Asian Economic and Financial Review
ISSN(e): 2222-6737
ISSN(p): 2305-2147
DOI: 10.18488/journal.aefr.2017.710.959.971
Vol. 7, No. 10, 959-971

URL: www.aessweb.com

TWIN DEFICITS OR RICARDIAN EQUIVALENCE? EMPIRICAL EVIDENCE IN THE APEC COUNTRIES

Cosimo Magazzino[1]

[1]*Department of Political Sciences, Roma Tre University, Via G. Chiabrera 199, Rome (RM), Italy Italian Economic Association (SIE); Royal Economic Society (RES), Italy*

Article History
Received: 13 June 2017
Revised: 24 July 2017
Accepted: 10 August 2017
Published: 15 August 2017

Keywords
Twin deficits
Ricardian equivalence
Trade balance
Public deficit
APEC
Panel data.

JEL Classification
B22; C33; N55; Q48.

ABSTRACT

The paper analyses the relationship between trade balance and government budget for the APEC countries over the 1980-2013 years. Using a panel data techniques, a 2-variable VAR is estimated. Empirical findings show that for the whole APEC members as well as for the ASEAN sub-sample a bi-directional causality is discovered, while for the American sub-sample the Neo-classical view holds. Moreover, the forecast errors decompositions seem confirm this analysis. Cointegration tests reveal the existence of a long-run relationship between these two variables, with most of the coefficients close to 1, although several ASEAN countries represent exceptions. Finally, causality analyses show that ten countries exhibit the absence of any causal relationship, in line with neutrality Ricardian hypothesis.

Contribution/ Originality: This study contributes in the existing literature on the relationship between current account balance and public budget. It is one of very few studies that have investigated the "twin deficits" phenomenon in the case of APEC countries.

1. INTRODUCTION

The Asia-Pacific Economic Cooperation (APEC) is an association of 22 economies bordering the Pacific Ocean who are working cooperatively to reduce barriers to trade and investment; ease the exchange of goods, services, resources, and technical know-how; and strengthen economic and technical cooperation. The APEC' members account for approximately 40 percent of the world's population, approximately 55 percent of world GDP, and about 44 percent of world trade. These countries have declared their intention to establish free trade and investment in the region by the year 2010 for industrialized members and 2020 for the others.

Within the strategic goal of the APEC, we found policies for sustainable and broad-based development with equity; macroeconomic stability; prudent public finance management (Ramstetter, 2000).

In this study, the relationship between current account balance and public budget in 22 APEC countries is explored for the 1980-2013 years, using several panel data methodologies. The results should help to define and implement the appropriate trade and budgetary policies in these countries. Moreover, it is interesting to note that this issue has not been investigated for most of the APEC countries, both in time series and panel data studies.

The twin deficit hypothesis, hereafter the TDH, argues that fiscal deficits lead to current account deficits. On the other hand, according to the Ricardian equivalence hypothesis (REH), there is no link between the fiscal deficit and the current account deficit, because holding constant the real interest rate, any decrease in taxes determines a decrease in present consumption, which increases private savings.

Besides the Introduction, the remainder of the paper is organized as follows. Section 2 gives a brief survey of the literature. Section 3 contains an overview of the econometric methodology and a brief discussion of the data used. Section 4 discusses the results. Section 5 presents some concluding remarks and, finally, Section 6 gives suggestions for future researches.

2. LITERATURE REVIEW

As clarified in Kim and Kim (2006) four possible causation linkages may be present between budget deficits and current account imbalances:

1. the Keynesian (or conventional) view, based on Mundell (1968) and Fleming (1962) model, with a chronic budget deficit that generates a trade deficit; here, a causality flow running from budget balance to trade balance is postulated;
2. the Neo-classical view, if, in contrast to the previous case, chronic and excessive current account deficit may lead to budget deficit, in order to strengthen the recovery; thus, causality runs from trade balance to government budget;
3. the Ricardian (or neutrality) view, which assume the absence of any causal relationship between trade and budget deficits;
4. and, finally, the bi-directional hypothesis, according to which, while budget deficit may cause current account deficit, the existence of significant feedback may cause causality between the two variables to run in both directions.

Interestingly, to our knowledge there is no paper that have analyzed the relationship between trade balance and government budget in the context of APEC members.

Furthermore, we try to sum up some relevant empirical results reached by previous studies in Table 1.

As regards empirical studies on the APEC countries, for panel data analyses (Lau and Baharumshah, 2006) studying a panel of SEACEN countries, provided evidence to support the view that Asian budget deficit causes current account deficit directly as well as indirectly. Jayaraman *et al.* (2010) studied the Pacific Island countries and found evidence in support of the twin deficits hypothesis in terms of their short-and long-run relationship. The empirical results in Aristovnik and Djurić (2010) suggest that budget deficits in the EU member states and candidate countries have generally signaled relatively high level of substitutability between private and public savings, implying a relatively low correlation between fiscal and external imbalances.

