Pacific Island Countries in a Globalized World: A Study of Macroeconomic Interdependence and Regional Integration

T K Jayaraman and Chee-Keong Choong

In the context of globalization and development, and in particular the complex interactions between them, the Pacific Island Countries (PICs), once considered remote and untouched by sophisticated financial sector instruments, are now deeply affected by the second and third waves of the world-wide recession following the financial and banking crises in the industrialized countries. Consequent decline in economic activities in the advanced countries caused a general slow-down in all PICs. With the exception of Papua New Guinea, the PICs have narrow resource bases and limited export earning capabilities. Further, they are heavily dependent on imports ranging from food and fuel to machinery and manufactured goods. Global economic downturn has resulted in decrease in tourism earnings and inward remittances, which are the main sources of foreign exchange earnings. Thus, the economic crisis has brought into sharp focus the topic of macroeconomic interdependence of PICs for further examination, as part of regional economic integration. This paper deals with six major countries in the South Pacific region, viz., Fiji, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu. Adopting a vector autoregressive (VAR) methodology, the study shows that there is strong evidence of country-specific shock affecting the variability of outputs in all PICs in the short-run. In the long run, it is found that the global output shock represented by the USA output shock is the most important shock followed by regional shocks. However, the quick and early recovery of Australia has re-established the case of regional economic integration with Australia and New Zealand. This has been the goal of Pacific Plan endorsed by the inter-governmental organization consisting of PICs, and Australia and New Zealand.

I Introduction

The ongoing global economic recession since the third quarter of 2008 has once again brought into sharp focus the topic of regional integration of 14 independent Pacific Island Countries (PICs),[1] which is the goal of Pacific Plan approved in

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[1] The 14 independent Pacific island countries, which are the members of the formal inter-governmental organization, known as Pacific Islands Forum are: Cook Islands, Fiji, Kiribati, Federated States of Micronesia (FSM), Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

2003 by the inter-government regional organization, Pacific Islands Forum (PIF).[2] The ultimate objective ,widely floated in the euphoria following the birth of the euro in 1999, was to bring about economic integration through freer trade among PICs and the region's two major countries, Australia and New Zealand and adoption of Australian dollar as the common currency (de Brouwer 2000; Australian Senate Committee 2003).

As the leading metropolitan country in the region, Australia has successfully weathered the global economic downturn, emerging as the best performer amongst all the industrialized countries (OECD 2010). Aside from growing at 1.5 per cent during 2009, it is also one of the first to raise interest rates - three times since October 2009. On the other hand, New Zealand, which fell into recession much before the start of the global financial crisis, having been hit by debt-driven consumer spending, has yet to recover. With contraction for five consecutive quarters in 2008-2009, New Zealand's economic growth declined by 1.4 per cent in 2009.

For trade and investment as well as inward remittances, the 14 PICs in the South Pacific and the North Pacific regions are dependent on Australia and New Zealand, and on the United States. Consequently, they have been adversely affected by decline in foreign exchange earnings from exports, tourist arrivals, and fall in remittance inflows. However, two PICs stand out different from the rest. They are Papua New Guinea (PNG) and Vanuatu which accumulated substantial foreign exchange reserves by 2007, facilitated by the pre-crisis commodity price boom in the case of PNG, and through implementation of prudent fiscal and monetary policies in the case of Vanuatu, affording the luxury of fiscal stimulus budgets. Both of them have thus steered clear by reducing to a considerable extent the adverse effects of the shocks of global economic crisis, despite their substantial macroeconomic interdependence on the rest of the world.

A study of macroeconomic interdependence of PICs will therefore be of interest to policy-makers. This paper focuses on six major PICs,[3] namely, Fiji, PNG, Samoa, Solomon Islands, Tonga and Vanuatu as they have consistent time series of data for empirical analysis. The object is to examine how far shocks to global output represented by that of the United States and regional output represented mainly by that of Australia affect the PIC's output. The paper is organized on the following lines: the second section presents a brief review of

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[2] The formal inter-governmental organization was established in 1971 and was known then as the South Pacific Islands Forum. With the addition of the North Pacific island states, which were the former trust territories of the United States, the name was changed to Pacific Islands Forum. In addition to 14 PICs, Pacific Island Forum (PIF) consists of two advanced countries, Australia and New Zealand as well, (Jayaraman 2007).

[3] The six PICs, namely, Fiji, PNG, Samoa, Solomon Islands, Tonga and Vanuatu have their own independent currencies, whereas the other eight have been dollarized. Cook Islands and Niue have adopted the New Zealand dollar as legal tender; Kiribati, Nauru and Tuvalu, the Australian dollar; and Palau, FSM and Marshall Islands, the United States dollar.

PICs' growth performance; the third outlines the modeling methodology employed for the study; the fourth section reports the results; and the fifth and final section presents some policy conclusions.

II A Brief Review of PICs' Economic Performance

The PICs are grouped three: Melanesian, Polynesian and Micronesian countries. They display a wide variety of characteristics (Table 1), with population levels ranging from less than 2000 in Niue to nearly six million in PNG. The Melanesian group (Fiji, PNG, Solomon Islands and Vanuatu) with their large volcanic islands have arable land and a good supply of water, making them suitable for agriculture. The Polynesian countries (Tonga, Samoa and Cook Islands) have small populations, with little potential for large scale agriculture and manufacturing and hence have to depend more on tourism and to a smaller extent, fisheries. The Micronesian countries are mostly coral atolls countries with much less resource base, being dependent on remittances, trust funds and fisheries exports for their income.

