$Y_{i,t}$	-2.14	-1.79	2.18	2.14	2.04*	1.27	2.26**	2.74
ΔlnYi, t_{-1}	-0.14	-0.35*	6.63	6.62	1.97*	-2.17*	1.02	2.13*
ΔlnYi, t_{-2}	3.65*	3.72	-12.69*	-12.68*			-4.64*	-5.81*
ΔlnYi, t_{-3}			3.91	4.03				
ΔlnYi, t_{-4}								
Δln$REX_{i,t}$	0.76*		0.14		0.25		-0.18	
ΔlnREXi t_{-1}								
ΔlnREXi t_{-2}								
ΔlnREXi,t_{-3}								
ΔlnREXi,t_{-4}								
ΔPSC_t		1.21*		0.20		0.59*		0.59
ΔPSC_{t-1}								-1.19
ΔPSC_{t-2}								-1.09
ΔPSC_{t-3}								2.67*
ΔPSC_{t-4}								-0.84
ΔNSC_t		-1.12		0.12		-1.05**		
ΔNSC_{t-1}		0.56				0.88**		-1.04
ΔNSC_{t-2}		1.26						1.11**
ΔNSC_{t-3}								
ΔNSC_{t-4}								
Panel B: Long–Run Estimates								
ln Y_{NZ}	-2.09	-4.29*	-0.88	-1.34	1.02	0.89	2.42	3.94
ln Y_i	2.30*	2.52*	0.04	0.18	0.09	-1.14*	-4.54*	-2.96
ln REX_i	1.28*		0.22		0.32		-0.62	
PSC		1.94*		0.32		0.75*		-0.99**
NSC		1.11*		0.19		-0.22		0.22
Constant	-0.77	3.77	2.55	3.15	-3.44*	2.36	14.64*	3.92
Panel C: Diagnostic Statistics								
F	5.95*	5.55*	8.57*	7.11*	12.78*	11.21*	3.83*	3.52
ECM_{t-1}	-0.59*	-0.63*	-0.62*	-0.62*	-0.78*	-0.78*	-0.29*	-0.31*
LM	0.59	0.87	0.57	0.47	0.88	0.38	0.01	0.56
RESET	1.18	0.001	0.002	0.002	1.88	0.07	0.82	0.27
Adjusted R^2.	0.56	0.58	0.58	0.58	0.86	0.87	0.67	0.69
CS (CS^2)	S(S)	S(S)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)
WALD – S		4.44*		0.004		1.45		0.03
WALD – L		1.98		3.08**		8.69*		0.20

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Notes:

a. T-ratios: numbers inside the parentheses next to coefficient estimates are absolute value, **, * indicate significance at the 10% and 5% levels, respectively.

b. F-Test: upper bound critical value for cointegration when there are three exogenous variables is 3.77 (4.35) at the 10% (5%) level of significance, Pesaran *et al*. (2001, Table CI, Case III, p. 300).

c. $ECM_{t-1:}$ The critical value of significance is -3.47 (-3.82) at the 10% (5%) level when k =3. The comparable figures when k = 4 are -3.67 and -4.03, respectively, Banerjee *et al*. (1998, Table 1).

d. Lagrange Multiplier (LM.) test of residual serial correlation. It is distributed as $\chi 2$ with one degree of freedom (first-order) with critical value at significance level is 2.71(3.84), 5% (10%)

e. RESET: (Ramsey's misspecification test) distributed as χ^2 with 1 degree of freedom. It has a critical value of 3.84 (5%) and 2.70 (10%) levels.
f. Dummy is significant, Global Financial Crisis of 2008, #; Asian Financial Crisis, +; both, &.

g. Wald test is distributed as χ^2 with 1 degree of freedom, i.e., the critical value is 2.71(3.84) at 10% (5%) significance.

Based on the short-run real bilateral exchange rates (Panel A-REX), Canada, China, Hong Kong, Indonesia, South Korea, Malaysia, and Singapore with at least the lagged coefficient is significant. Compared to the asymmetric approach, in non-linear models (NL-models), either ΔPSCor ΔNSChaveat least one significant lag coefficient except for Japan and Switzerland. By shifting to anon-linear model, the number of cases increases to 11 compared to 7 in the linear model. Majority of these cases, the estimated coefficient ΔNSC is different from ΔPSC, supporting short-run asymmetric effects of appreciation versus depreciation. However, their sum is not different since the Wald test reported in Panel C as Wald-S is insignificant in all models except Singapore. In addition, there is the support of short-run adjustment asymmetry in the cases of Australia, Canada, China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, Thailand, and the USA since all these models have different lag orders.