Table-1. Results of existing literature on trade balance and net lending for Southeast Asian countries

Author(s)	*APEC countries*	*Time period*	*Causality*
Kearney and Fallick (1987)	Australia, Canada, Japan, USA (A)	1957-1985	-
Bernheim (1988)	Canada, Mexico, Japan, USA (A)	1960-1984	NL→CAB: Canada, Mexico, USA Neutrality: Japan
Karunaratne (1992)	Australia	1983-1991	NL→CAB
Anoruo and Ramchander (1998)	Indonesia, Korea, Malaysia, the Philippines (A)	1957-1993	CAB↔NL: Malaysia CAB→NL: Indonesia, Korea, the Philippines
Khalid and Guan (1999)	Australia, Canada, Indonesia, Mexico, USA (A)	1950-1994	CAB→NL: Indonesia NL→CAB: Canada, Mexico, USA Neutrality: Australia
Chang (2004)	Taiwan (A)	1967-2002	NL→CAB
Baharumshah *et al.* (2006)	Indonesia, Malaysia, the Philippines, Thailand (Q)	1976-2000	CAB↔NL: Malaysia, the Philippines CAB→NL: Indonesia NL→CAB: Thailand
Kim and Kim (2006)	Korea (A)	1970-2003	CAB→NL
Lau and Baharumshah (2006)	Indonesia, Korea, Malaysia, Singapore, the Philippines, Thailand (A)	1980-2001	CAB↔NL: Indonesia, Malaysia, the Philippines, Thailand CAB→NL: Myanmar NL→CAB: Korea, Singapore
Salvatore (2006)	Canada, Japan, USA (A)	1973-2005	-
Baharumshah and Lau (2007)	Thailand (Q)	1976-2000	NL→CAB
Pahlavani and Saleh (2009)	the Philippines (A)	1970-2005	CAB↔NL
Baharumshah and Lau (2009)	Indonesia, Japan, Korea, Malaysia, Singapore, the Philippines, Thailand (Q)	1980-2004	CAB↔NL: Malaysia NL→CAB: Indonesia, Korea, the Philippines, Thailand Neutrality: Japan, Singapore
Lau and Tang (2009)	Cambodia (Q)	1996-2006	CAB↔NL
Lau *et al.* (2010)	Indonesia, Korea, Malaysia, the Philippines, Thailand (Q)	1976-2008	CAB↔NL: the Philippines CAB→NL: Indonesia, Korea NL→CAB: Malaysia, Thailand
Mohammadi and Moshrefi (2012)	Korea, Malaysia, Singapore, Thailand (Q)	1975-2008	-
Makin and Narayan (2013)	Australia (Q)	1983-2009	-
Saysombath and Kyophilavong (2013)	Lao PDR (A)	1980-2010	CAB↔NL
Sobrino (2013)	Peru (Q)	1980-2012	CAB→NL

Notes: → indicates unidirectional causality, while ↔ implies bidirectional causality. (A): annual data; (Q): quarterly data.

Sources: our elaborations.

With regard to time-series analyses, in the early Nineties, the twin deficits hypothesis received much empirical support (Abell, 1990; Zietz and Pemberton, 1990; Rosenswieg and Tallman, 1993). More recently, Kim and Roubini (2008) U.S. results suggest that an expansionary fiscal policy shock, or a government budget deficit shock, improve the current account and depreciate the real exchange rate. Increases in private savings and declines in investment contribute to the current account improvement while a nominal exchange rate depreciation, as opposed to a relative price level change, is mainly responsible for the real exchange rate depreciation. Kulkarni and Erickson (2011) found that in case of Mexico there is no evidence of twin deficits, since there was no evidence of causality running in either direction. In case of India, there was a strong evidence in favor of the twin deficits hypothesis. While for Pakistan, an evidence of a unidirectional causality running from trade deficits to budget deficits emerges. Makin and Narayan (2013) empirical estimation on Australia show that fiscal external imbalances are closely enough related on

the basis of quarterly data to pass as twins. The evidence in Sobrino (2013) on Peru showed that current account causes fiscal account. In the short run, the fiscal policy has no effect on current account, but improvements in current account increase the probability of attaining a lower bounded fiscal deficit.

3. METHODOLOGY AND DATA

Our empirical strategy uses a panel-data Vector AutoRegression methodology. This technique combines the traditional VAR approach, which treats all the variables in the system as endogenous, with the panel data approach, which allows for unobserved individual heterogeneity. Here, we follow a similar strategy of Magazzino (2014).

The impulse-response functions describe the reaction of one variable to the innovations in another variable in the system, while holding all other shocks equal to zero. The identifying assumption is that the variables that come earlier in the ordering affect the following variables contemporaneously, as well as with a lag, while the variables that come later affect the previous variables only with a lag. In other words, the variables that appear earlier in the systems are more exogenous and the ones that appear later are more endogenous.

To avoid the problem of correlation between fixed effects and regressors, we use forward mean-differencing, also referred to as the Helmert procedure (Holtz Eakin *et al.*, 1988; Arellano and Bover, 1995) which removes only the forward mean. The coefficients are estimated by System Generalized Method of Moments (GMM-Sys) (Blundell and Bond, 1998). Our model also allows for country-specific time dummies, d_a, which are added to model *(1)* in order to capture aggregate, country-specific macro shocks that may affect all firms in the same way. These dummies have been dropped by subtracting the means of each variable calculated for each country-year. In addition, calculate standard errors of the impulse-response functions (IRFs) and confidence intervals (CIs) have been calculated through Monte Carlo (MC) simulations (Love and Zicchino, 2006).