Growth Performance

Table 2 presents the annual real GDP growth rates for six major PICs which have credible and consistent national accounts database. Their growth performance is one of mixed nature. While PNG, Samoa, Solomon Islands and Vanuatu recorded positive annual growth rates, Fiji and Tonga performed rather poorly. The reasons behind their poor growth are political instability following the military coup in 2006 in Fiji and pro-democracy riots in 2005 in Tonga. Amongst the better performers, the success of PNG and Solomon Islands is due to growth in exports; of mineral and non-minerals and tree-crops in the case of PNG; and exports of logs of timber in the case of Solomon Islands. In the absence of any spectacular growth in exports, prudent fiscal and monetary policies supported by remittances in the case of Samoa and surge in tourism receipts in Vanuatu helped them to maintain growth (UNESCAP 2010).

Just before the full brunt of global recession was felt, PICs experienced fairly reasonable growth, the average rate being 5.1 per cent, thanks to growth performance of two commodity-exporting economies of PNG (minerals and non-minerals) and Solomon Islands (logs of timber). Following the recession in 2008 in industrialized economies including the two major trading partners, Australia and New Zealand, PICs began to experience declining growth.

Trade Eelations

In regard to trade relations[4] within the region[5] including both Australia and New Zealand, PIF members have taken major initiatives for promoting trade in goods. From 1981 both Australia and New Zealand have accorded preferential access to their markets for the manufactured goods from PICs under the South Pacific Regional Trade and Economic Co-operation Agreement (SPARTECA).[6] Since the early 1990s, intra-regional trade was given a boost by the Melanesian Spearhead Group Trade Agreement (MSG) covering Solomon Islands, Fiji, Vanuatu and PNG.

Table 1: PICs: General Indicators, 2007

Country	Population ('000)	Population Growth (% Change/year)	Population Density	Urban Population	GDP Per capita US $
Melanesia					
Fiji	853	1.0	47	51.0	3,306
PNG	5,995	2.5	13	14.0	943
Solomon Is.	489	2.8	17	17.0	684
Vanuatu	215	2.7	18	24.0	1,799
Polynesia					
Cook Islands	22	0.6	91	70.2	7,549
Niue	1.8	-2.2	6.9	33.0	4,364
Samoa	186	0.8	66	23.0	2,277
Tonga	102	0.4	142	24.0	2,176
Tuvalu	10	1.6	381	48.1	1,346
Micronesia					
FSM	111	2.0	159	22.0	2,205
Kiribati	101	2.2	138	48.0	703
Marshall Is.	65	1.9	636	67.0	2,363
Nauru	10	0.6	482	100.0	3,500
Palau	20	2.0	85	12.0	671
Comparators					
Low Income Countries	-	2.0	85	12	671
Middle Income Countries	-	1.1	45	53	6,564

Sources: Prasad (2009); Aus AID (2008); and World Bank (2007).

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[4] Outside the regions, PICs have been negotiating the Economic Partnership Agreements (EPAs) with the EU. So far only Fiji and Papua New Guinea have signed interim EPAs to ensure continued access of their sugar and tuna to the EU market. Other PICs continue to benefit from EU's GSP programme and concessional free trade to some of the least developed member countries such as Kiribati, Solomon Islands, Tuvalu and Vanuatu.

[5] Amongst the PICs, only PNG, Solomon Islands, Tonga and Fiji are full WTO members.

[6] SPARTECA, which was signed in 1981 and subject to Rules of Origin, is a nonreciprocal trade agreement under which Australia and New Zealand offer duty-free and unrestricted access for three specified products: textiles, clothing and footwear (TCF). The local content for TCF imports from PICs has been lowered from time to time to promote greater exports. The requirement now stands at 15 per cent.

In 2002, two agreements were signed. One of them, known as Pacific Island Countries Trade Agreement (PICTA), was to promote free trade amongst all PICs, excluding the two advanced countries, Australia and New Zealand. The PICTA was signed by all PICs, except Marshall Islands and Palau. The PICTA came in force from 2010. The other agreement signed by PICS along with Australia and New Zealand, known as the Pacific Agreement on Closer Economic Relations (PACER) is aimed at establishing free trade in the region. The scope of PACER has been expanded to include trade in services as well. The expanded PACER is now called PACER PLUS. Negotiations on PACER Plus are expected to commence in 2011, targeting free trade by 2015.

Table 2: PICs: Growth Performance, 1996-2009

Year	Real GDP Growth Rate (%)					
	Fiji	PNG	Samoa	Solomon Islands	Tonga	Vanuatu
1995	2.1	-3.3	6.6	5.4	2.9	4.7
1996	4.8	6.6	7.3	1.9	-0.5	7.2
1997	-2.2	-6.3	0.8	-1.7	-3.2	8.6
1998	1.3	4.7	2.4	3.2	3.5	4.3
1999	8.8	1.9	3.1	-1.6	2.3	-3.2
2000	-1.6	-2.5	7.1	-14.2	5.4	2.7
2001	1.9	-0.1	8.1	-8.2	7.2	-2.6
2002	3.2	-0.2	1.8	-2.8	1.4	-7.4
2003	0.9	2.2	3.1	6.5	3.4	3.2
2004	5.5	2.7	3.4	8.0	1.1	5.5
2005	0.6	3.7	5.2	5.0	-3.3	6.5
2006	3.4	2.6	2.6	6.1	4.4	7.2
2007	-6.6	6.7	6.1	10.3	-0.3	6.6
2008	-1.2	7.3	3.3	7.0	1.0	5.7
2009	-2.5	4.5	-0.8	0.4	0.4	3.4

Sources: ADB (2009), UNESCAP (2009).

The PICs are more competitive than complementary in nature. Their exports except in the case of PNG (minerals) and Fiji (sugar) are similar and they seek the same markets. There is little inter-regional trade, amounting to only 15 per cent of the total exports. Tables 3 and 4 give the import and export shares of PICs in their top four markets. It is clear that the bulk of exports and imports of the PICs are from Australia (wheat and rice, milk, meat and manufactured and primary processed goods), New Zealand (milk, meat and processed goods), USA (manufactured goods, machinery and transport), Singapore (petroleum products) and Japan (machinery and transport). Economic conditions in these countries have a major impact on PICs (Prasad 2009).