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Long-run estimates for the linear model, Panel B, however, only in the cases of Australia, China, Hong Kong, Indonesia, South Korea, and Singapore confirms the definition of J-curve by Rose and Yellen (1989)[9]. In addition, Panel C shows that the F test for all linear models is significant.[10] Moving to the asymmetric approach, coefficient estimates in Panel B reveal that either the PSC or the NSC variable carries a significant coefficient supported by the cointegration test in Australia, Canada, China, Hong Kong, South Korea, Singapore, Thailand, and the USA. Nevertheless, Hong Kong, South Korea, Singapore, Thailand, and the USA depreciation of the N.Z. dollar improve the trade balance, and appreciation worsens it. Furthermore, in the cases of asymmetric manner are China, Hong Kong, Indonesia, and Switzerland. In these models, the Wald test reported as Wald -L, panel C, is significant, which corroborates the asymmetric definition of J-curve by Bahmani-Oskooee and Fariditavana (2016).

As for the long-run effects of income variables, New Zealand's income is positive and significant in two linear models compared to four non-linear models. The negative results from Malaysia and Singapore suggest that New Zealand's economy grows fewer imports from these two countries.[11] Most of New Zealand's trading partners' income models carry significant negative coefficients.

In Panel C, examine the diagnostic statistics for all models. All Lagrange Multiplier statistics (L.M.) show no evidence of serial correlation. In addition, Ramsey's RESET test proves that most of these models are correctly specified. To determine the stability of all estimated coefficients, CUSUM and CUSUMSQ tests identified as C.S. and CS^2 in Panel C. Identifying stable estimates by "S" and unstable estimates by "U.S." Overall, most estimates are stable. Finally, the adjusted R^2 shows that most models are considered a good fit.

IV. Summary and Conclusion

Policymakers and economists emphasize the outcomes of trade balance from currency depreciation or appreciations. Studies between exchange rates and trade balance have progressed over time. Early studies are more focused on aggregate trade data, and overtime it has evolved towards bilateral data. However, both approaches still lead to an aggregation bias. One of the dissenting opinions is that these studies assume the effects of exchange rate changes to be linear or symmetric. The non-linear exchange rate adjustment offers more support for the J-curve effect.

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[9] Definition introduced by Rose and Yellen (1981) is observing insignificant short-run effects followed by significant and positive long-run effects of REX. Alternatively, generic established definition of the J-curve was determined on negative or insignificant effects of real exchange rate (REX) changes at lower lags followed by positive effects at higher lags. This evidence in the case of China.

[10] Pesaran et al. (2001) upper bound matches Banerjee et al. (1998) values for large sample. Due to a smaller sample, this study will use Banerjee et al. (1998) values.

[11] As explained by Bahmani-Oskooee, (1986), this may possibly be due to an increase in production of import substitute goods.

Countries choose different exchange rate regimes to gain a trade balance advantage. In the case of the New Zealand dollar (NZD), as evidenced in figure 1, its trend shows a continuous depreciation since 2000. Does this trend provide an added advantage towards its trade balance?

This paper evaluates New Zealand's trade balance with 13 of her trading partners using quarterly data with China and Australia are the most significant trading partners. Indeed, depreciation of NZD influences New Zealand's improvement of trade balances both short run and long run. Evidence shows that both approaches, linear and non-linear models, support the J-curve effects. In addition, the short-run effects of exchange rate changes are asymmetric in all models and lasted into the long-run significant asymmetric effects in the cases of China, Hong Kong, Indonesia, and Switzerland, implying that with these partners long-run effects NZD either by appreciation or depreciation, nonetheless these findings are partners' specific. Exchange rate depreciation is helpful since its domestic growth is supported by tourism and solid population growth, construction activity, and accommodative monetary policy. The depreciation of the New Zealand dollar is expected to insulate the domestic economy from the weaker world outlook by supporting exporters and encouraging substitution towards domestically produced goods and services as evidence, in the case, of Malaysia and Singapore.

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