Then, we also present variance decompositions, which show the percent of the variation in one variable that is explained by the shock to another variable, accumulated over time. The variance decompositions show the magnitude of the total effect. We report the total effect accumulated over 10 years, as longer time horizons produced equivalent results.

We test for cointegration among the *I(1)* variables using two tests. The first test we show is due to Westerlund (2007). As for these tests, the G_a and G_t statistics test H_0: $a_i=0$ for all i versus H_1: $a_i<0$ for at least one i. While the P_a and P_t test statistics pool information over all the cross-sectional units to test H_0: $a_i=0$ for all i against the alternative $a_i<0$ for all i. The test developed by Pedroni (2004) provided seven test statistics that can be used to test the null of no cointegration in the multivariate case. These test statistics are grouped into two categories: "group mean" statistics that average the results of individual country test statistics, and "panel" statistics that pool the statistics along the within-dimension. Within both groups, Pedroni develops test statistics that are non-parametric (*rho* and *pp*) and parametric (ADF, as well as panel *v*) (Neal, 2014).

Finally, causality analysis is conducted for each country in our panel. Granger causality tests (Granger, 1969) are statistical tests of causality in the sense of determining whether lagged observations of another variable have incremental forecasting power when added to a univariate autoregressive representation of a variable. X_t is Granger causal for y_t if x_t helps predict y_t at some stage in the future. It should be noticed, however, that Granger causality is not causality in a deep sense of the word. It just talks about linear prediction, and it only has "teeth" if one thing happens before another.

Table 2. Exploratory data analyses

Country	Variable	Mean	Median	Variance	Skewness	Kurtosis	Inter-Quartile Range
Australia	CAB	-4.2632	-4.4415	1.2461	0.1566	2.1609	1.862
	NL	-0.6350	0.1740	5.4890	-0.4859	1.7898	3.759
Brunei	CAB	51.5940	47.2890	377.8668	0.7458	2.6337	14.054
	NL	2.7797	3.4350	418.3856	0.1063	2.3378	20.427
Canada	CAB	-1.1959	-1.4515	4.6533	0.3202	1.7044	3.633
	NL	-3.4519	-4.2005	13.6775	0.1181	1.6836	6.831
Chile	CAB	-2.6604	-2.2085	15.9760	-0.6678	3.7107	3.916
	NL	1.2352	0.0980	9.7781	0.7474	3.0530	2.569
China	CAB	2.2834	1.8515	9.2897	0.7064	3.7317	2.617
	NL	-1.8505	-1.9015	0.8800	0.5805	3.8904	1.004
Hong Kong	CAB	4.7190	5.6995	26.1584	-0.4134	2.5109	6.184
	NL	1.3123	1.1120	10.2878	-0.0012	2.9558	3.922
Indonesia	CAB	-0.4661	-0.9635	9.9428	0.0481	2.2743	5.026
	NL	-0.6508	-0.9955	1.9426	0.8114	3.4418	2.001
Japan	CAB	2.5599	2.6980	1.2956	-0.8618	4.5331	1.151
	NL	-4.2554	-4.0020	12.2465	0.0075	2.2186	5.199
Korea	CAB	1.1589	1.5075	14.7027	0.2688	4.1282	4.283
	NL	1.7428	1.6800	1.1339	0.1544	2.7399	1.468
Malaysia	CAB	3.7916	6.4915	93.6473	-0.1591	1.6017	16.519
	NL	-2.2930	-3.1110	6.8638	0.8312	2.6054	3.668
Mexico	CAB	-1.6733	-1.1050	4.8321	-0.0423	3.1379	2.133
	NL	-2.7395	-2.6955	3.4714	-0.1856	1.8798	3.093
New Zealand	CAB	-5.0666	-4.7150	3.9780	-0.2973	2.3873	2.597
	NL	-0.1958	0.6240	10.4408	-0.2457	1.8304	5.422
Papua New Guinea	CAB	-3.4788	-3.4330	141.6671	-0.4966	3.4673	13.921
	NL	-1.2399	-1.4205	19.6881	0.1507	3.0728	5.417
Peru	CAB	-3.4542	-3.5550	9.8222	0.0225	2.2944	4.346
	NL	0.0418	-0.3470	3.2616	0.2821	1.6700	3.41
the Philippines	CAB	-0.6811	-0.4070	11.5807	0.0729	1.9052	5.385
	NL	-1.5812	-1.5215	2.1219	-0.1085	1.6583	2.651
Russia	CAB	5.9061	5.1175	23.0962	0.6286	2.9797	7.309
	NL	1.3693	1.5040	23.7528	-0.3688	2.2669	6.813
Singapore	CAB	11.4089	13.4670	109.8003	-0.7168	2.6568	14.391
	NL	7.8856	7.2800	15.3465	0.0702	2.8956	4.852
Chinese Taipei	CAB	8.4599	8.9025	4.5266	-0.3401	2.2036	2.973
	NL	-2.6375	-2.5000	3.6207	-0.0578	1.9806	3.400
Taiwan	CAB	6.8870	6.8080	22.1048	0.8996	4.2716	5.799
	NL	-3.9950	-3.9845	6.0023	-0.0474	1.9329	4.282
Thailand	CAB	-0.6656	-1.3930	32.5105	0.5022	2.3720	8.840
	NL	-1.4083	-1.6810	11.3908	-0.6334	2.6746	4.675
USA	CAB	-2.7094	-2.7515	2.8807	-0.1187	2.2654	2.324
	NL	-4.9724	-4.7299	8.9478	-0.6403	3.8488	2.325
Vietnam	CAB	-3.6961	-3.3275	15.6882	-0.2878	2.8381	4.324
	NL	-2.1919	-2.1060	3.0991	-1.1383	4.5352	1.673