Table 5 shows the trade share of GDP for the PICs. For some of the remittance-dependent economies such as Tuvalu, Kiribati, Samoa and Tonga, the

decline in imports caused by lower remittances can have implications for the overall trade volumes. For most of them, a decline in trade volumes will have direct implications for the GDP, which means lower growth rates in the future (Prasad 2009).

Twin Deficits

Declining aid for budgetary support and rising domestic public sector expenditure with stagnant tax revenues led to widening budget deficits (Table 6) in all PICs. With continuing dependence on imports of all food items including rice, wheat, fuel and manufactured goods led to further widening of the trade deficits. However, remittances continued to provide valuable support to the traditionally remittance dependent economies of Samoa and Tonga and resurgence of tourism in Vanuatu at the cost of Fiji, which had experienced political instability following the military coup in December 2006. Consequently, current account balances were at sustained levels (Table 7). However, international reserves to support exchange rate levels were low in 2009 compared to earlier levels in (Table 8). Thanks to the declining prices, especially of petroleum products since 2008, inflation moderated in most of the PICs (Table 9).

Table 3: PIC Export Markets (% total exports)

	Market 1		Market 2		Market 3		Market 4		Total Share from 4 Markets	Intra-regional Share
Cook Is.	Japan	30.8	NZ	12.9	Australia	7.1			50.8	20.0
FSM	Japan	21.4	USA	20.9	Guam	3.4			45.7	0.0
Fiji	USA	19.1	Australia	16.5	UK	11.9			47.5	16.5
Kiribati	USA	26.2	Belgium	24.6	Japan	16.4	Australia	8.6	75.8	8.6
Nauru	S. Africa	56.7	India	15.4	Canada	5.9	Australia	1.0	79.0	1.0
Niue	N/A									0.0
RMI	N/A									0.0
Palau	USA	N/A	Japan	N/A	Singapore	N/A				0.0
PNG	Australia	29.0	Japan	8.7	China	5.4			43.1	29.0
Solomon Is.	China	39.7	Korea	15.1	Thailand	6.7	Australia	1.3	62.8	1.3
Samoa	Australia	65.5	USA	8.2	Samoa	3.5			77.2	65.5
Tonga	Japan	33.3	USA	26.6	NZ	11.1	Australia	2.0	73.0	13.1
Tuvalu	Germany	62.1	Italy	20.7	Fiji	7.0	Australia	2.7	92.5	9.7
Vanuatu	Thailand	47.0	Malaysia	18.6	Poland	8.3	Australia	1.5	75.4	1.5
Average									65.71	15.11

Sources: Prasad (2009); Nathan (2007).

Table 4: PIC Import Sources (% total imports)

	Source 1		Source 2		Source 3		Source 4		Share 4 Sources	Intra-regional Share
Cook Is.	NZ	79.3	Australia	6.3	Fiji	6.0			91.6	91.6
FSM	USA	36.1	Guam	13.9	Japan	11.5	H. Kong	5.8	67.3	0.0
Fiji	Singapore	27.3	Australia	23.5	NZ	18.6			69.4	42.1
Kiribati	Australia	33.5	Fiji	27.5	Japan	18.4			79.4	61.0
Nauru	Australia	63	USA	10.3	Germany	7.5			80.8	63.0
Niue	NZ	97.6	Australia	0.3					97.9	97.9
RMI	USA	65.4	Australia	13.4	Japan	4.9			83.7	13.4
Palau	USA	45.0	Singapore	27.9	Japan	8.0	Philippines	6.5	87.4	0.0
PNG	Australia	55.7	Singapore	13.7	Japan	4.4			73.8	55.7
Solomon Is.	Australia	25.5	Singapore	25.0	NZ	6.0			56.5	31.5
Samoa	NZ	21.8	Fiji	20.5	Singapore	12.2	Australia	8.8	63.3	51.1
Tonga	NZ	36.1	Fiji	26.0	Australia	10.2			72.3	72.3
Tuvalu	Fiji	45.8	Japan	18.8	China	18.1	Australia	7.7	90.4	53.5
Vanuatu	Australia	15.2	Japan	13.8	Singapore	12.1			41.1	15.2
Average									75.35	46.31

Sources: Prasad (2009); Nathan (2007).

Table 5: Share of Trade in GDP

Country	Share of Trade in GDP (2006)
Cook Is.	74.0
Fiji	82.9
Kiribati	92.3
Marshal Is.	59.2
FSM	56.9
Nauru	166.9
Palau	115.7
PNG	79.9
Samoa	44.9
Solomon Is.	55.1
Tonga	53.7
Tuvalu	42.1
Vanuatu	47.4

Source: ADB (2008).

Table 6: PICs: Budget Balances

	2005	2006	2007	2008	2009 (est.)
Fiji	-3.4	-2.9	-1.3	-1.5	-2.9
PNG	0.0	3.1	2.5	1.0	0.2
Samoa	0.3	0.3	1.1	-3.2	-14.2
Solomon Is.	2.5	1.5	-1.1	-5.8	-0.5
Tonga	2.4	1.5	1.5	2.0	-2.8
Vanuatu	2.1	1.2	-0.3	6.3	0.1

Sources: ADB (2009), UNESCAP (2009), ANZ (2010).

Table 7: PICs: Current Account Balance (% of GDP)

	2005	2006	2007	2008	2009
Fiji	-11.4	-19.0	-14.0	-18.5	-10.0
PNG	12.4	7.3	1.8	2.8	-6.8
Samoa	-10.7	-16.8	-8.4	-12.4	2.6
Solomon Is.	-6.9	-6.3	-12.4	-18.7	-7.0
Tonga	-2.7	-8.0	-8.5	-9.0	-14.3
Vanuatu	-7.4	-4.1	-5.9	-7.4	-2.2

Sources: UNESCAP (2010), ANZ (2010).

Table 8: Official International Reserves

	Central Bank's Target of Months of Import Cover	Actual Months of Import Cover End 2007	Actual Months Of Import Cover End 2008	Actual Months of Import Cover 2009
Fiji	4.0	4.4	2.9	3.5
PNG	5.0	13.0	10.9	7.1
Samoa	5.0	4.7	4.4	4.3
Solomon Is.	3.0	3.7	2.5	2.1
Tonga	5.0	4.4	4.8	4.7
Vanuatu	4.0	7.0	5.8	5.4

Sources: ADB (2009), UNESCAP (2009).

Table 9: PICs: Inflation (2005-2009)

	2005	2006	2007	2008	2009
Fiji	2.4	2.5	4.3	7.7	4.0
PNG	1.8	2.4	0.9	10.6	5.7
Samoa	1.9	3.8	5.5	11.5	6.1
Solomon Is.	7.4	11.2	7.7	17.2	1.5
Tonga	8.3	6.4	5.9	10.4	1.1
Vanuatu	1.2	2.0	3.9	4.8	2.3

Sources: ADB (2009), UNESCAP (2009), ANZ (2010).

III Modeling Methodology and Data

Nature of Shocks

Macroeconomic interdependence is signified by transmission of shocks from one economy to another. These shocks affect both supply and demand sides of a given economy. They may be either internal or external. Domestic supply shocks are of two kinds: positive and negative. Positive domestic supply shocks, which boost supply, stem from policy reforms and institutional improvements aiming at better governance, thereby increasing productivity. On the other hand, negative supply shocks dent supply. The usual negative shocks for a small economy, dependent on fuel imports, are external in terms of a rise in oil price or fall in terms of trade. Domestic negative supply shocks arise from both natural disasters (such as earthquakes and cyclones) man-made disasters, (including military coups and social unrest).

Demand shocks are also of two kinds. Positive ones are those stepping up aggregate demand (including the rise in private sector activities) or fiscal stimulus in times of depressed domestic demand. Negative demand shocks, which reduce aggregate demand, usually emanate from fall in investor confidence that decreases capital formation. These shocks might originate either within a country or outside the country.

The study adopts the vector autoregression (VAR) modeling methodology, which has been utilized by notable studies, including Kawai and Motonishi (2005) and Takagi (2008) with a view to investigating how shocks from one particular country to another are transmitted. However, the choice of variables for econometric modeling to study the impact of shocks on PICs is dictated by the limited number of annual observations available for the study. National income data for most of the PICs are available only from 1980, as they have been compiled only after their independence. Our study, therefore, covers only a short 29-year period (1980-2008). We choose four variables: real gross domestic product (RGDP) of the USA representing global output, RGDP of Australia and RGDP of New Zealand, and RGDP of respective PICs. All real outputs are expressed in index numbers for removing the influence of exchange rate changes.

The Model

The VAR model comprises four variables and the moving average representations are given below:

$$
\begin{aligned}
LUSA_t = \sum \alpha_{1i} LUSA_{t-j} + \sum \alpha_{2i} LAUS_{t-j} + \\
\sum \alpha_{3i} LNZ_{i,t-j} + \sum \alpha_{4i} LPIC_{i,t-j}
\end{aligned}
\qquad \dots (1)
$$

$$LAUS_t = \sum \phi_{1i}LUSA_{t-j} + \sum \phi_{2i}LAUS_{t-j} +$$
$$\sum \phi_{3i}LNZ_{i,t-j} + \sum \phi_{4i}LPIC_{i,t-j} \qquad \dots (2)$$

$$LNZ_t = \sum \mu_{1i}LUSA_{t-j} + \sum \mu_{2i}LAUS_{t-j} +$$
$$\sum \mu_{3i}LNZ_{i,t-j} + \sum \mu_{4i}LPIC_{i,t-j} \qquad \dots (3)$$

$$LPIC_{i,t} = \sum \eta_{1i}LUSA_{t-j} + \sum \eta_{2i}LAUS_{t-j} +$$
$$\sum \eta_{3i}LNZ_{i,t-j} + \sum \eta_{4i}LPIC_{i,t-j} \qquad \dots (4)$$

where
USA = RGDP of USA;
AUS = RGDP of Australia;
NZ = RGDP of New Zealand; and
PIC_i = RGDP of FICs (where i = FIJI, PNG, SAM, SI, TON, VAN)

As noted by Takagi (2008), the estimation of a VAR system is sensitive to the choice of particular strategy such as the ordering of the variables and lag length. We assume that initially, in the first round a shock to output of the USA affects the outputs of Australia, New Zealand and PICs; a shock to Australia's output affects the outputs of New Zealand and PICs; and a shock to the output of New Zealand affects PICs' output; and PICs' output affects none of the other countries. Accordingly, we enter the variables (RGDP) in that order, namely: *USA, AUS, NZ, and PIC*s. We employ the Akaike information criterion for determining the lag length.

Two Measures

Two approaches are employed: the first approach is to determine how each endogenous variable responds over time to a shock in that variable itself and in every other endogenous variable. The second approach traces the response of the endogenous variable to such shocks. Accordingly, we have two measures: One measure is to determine how much of the total variance of each Pacific island country's output is explained by the variance in the USA, Australia and New Zealand outputs. The first measure, known as variance decomposition analysis, enables us to conclude about the proportion of changes in a variable resulting from its own shocks as well as shocks to other variables in the system (Enders 1995: 311). For instance, if USA, Australia and New Zealand shock explains none of the forecast error variance of each of PIC's RGDP at all time horizons, it would mean economic growth of PICs may evolve independently of the global and regional shocks.