Notes: SD: Standard Deviation; IQR: Inter-Quartile Range; PSD: Pseudo Standard Deviation.

Sources: our calculations on IMF data.

Here, CAB is current account balance (% of GDP), and NL represents General government net lending/borrowing (% of GDP). The empirical analysis uses yearly data from 1980 to 2013 for 21 APEC countries (Australia, Brunei, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand,

Papua New Guinea, Peru, the Philippines, Russia, Singapore, Chinese Taipei, Taiwan, Thailand, USA, and Vietnam). The data are derived from the IMF *World Economic Outlook Database*[1].

Table 2 gives descriptive statistics for each APEC member state. In general, mean value of trade balance is positive for Asian countries and negative for the American ones. Brunei, with its extraordinary surplus, seems an outlier. As regards the public deficit, Russia is the only big economy of the area with a positive mean value. For both our variables it is observed that 0 < Skewness < 1, the only exception being represented by net lending in Vietnam. While kurtosis is everywhere >1.5 and <4.5.

Correlation analysis reveals that in the whole APEC panel the series are poorly correlated, since the correlation coefficient is equal to 0.2849. Moreover, this correlation increases to 0.4044 for the American member states, while it is equal to 0.3013 for the ASEAN ones. However, all these linear associations are statistically significant at 1% level. For nine countries, a remarkable association is found between these two variables at least at 5% significance level, with Canada as the only state of the American continent. In the bargain, the sign of this correlation is negative for the most of ASEAN countries (Brunei and Taiwan representing the only exceptions).

4. RESULTS

We estimate the coefficients of the system given in *(1)* after the fixed effects and the country-time dummy variables have been removed. In Table 3, we report the results of the model with three variables {CAB, NL}.

Table-3. Main results of a 3-variable VAR model

Whole panel				
Response of	**Response to**			
	CAB (*t*-1)	**NL (*t*-1)**	**CAB (*t*-2)**	**NL (*t*-2)**
CAB (*t*)	0.8358***	-0.1069	-0.0931	0.1546***
	(0.1015)	(0.0766)	(0.0756)	(0.0604)
NL (*t*)	-0.0524	0.6002***	0.2064**	0.1500
	(0.1486)	(0.1947)	(0.0998)	(0.1462)
N obs.	474			
N countries	22			
Panel A (American)				
Response of	**Response to**			
	CAB (*t*-1)	NL (*t*-1)	CAB (*t*-2)	NL (*t*-2)
CAB (*t*)	0.5729***	0.0020	0.0986	0.0804
	(0.1392)	(0.0833)	(0.1194)	(0.0825)
NL (*t*)	0.4761***	1.1771***	0.3633***	-0.4603***
	(0.1352)	(0.1115)	(0.1122)	(0.1118)
N obs.	109			
N countries	5			
Panel B (ASEAN)				
Response of	**Response to**			
	CAB (*t*-1)	NL (*t*-1)	CAB (*t*-2)	NL (*t*-2)
CAB (*t*)	0.9013***	-0.0952	-0.1343	0.1576***
	(0.1238)	(0.0931)	(0.1015)	(0.0582)
NL (*t*)	0.0030	0.5098**	0.3237**	0.2589
	(0.1891)	(0.2387)	(0.1501)	(0.1718)
N obs.	166			
N countries	8			

Notes: Two variable VAR model is estimated by GMM, country-time and fixed effects are removed prior to estimation. Reported numbers show the coefficients of regressing the row variables on two lags of the column variables. Heteroskedasticity adjusted Standard Errors are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

[1] http://www.imf.org/external/pubs/ft/weo/2012/01/weodata/index.aspx.

We discuss general results of the 2-variable VAR model first, before proceeding to the ones of variance decompositions. For the whole APEC countries, we observe that the response of current account to public budget is positive in the estimated coefficients and impulse responses. This is reasonable, insomuch as a deterioration of budget balance generates new aggregate demand and, thus, new imports. The coefficient of *CAB* one period lagged (*t-1*) is statistically significant in its own equation, showing that this variable is influenced by its past. Moreover, current account balance has a positive effect on net lending (both in the estimated coefficients and in impulse responses). In addition, this result is in line with theoretical explanations, since a decrease of trade balance provokes a lower GDP and a reduced taxable income, which generates a decrease in public revenues. Therefore, for both the whole panel and the sub-sample consisting of ASEAN members we find empirical support for feedback hypothesis (since a bi-directional causality emerges). On the other hand, for the sub-sample of American countries, our results are in line with the Neo-classical view, given the fact that we assist to a causality flow running from trade balance to public budget.