The second measure is known as the impulse response function analysis. It is an effective way to visualize movements over time in response to different shocks in the system (Enders 1995: 306). When employed, it would measure the

response of a given PIC's output to a 1 standard deviation shock to outputs of the USA, Australia and New Zealand. It would thus enable us to trace out the effects of shocks to each PIC by global or regional shock. For undertaking the econometric exercises, all the variables were transformed into logs.

IV Results and Interpretations

Unit Root Tests

We employed two testing procedures for examining the order of integration of each series, namely Ng and Perron (2001) and KPSS (Kwiatkowski, *et al.* 1992) unit root tests. The results by both tests indicate that the time series are non-stationary in levels. After first differencing, however, unit root tests reveal that the series are of $I(1)$[7].

Table 10: Cointegration Tests for Multiple Cointegrating Vectors

Null Hypothesis	Alternative Hypothesis	Trace Statistic	Critical Value	Maximum Eigenvalue Statistic	Critical Value
Fiji (1981-2008)					
R=0	r>0	70.4444**	63.8761	44.8219**	32.1183
R≤1	r>1	25.6224	42.9152	12.9840	25.8232
R≤2	r>2	12.6384	25.8721	8.3069	19.3870
R≤3	R=4	4.3314	12.5179	4.3314	12.5179
PNG (1981-2008)					
R=0	r>0	82.3877**	63.8761	41.6160**	32.1183
R≤1	r>1	40.7717	42.9152	23.4425	25.8232
R≤2	r>2	17.3292	25.8721	13.2920	19.3870
R≤3	R=4	4.0371	12.5179	4.0371	12.5179
Samoa (1981-2008)					
R=0	r>0	74.3257**	63.8761	33.1942**	32.1183
R≤1	r>1	41.1315	42.9152	24.7735	25.8232
R≤2	r>2	14.3579	25.8721	7.7748	19.3870
R≤3	R=4	6.5830	12.5179	6.5830	12.5179
Solomon Is. (1990-2008)					
R=0	r>0	112.1385**	63.8761	65.5246**	32.1183
R≤1	r>1	46.6138**	42.9152	26.8523**	25.8232
R≤2	r>2	19.7615	25.8721	15.6864	19.3870
R≤3	R=4	4.0750	12.5179	4.0750	12.5179

Contd…

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[7] For conservation of space, we have not given the results. They will be made available on request.

Table 10: Cointegration Tests for Multiple Cointegrating Vectors

Null Hypothesis	Alternative Hypothesis	Trace Statistic	Critical Value	Maximum Eigenvalue Statistic	Critical Value
Tonga (1981-2008)					
R=0	r>0	72.0143**	63.8761	33.4495**	32.1183
R≤1	r>1	38.5647	42.9152	23.0393	25.8232
R≤2	r>2	15.5254	25.8721	11.1562	19.3870
R≤3	R=4	4.3691	12.5179	4.3691	12.5179
Vanuatu (1981-2008)					
R=0	r>0	69.1791**	63.8761	32.98395**	32.1183
R≤1	r>1	36.1952	42.9152	19.53923	25.8232
R≤2	r>2	16.6560	25.8721	13.51543	19.3870
R≤3	R=4	3.1405	12.5179	3.140571	12.5179

Notes: ** Significance at the 5 per cent level.

Cointegration Analysis

Given the common stationary properties of the series, the next stage is to examine for the presence of cointegration in each FCI in regard to global (USA) and regional (Australia and New Zealand) shocks. In this analysis, we use the Johansen and Juselius (1990) procedure of examining the existence of cointegration. Results of the cointegration procedure, using an optimal lag structure for the VAR, are reported in Table 10 for each PIC. Both the maximum eigenvalue and trace statistics show that there appears at least a single cointegrating vector in all PICs, except Solomon Islands which have two cointegrating vectors. The results confirm that in each PIC global and regional shocks are cointegrated.

Granger Causality Analysis

Given the presence of a cointegrating relationship, we then conduct the Granger causality tests to examine the short-run temporal causality relationship of each PIC and both global and regional shocks. Results of the Granger causality tests based on the vector error correction model (VECM) are shown in Table 11. We find that the error correction term (ECT) in the equation with each country's GDP in first difference as dependent variable is statistically significant at 10 per cent significance level or better, while ECTs in other equations are not significant. It is obvious that for each PIC, the Granger causality stems forth only from global and/or regional shocks.

Table 11: Temporal Causality Results based on Vector Error-correction Models

	F-Statistics				ECT	(t-Statistics)
	ΔUS	ΔAUS	ΔNZ	ΔPIC		
Fiji						
ΔUS	-	0.5792	0.0287	0.2041	-0.0363	(-0.121)
ΔAUS	6.2572 **	-	1.4143	2.2007	-0.0783	(-0.372)
ΔNZ	0.6837	1.4729	-	0.4069	-0.7196	(-0.919)
ΔFIJI	6.2303 **	2.5252 *	6.3183 **	-	-0.7083 *	(-1.991)
PNG						
ΔUS	-	1.0597	0.2741	0.3359	-0.1722	(-1.385)
ΔAUS	0.8888	-	0.1863	0.5614	-0.0672	(-0.524)
ΔNZ	0.8694	1.0058	-	0.7300	-0.0646	(-0.239)
ΔPNG	0.9529	6.4063 ***	1.3326	-	-0.9100 *	(-1.826)
Samoa						
ΔUS	-	0.1326	0.1199	0.0477	-0.2496	(-0.517)
ΔAUS	0.4757	-	0.5586	0.3487	-0.3478	(-1.021)
ΔNZ	2.0262	1.5002	-	1.2559	-0.0427	(-0.108)
ΔSAM	2.9815 *	7.1839 ***	8.8572 ***	-	-0.1471 **	(-2.259)
Solomon Is.						
ΔUS	-	2.1294	0.5540	0.2464	-0.7801	(-1.752)
ΔAUS	4.8321 *	-	0.5967	3.0281	-0.5255	(-1.110)
ΔNZ	0.7821	0.2695	-	0.4986	-0.3655	(-0.255)
ΔSI	10.5545 ***	16.9733 ***	41.9919 ***	-	-0.6916 ***	(-3.707)
Tonga						
ΔUS	-	1.6318	0.5581	2.1055	-0.8392	(-1.170)
ΔAUS	0.9034	-	1.1994	0.1024	-0.3963	(-1.078)
ΔNZ	1.0322	1.2735	-	2.1824	-0.5248	(-0.446)
ΔTON	3.7825 *	0.2505	2.6479 *	-	-0.3377 **	(-2.609)
Vanuatu						
ΔUS	-	1.8095	0.6341	0.9914	-0.8473	(-1.433)
ΔAUS	1.0420	-	1.7304	0.5023	-0.0737	(-0.128)
ΔNZ	0.7690	0.5500	-	0.2943	-0.1018	(-0.086)
ΔVAN	4.1025 *	5.9795 **	3.9833 *	-	-0.8749 **	(-2.653)