Table-4. Variance decompositions

Variable	**CAB**	**NL**
Whole panel (10 periods ahead)		
CAB	0.9073	0.0927
NL	0.2407	0.7593
Variable	**CAB**	**NL**
American (10 periods ahead)		
CAB	0.9448	0.0552
NL	0.1512	0.8488
Variable	**CAB**	**NL**
ASEAN (10 periods ahead)		
CAB	0.9292	0.0708
NL	0.2923	0.7077

Notes: Percent of variation in the row variable explained by column variable.

The variance decompositions for our panel presented in Table 4 are in line with previous findings. In fact, the trade balance explains nearby 24% of variation of budget balance 10 periods ahead (in an increasing way). Moreover, this effect is more pronounced for the ASEAN members (29%). While the variance decomposition of the current account balance is mainly due to its own variation, since after 10 periods ahead only 6-9% of its variability is explained by government budget.

A standard assumption in panel data models is that the error terms are independent across cross-sections. Empirical results in Table 5 show that, at 1% significance level, the null hypothesis of cross-sectional independence in our panel may not be maintained for both series (*CAB* and *NL*).

Table-5. Panel cross-section dependence tests.

	1		**2**		**3**	
Area	**CAB**	**NL**	**CAB**	**NL**	**CAB**	**NL**
APEC	3.052*** (0.0023)	24.788*** (0.0000)	10.831 (0.9660)	90.902*** (0.0000)	6.28*** (0.0000)	19.06*** (0.0000)

Notes: 1. Pesaran (2004) cross-sectional dependence in panel data models test; 2: Friedman (1937) test for cross-sectional dependence by using Friedman's χ^2 distributed statistic; 3: Pesaran (2004) CD test for cross-section dependence in panel time-series data. P-Values in parentheses. Tests include the intercept. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Table 5 shows the results of panel cross-section dependence tests. In general, *CAB* appears to be non-stationary (*I(1)*) everywhere, especially in the specification without trend (the more reliable). Similar conclusions could be derived for net lending.

To eliminate the cross-dependence, the standard DF (or ADF) regressions are augmented with the cross-section averages of lagged levels and first-differences of the individual series (CADF statistics). Here, when cross-dependence problem is taken into account, both current account and net lending series are integrated of order 1 in our sample. In fact, the null hypothesis that all series are non-stationary largely holds.

Table-6. Panel unit root test in presence of cross section dependence tests

Pesaran's CADF test				
Area	**CAB**		**NL**	
	Constant	**Constant and trend**	**Constant**	**Constant and trend**
APEC	-0.876 (0.190)	2.498 (0.994)	0.368 (0.643)	1.822 (0.966)

Notes: *Z-t*-bar or *t*-bar statistics and, in parentheses, P-Values.

The panel cointegration tests point to the existence of a long-run relationship between current account balance and net lending. Here, the null of absence of cointegration is clearly rejected by Westerlund (2007) tests, at 1 per cent level (see Table 7). Thus, panel data cointegration findings reveal the existence of a long-run relationship between current account and budget balance in the APEC countries.

Table-7. Panel cointegration tests.

Westerlund's tests					
Area	**Group statistics and Panel statistics**	**Constant**		**Constant and trend**	
		Value	**P-Value**	**Value**	**P-Value**
APEC	Gt	-4.882	0.000	-7.083	0.000
	Ga	-9.981	0.008	-15.699	0.004
	Pt	-8.539	0.055	-18.273	0.000
	Pa	-5.795	0.071	-16.272	0.000
Pedroni's tests					
Test statistics		Panel (within dimension)		Group (between dimension)	
v		2.38		.	
rho		-3.334		-1.366	
t		-3.766		-3.524	
adf		-4.152		-4.016	

Notes: P-Values at the 5% significance level in parentheses. Panel cointegration tests include intercept.

As regards the Pedroni's panel cointegration tests, the results overall indicate a cointegrating relationship between our two variables. Statistical inference is straightforward because all the test statistics are distributed $N(0,1)$. All test statistics are at least significant at the 10 per cent level, with the more trustworthy panel and group ADF test statistics being rejected at the 1 per cent significance level. Therefore, the PDOLS results support the long-run hypothesis. Emulating Pedroni (2004) original use of the program for this empirical application, we set the number of lags and leads in the DOLS regression to 4, and the number of lags used in the Bartlett kernel for the Newey and West (1994) long-run variance of the residuals to 4. No common time dummies were used for the individual country results. Most of the coefficients are close to 1, but some are notably higher or lower. Interestingly, this is the case for several ASEAN countries (Table 8).

Table-8. Individual DOLS results.

Country	β	t	Country	β	t
Australia	-0.151	-12.94	New Zealand	-0.042	-11.210
Brunei	0.481	-3.089	Papua New Guinea	-0.126	-3.009
Canada	0.647	-6.307	Peru	0.000	0.000
Chile	0.955	-0.368	Russia	0.302	0.000
China	1.835	0.538	the Philippines	4.537	2.138
Hong Kong	-0.549	-2.655	Singapore	-0.167	-1.618
Indonesia	-5.648	-2.728	Taiwan	2.394	4.042
Japan	-0.145	-22.36	Chinese Taipei	0.000	0.000
Korea	1.731	0.4264	Thailand	-0.425	-3.961
Malaysia	-5.233	-22.27	USA	-0.230	-7.212
Mexico	1.280	1.504	Vietnam	14.820	7.008

Notes: P-Values at the 5% significance level in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$. Bonferroni's correction applied.

In Table 9, we show the results for causality tests. We perform Granger causality tests to investigate whether lagged values of trade balance help in forecasting government budget, and vice versa.

Table-9. Results for Granger causality tests

Country	Granger causality	χ^2	P-Value	Country	Granger causality	χ^2	P-Value
Australia	CAB→NL NL→CAB	10.63 4.34	0.0049*** 0.1142	New Zealand	CAB→NL NL→CAB	3.24 3.52	0.1984 0.1724
Brunei	CAB→NL NL→CAB	4.33 4.56	0.1149 0.1024	Papua New Guinea	CAB→NL NL→CAB	2.14 2.26	0.3433 0.3227
Canada	CAB→NL NL→CAB	3.51 6.53	0.1725 0.0382**	Peru	CAB→NL NL→CAB	19.48 2.10	0.0001*** 0.3506
Chile	CAB→NL NL→CAB	33.27 0.24	0.0000*** 0.8849	Russia	CAB→NL NL→CAB	0.43 0.94	0.8052 0.6236
China	CAB→NL NL→CAB	1.74 1.21	0.4190 0.5457	the Philippines	CAB→NL NL→CAB	2.43 0.76	0.2963 0.6843
Hong Kong	CAB→NL NL→CAB	0.45 0.54	0.7989 0.7638	Singapore	CAB→NL NL→CAB	4.84 2.71	0.0890* 0.2579
Indonesia	CAB→NL NL→CAB	14.35 2.37	0.0008*** 0.3062	Taiwan	CAB→NL NL→CAB	19.63 6.40	0.0001*** 0.0407**
Japan	CAB→NL NL→CAB	0.87 0.44	0.6469 0.8041	Chinese Taipei	CAB→NL NL→CAB	43.56 10.61	0.0000*** 0.0050***
Korea	CAB→NL NL→CAB	11.23 0.26	0.0036*** 0.8789	Thailand	CAB→NL NL→CAB	2.01 3.59	0.3661 0.1661
Malaysia	CAB→NL NL→CAB	12.83 1.47	0.0016*** 0.4785	USA	CAB→NL NL→CAB	2.72 1.21	0.2564 0.5457
Mexico	CAB→NL NL→CAB	1.58 3.30	0.4530 0.1920	Vietnam	CAB→NL NL→CAB	1.18 0.70	0.5554 0.7050

Notes: 5% P-Values. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Empirical findings listed in Table 9 suggest a bidirectional flow (with a feedback mechanism) for Taiwan and Chinese Taipei. The Neoclassical view (if causality runs from current account to budget balance) holds for Australia, Chile, Indonesia, Korea, Malaysia, Peru, and Singapore. On the other hand, only Canada shows a unidirectional causality running from net lending to current account, in line with the Twin Deficits Keynesian (or conventional) view. Finally, ten countries exhibit the absence of any causal relationship (neutrality Ricardian hypothesis). These results confirm the predominance of the Ricardian hypothesis in the APEC area. In general, the results are in line with those in Masih and Masih (1996) and Soytas and Sari (2003).

5. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, we have analyzed the nexus between trade balance and budget balance in 22 APEC countries over the period 1980-2013. Correlation analyses showed low linear association, both in the whole panel and in the two sub-samples (consisting, respectively, of American and ASEAN countries). The empirical strategy uses a panel VAR approach: the 2-variable VAR estimates underline that for both the whole panel and the ASEAN groups the feedback hypothesis holds (since a bi-directional causality emerges). While for the American countries sub-sample, only trade balance lags are statistically significant in explaining budget balance dynamics, in line with the Neo-classical view. The forecast errors variance decompositions analyses showed that trade balance variance is mainly due to uncertainty in *CAB* itself (at least in this variables' ordering). The error variance in the budget balance is sensible to disturbances in the current account equation. Thus, for the estimated sample, these results reinforced the VAR and IRFs analyses. Moreover, this effect is more pronounced for the ASEAN members. Furthermore, panel data cointegration findings revealed the existence of a long-run relationship between current account and budget balance in the APEC countries. Finally, Granger causality tests suggest a bidirectional flow for Taiwan and Chinese Taipei; a unidirectional flow running from current account to budget balance (the Neoclassical view) for Australia, Chile, Indonesia, Korea, Malaysia, Peru, and Singapore; a unidirectional causality flow running from net lending to current account (Twin Deficits Keynesian view) for Canada; and, finally, no causal link (neutrality Ricardian hypothesis) in ten countries. Therefore, these results confirm the predominance of the Ricardian hypothesis in the APEC area.