Notes: * Significance at the 10 per cent level, ** Significance at the five per cent level, *** Significance at the one per cent level.

Variance Decomposition Analysis

Variance decomposition analysis is used based on Cholesky factorization with the following ordering, namely: *USA, AUS, NZ* and the relevant *PIC*. The analysis is done up to a 10-year horizon. We used different orderings of the variables. The findings are robust to changes, as the correlation coefficients of residuals are found low.

The results of variance decomposition procedure for the selected six PICs are presented in Tables 12 to 18. We find that there is a strong evidence of country-specific shock's in the variability of outputs in all PICs in the short-run. About 50 per cent variability in the output of Samoa output, 57 per cent in Fiji, 64 per cent in Tonga, 75 per cent in Vanuatu, 82 per cent in Tuvalu and 87 per cent in Solomon Islands at the one-year-ahead forecast is attributed to their respective own innovations. However, the impact of shock decreases over the remaining time horizons and by 10 years ahead.

In the long run, it is found that the global shock represented by that of the USA is the most important when compared with shocks to outputs of Australia and New Zealand in Fiji, PNG, Solomon Islands and Tonga (more than 30 per cent at the 10-year-ahead forecast). However, even though the contribution of New Zealand's output shock relative to US output shock was not high in Fiji, PNG and Solomon Islands, its contribution is relatively high in Samoa (38 per cent to 63 per cent) and Tonga (21 per cent to 38 per cent) not only in the short-run, but also in the long-run.

Table 12: Results of Variance Decomposition Analysis for Fiji

Period	S.E.	USA	AUS	NZ	FIJI
1	0.0404	19.4378	3.2844	19.5686	57.7091
2	0.0449	30.1717	2.7217	19.5312	47.5754
3	0.0488	34.0163	2.5266	17.0550	46.4021
4	0.0514	38.2355	2.5565	15.5171	43.6909
5	0.0537	41.6002	2.4858	15.2526	40.6614
6	0.0557	44.0837	2.3580	15.7426	37.8156
7	0.0575	46.0410	2.2297	16.2576	35.4718
8	0.0591	47.7556	2.1228	16.4616	33.6601
9	0.0603	49.3248	2.0396	16.3524	32.2833
10	0.0614	50.7430	1.9752	16.0582	31.2236

Correlation Matrix of the Reduced Form VAR residuals

	USA	AUS	NZ	FIJI
USA	1	0.6166	0.3288	0.4409
AUS	0.6166	1	0.3835	0.4145
NZ	0.3288	0.3835	1	0.5918
FIJI	0.4409	0.4145	0.5918	1

Notes: Cholesky Ordering: USA, AUS, NZ, FIJI.

Table 13: Results of Variance Decomposition Analysis for PNG

Period	S.E.	USA	AUS	NZ	PNG
1	0.0427	0.5633	6.2346	11.4013	81.8008
2	0.0723	24.1711	5.5978	3.9793	66.2518
3	0.0987	42.2224	3.0661	3.4364	51.2752
4	0.1279	49.2994	4.2871	5.4730	40.9405
5	0.1600	53.2090	7.6113	7.6176	31.5621
6	0.1892	55.6485	9.7736	9.0406	25.5373
7	0.2124	57.0193	11.6822	8.9893	22.3092
8	0.2274	58.0253	13.0029	8.2417	20.7302
9	0.2347	58.5625	13.5806	7.7850	20.0720
10	0.2378	57.9184	13.6311	8.7909	19.6595

Correlation Matrix of the Reduced Form VAR residuals

	USA	AUS	NZ	PNG
USA	1	0.3832	0.4190	-0.0751
AUS	0.3832	1	0.3165	-0.2594
NZ	0.4190	0.3165	1	0.2277
PNG	-0.0751	-0.2594	0.2277	1

Notes: Cholesky Ordering: USA, AUS, NZ, PNG

Table 14: Results of Variance Decomposition Analysis for Samoa

Period	S.E.	USA	AUS	NZ	SAM
1	0.0347	1.2596	10.0290	38.6253	50.0861
2	0.0413	1.2095	14.2751	40.5521	43.9634
3	0.0514	1.6654	15.8906	53.4246	29.0194
4	0.0620	1.7413	18.0631	58.9191	21.2765
5	0.0692	2.0974	17.6739	63.1225	17.1063
6	0.0740	2.5024	17.1052	65.4081	14.9843
7	0.0765	3.1846	16.6228	66.1267	14.0659
8	0.0776	4.1755	16.2560	65.7389	13.8296
9	0.0783	5.4274	15.9725	64.6411	13.9590
10	0.0794	6.8726	15.7741	63.0934	14.2600

Correlation Matrix of the Reduced Form VAR residuals

	USA	AUS	NZ	SAM
USA	1	0.5288	0.3769	-0.1122
AUS	0.5288	1	0.1837	-0.3281
NZ	0.3769	0.1837	1	0.5391
SAM	-0.1122	-0.3281	0.5391	1

Notes: Cholesky Ordering: USA, AUS, NZ, SAM.