6. SUGGESTIONS FOR FUTURE RESEARCHES

Given the little amount of studies devoted to the analysis of the nexus current account balance and public deficit for the APEC countries, new studies might concern the estimation of an empirical model that captures the essential features of both TD and RE theories, as in Mohammadi (2004); Bartolini and Lahiri (2006); Magazzino (2012) and Forte and Magazzino (2013).

Appendix

Table-A. Correlation between current account and net lending.

Country	Adjusted correlation coefficient	Country	Adjusted correlation coefficient
Australia	-0.5518*** (0.0035)	New Zealand	-0.2954 (0.1197)
Brunei	0.3892** (0.0369)	Papua New Guinea	0.0668 (0.7564)
Canada	0.7023*** (0.7321)	Peru	0.2163 (0.4576)
Chile	0.3583 (0.1443)	Russia	0.4785* (0.0608)
China	0.3605** (0.0426)	the Philippines	-0.0815 (0.7328)
Hong Kong	-0.0666 (0.7626)	Singapore	-0.3534* (0.0902)
Indonesia	-0.7975*** (0.0000)	Taiwan	0.3714** (0.0306)
Japan	0.0112 (0.9497)	Chinese Taipei	-0.7859** (0.0208)
Korea	0.2100 (0.2333)	Thailand	-0.6941*** (0.0010)
Malaysia	-0.6891*** (0.0002)	USA	-0.0165 (0.9262)
Mexico	-0.3867* (0.0620)	Vietnam	0.0353 (0.8827)

Notes: P-Values at the 5% significance level in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$. Bonferroni's correction applied.

Funding: This study received no specific financial support.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

REFERENCES

Abell, J.D., 1990. Twin deficits during the 1980s: An empirical investigation. Journal of Macroeconomics, 12(1): 81-96. *View at Google Scholar | View at Publisher*

Anoruo, E. and S. Ramchander, 1998. Current account and fiscal deficits: Evidence from five developing economies of Asia. Journal of Asian Economics, 9(3): 487-501. *View at Google Scholar | View at Publisher*

Arellano, M. and O. Bover, 1995. Another look at the instrumental variable estimation of error component models. Journal of Econometrics, 68(1): 29-51. *View at Google Scholar | View at Publisher*

Aristovnik, A. and S. Djurić, 2010. Twin deficits and the Feldstein-Horioka puzzle: A comparison of the EU member states and candidate countries. MPRA Paper, No. 24149.

Baharumshah, A.Z., M. Khalid and E. Lau, 2006. Testing twin deficits hypothesis using VARs and variance decomposition. Journal of the Asia Pacific Economy, 11(3): 331-354. *View at Google Scholar | View at Publisher*

Baharumshah, A.Z. and E. Lau, 2007. Dynamics of fiscal and current account deficits in Thailand: Empirical investigation. Journal of Economic Studies, 34(6): 454-475. *View at Google Scholar | View at Publisher*

Baharumshah, A.Z. and E. Lau, 2009. Structural breaks and the twin deficits hypothesis: Evidence from East Asian countries. Economics Bulletin, 29(4): 2517-2524. *View at Google Scholar*

Bartolini, L. and A. Lahiri, 2006. Twin deficits, twenty years later. Current Issues in Economics and Finance, 12(7): 1-7. *View at Google Scholar*

Bernheim, B.D., 1988. Budget deficit and balance of trade, in Brown, J.R., (Ed.), Tax policy and the economy. Cambridge: MIT Press. pp: 1-31.

Blundell, R. and S. Bond, 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1): 115-143. *View at Google Scholar | View at Publisher*

Chang, H.C., 2004. Budget balance and trade balance: Kin or Strangers. A case study of Taiwan. Oxford Journal: An International Journal of Business & Economics, 2(1): 75-81.

Fleming, J.M., 1962. Domestic financial policies under fixed and under floating exchange rates. International Monetary Fund Staff Papers, 9(3): 369-379. *View at Google Scholar*

Forte, F. and C. Magazzino, 2013. Twin deficits in the European countries. International Advances in Economic Research, 19(3): 289-310. *View at Google Scholar | View at Publisher*

Friedman, M., 1937. The use of ranks to avoid the assumption of normality implicit in the analysis of variance. Journal of the American Statistical Association, 32(200): 675-701. *View at Google Scholar | View at Publisher*

Granger, C.W.J., 1969. Investigating causal relations by econometric models and cross-spectral methods. Econometrica, 37(3): 424-438. *View at Google Scholar | View at Publisher*

Holtz Eakin, D., W. Newey and H. Rosen, 1988. Estimating vector autoregression with panel data. Econometrica, 56(6): 1371-1395. *View at Google Scholar | View at Publisher*

Jayaraman, T.K., C.K. Choong and S.H. Law, 2010. Testing the validity of twin deficit hypothesis in pacific Island countries: An empirical investigation. Economics Bulletin, 30(2): 1233-1248. *View at Google Scholar*

Karunaratne, N.D., 1992. The twin deficits hypothesis in the Australian context. Economia Internazionale, 45(3/4): 330-350.

Kearney, C. and L. Fallick, 1987. Macroeconomic policy and the balance of payments in Australia. Economic Analysis and Policy, 17(2): 131-148. *View at Google Scholar*

Khalid, A.M. and T.W. Guan, 1999. Causality tests of budget and current account deficits: Cross-country comparisons. Empirical Economics, 24(3): 389-402. *View at Google Scholar | View at Publisher*

Kim, C.H. and D. Kim, 2006. Does Korea have twin deficits? Applied Economics Letters, 13(10): 675-680. *View at Google Scholar | View at Publisher*

Kim, S. and N. Roubini, 2008. Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the U.S. Journal of International Economics, 74(3): 362-383. *View at Google Scholar | View at Publisher*

Kulkarni, K.G. and E.L. Erickson, 2011. Twin deficit revisited: Evidence from India, Pakistan and Mexico. Journal of Applied Business Research, 17(2): 97-104. View at Google Scholar | View at Publisher

Lau, E. and A.Z. Baharumshah, 2006. Twin deficits hypothesis in SEACEN countries: A panel data analysis of relationships between public budget and current account deficits. Applied Econometrics and International Development, 6(2): 213-226.

Lau, E., S.A. Mansor and C.H. Puah, 2010. Revival of the twin deficits in Asian crisis affected countries. Economic Issues, 15(1): 29-53. View at Google Scholar

Lau, E. and T.C. Tang, 2009. Twin deficits in Cambodia: Are there reasons for concern? An empirical study. Monash University Department of Economics Discussion Paper, 11/09.

Love, I. and L. Zicchino, 2006. Financial development and dynamic investment behavior: Evidence from panel VAR. Quarterly Review of Economics and Finance, 46(2): 190-210. View at Google Scholar | View at Publisher

Magazzino, C., 2012. Fiscal policy, consumption and current account in the European countries. Economics Bulletin, 32(2): 1330-1344. View at Google Scholar

Magazzino, C., 2014. The relationship between revenue and expenditure in the ASEAN countries. East Asia, 31(3): 203-221. View at Google Scholar | View at Publisher

Makin, A.J. and P.K. Narayan, 2013. Re-examining the "twin deficits" hypothesis: Evidence from Australia. Empirical Economics, 45: 817-829. View at Publisher

Masih, A.M.M. and R. Masih, 1996. Electricity consumption, real income and temporal causality: Results from a multicountry study based on cointegration and error correction modeling techniques. Energy Economics, 18(3): 165-183. View at Google Scholar | View at Publisher

Mohammadi, H., 2004. Budget deficits and the current account balance: New evidence from panel data. Journal of Economics and Finance, 28(1): 39-45. View at Google Scholar | View at Publisher

Mohammadi, H. and G. Moshrefi, 2012. Fiscal policy and the current account new evidence from four East Asian countries. Applied Economics Letters, 19(2): 167-173. View at Google Scholar | View at Publisher

Mundell, R.A., 1968. International economics. New York: Macmillan.

Neal, T., 2014. Panel cointegration analysis with xtpedroni. Stata Journal, 14(3): 684-692. View at Google Scholar

Newey, W.K. and K.D. West, 1994. Automatic lag selection in covariance matrix estimation. Review of Economic Studies, 61(4): 631-653. View at Google Scholar | View at Publisher

Pahlavani, M. and A.S. Saleh, 2009. Budget deficits and current account deficits in the Philippines: A casual relationship? American Journal of Applied Sciences, 6(8): 1515-1520. View at Google Scholar

Pedroni, P., 2004. Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. Econometric Theory, 20(3): 597-625. View at Google Scholar | View at Publisher

Pesaran, M.H., 2004. General diagnostic tests for cross section dependence in panels. CESifo Working Paper Series, 1229.

Ramstetter, E.D., 2000. Recent trends in foreign direct investment in Asia: The aftermath of the crisis to late 1999. ICSEAD Working Paper, No. 2000-02.

Rosenswieg, J.A. and E.W. Tallman, 1993. Fiscal policy and trade adjustment: Are the deficits really Twins? Economic Inquiry, 31(4): 580-589. View at Google Scholar | View at Publisher

Salvatore, D., 2006. Twin deficits in the G-7 Countries and Global Structural Imbalances. Journal of Policy Modeling, 28(6): 701-712. View at Google Scholar | View at Publisher

Saysombath, P. and P. Kyophilavong, 2013. Twin deficits in the lao PDR: An empirical study. International Business and Management, 7(1): 62-68. View at Google Scholar

Sobrino, C.R., 2013. The twin deficits hypothesis and reverse causality: A short-run analysis of Peru. Journal of Economics, Finance and Administrative Sciences, 18(34): 9-15. View at Google Scholar | View at Publisher

Soytas, U. and R. Sari, 2003. Energy consumption and GDP: Causality relationship in G-7 countries and emerging markets. Energy Economics, 25(1): 33-37. View at Google Scholar | View at Publisher

Westerlund, J., 2007. Testing for error correction in panel data. Oxford Bulletin of Eco-nomics and Statistics, 69(6): 709-748. *View at Google Scholar* | *View at Publisher*

Zietz, J. and D.K. Pemberton, 1990. The US budget and trade deficits: A simultaneous equation model. Southern Economics Journal, 57(1): 23-34. *View at Google Scholar* | *View at Publisher*