Table 15: Results of Variance Decomposition Analysis for Solomon Islands

Period	S.E.	USA	AUS	NZ	SI
1	0.0544	0.0334	5.8606	6.9990	87.1070
2	0.0831	5.0180	12.9584	16.2956	65.7280
3	0.1013	4.4928	13.7674	29.9615	51.7783
4	0.1148	5.5313	10.7962	43.3114	40.3611
5	0.1401	18.1222	10.6317	41.0746	30.1715
6	0.1852	32.9752	15.5594	26.8955	24.5699
7	0.2397	40.4869	20.8576	16.2138	22.4417
8	0.2875	42.1609	24.5605	11.8313	21.4474
9	0.3177	40.5491	26.4929	12.3936	20.5644
10	0.3318	37.6433	26.3648	16.5887	19.4033
Correlation Matrix of the Reduced Form VAR residuals					
		USA	AUS	NZ	SI
USA		1	0.4959	0.4492	-0.0183
AUS		0.4959	1	0.6023	0.2012
NZ		0.4492	0.6023	1	0.3038
SI		-0.0183	0.2012	0.3038	1

Notes: Cholesky Ordering: USA, AUS, NZ, SI.

Table 16: Results of Variance Decomposition Analysis for Tonga

Period	S.E.	USA	AUS	NZ	TON
1	0.0202	0.1942	14.3032	21.7006	63.8020
2	0.0287	5.0747	11.9076	50.0543	32.9634
3	0.0351	15.6903	11.8620	47.5903	24.8574
4	0.0377	19.7357	10.4592	46.2084	23.5967
5	0.0386	21.9243	9.9811	44.7730	23.3216
6	0.0392	23.9971	9.6892	43.4026	22.9111
7	0.0399	26.0627	9.3583	42.2172	22.3619
8	0.0406	27.9392	9.0481	41.0647	21.9480
9	0.0412	29.5701	8.8068	39.8873	21.7358
10	0.0418	30.9641	8.6262	38.7877	21.6221
Correlation Matrix of the Reduced Form VAR residuals					
		USA	AUS	NZ	TON
USA		1	0.4514	0.2865	0.0441
AUS		0.4514	1	0.2258	-0.3176
NZ		0.2865	0.2258	1	0.4152
TON		0.0441	-0.3176	0.4152	1

Notes: Cholesky Ordering: USA, AUS, NZ, TON.

Table 17: Results of Variance Decomposition Analysis for Vanuatu

Period	S.E.	USA	AUS	NZ	VAN
1	0.0391	4.0105	8.1371	13.1717	74.6807
2	0.0622	6.8834	23.1188	8.5196	61.4782
3	0.0756	6.1150	32.2986	6.8716	54.7149
4	0.0839	5.1613	37.3605	6.3497	51.1285
5	0.0884	4.8920	39.6638	6.0458	49.3984
6	0.0904	5.3445	40.5430	5.7758	48.3367
7	0.0915	6.1331	40.5498	5.9127	47.4044
8	0.0925	6.8974	40.1022	6.4846	46.5158
9	0.0934	7.6418	39.4709	7.2499	45.6373
10	0.0943	8.4311	38.7766	8.0360	44.7564

Correlation Matrix of the Reduced Form VAR residuals

	USA	AUS	NZ	VAN
USA	1	0.4431	0.4146	0.2003
AUS	0.4431	1	0.2111	0.3445
NZ	0.4146	0.2111	1	-0.2383
VAN	0.2003	0.3445	-0.2383	1

Notes: Cholesky Ordering: USA, AUS, NZ, VAN.

The results show that Australia output shock is most important in explaining the variability in Vanuatu's output not only in the short-term (23 per cent), but also in the long-run (38 per cent). It explains only to a small extent the variation in the outputs of other remaining PICs. Given the economic dependence and openness of some PICs on Australia, the minimal role of this shock is surprising. This might be due to the fact that that the dynamics of production structures in PICs differ greatly from those of Australia and New Zealand.

Impulse Response Function

We also employed impulse response functions (IRF) to derive more information on the macroeconomic interdependence of PICs. Figures 1 to 6 present the results of the generalized impulse response functions for the six PICs, which are plotted out to the 10 years. Since the variables are all in logs and as they are entered into IRF analysis in their first differences, the vertical axis shows the values in percentages. The horizontal axis shows the passage of time: in this case 10 years are displayed. In each graph, point estimates of the function are represented by a solid line while the dotted lines indicate a two standard deviation band around the point estimates. A shock is said to be significant when the lower standard deviation band is above the zero line.

As shown in these Figures, the results are consistent with our findings in variance decomposition analysis. It shows that most of these PICs are greatly influenced by their own country-specific conditions in the short and medium

terms. The effect of the country-specific shock to these PICs is persistently volatile. However, these impulses slowly decay and are persistent in medium and the long-terms. The impulse response to USA (global) output shock rapidly fluctuates over the first 3 years and then flattens out in the medium and long terms in Fiji, PNG, Tonga and Vanuatu. In the other two PICs, the impulse responses to global output shocks are slightly more volatile than those for regional shock.

Figure 1: Fiji: Results of Impulse Response Function Analysis


Response to Cholesky One S.D. Innovations ± 2 S.E.
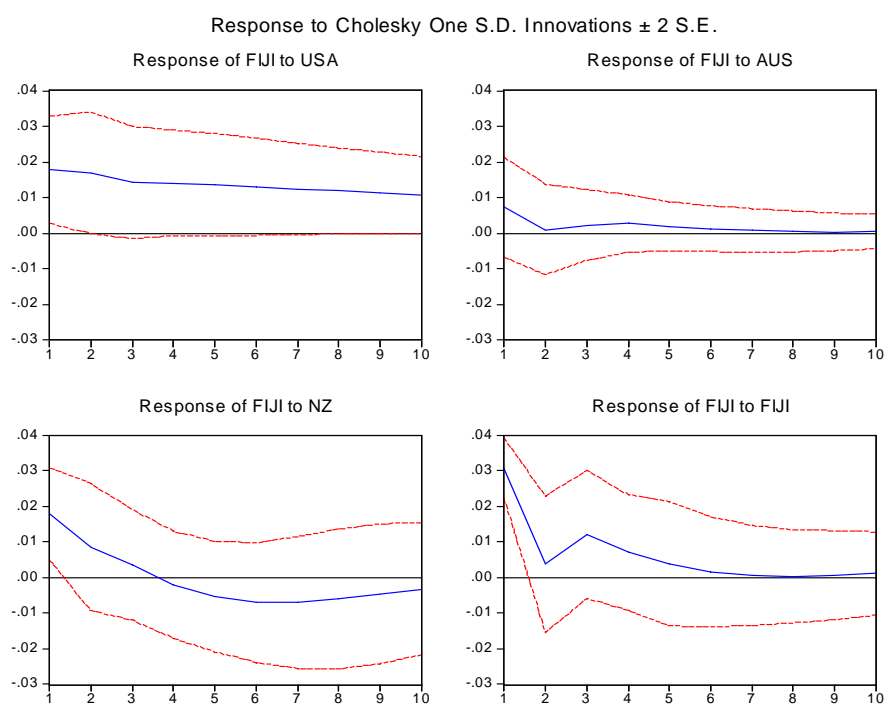
Figure 2: PNG: Results of Impulse Response Function Analysis

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of PNG to USA

Response of PNG to AUS

Response of PNG to NZ

Response of PNG to PNG
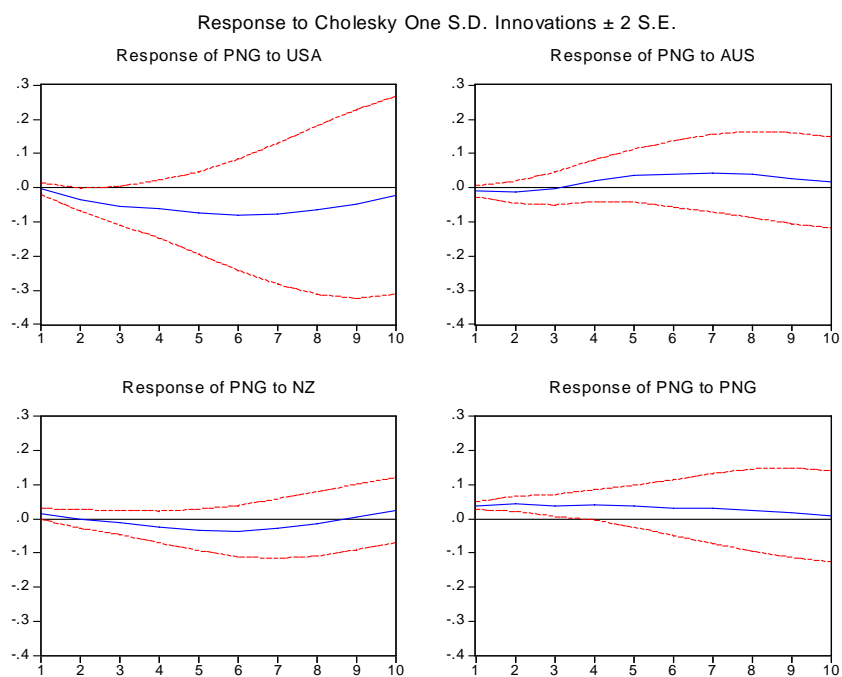
Figure 3: Samoa: Results of Impulse Response Function Analysis

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of SAM to USA

Response of SAM to AUS

Response of SAM to NZ

Response of SAM to SAM
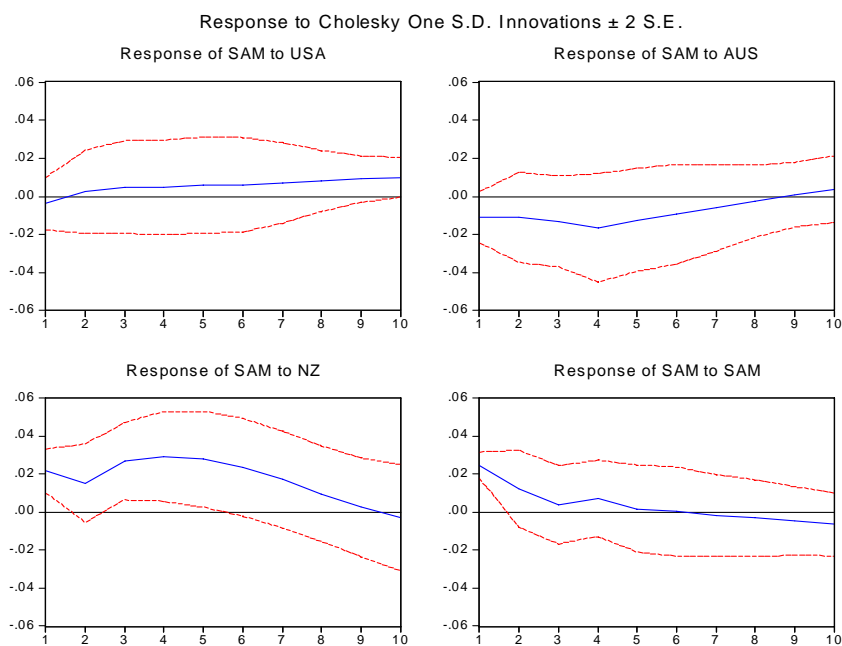
Figure 4: Solomon Islands: Results of Impulse Response Function Analysis

Response to Cholesky One S.D. Innovations ± 2 S.E.
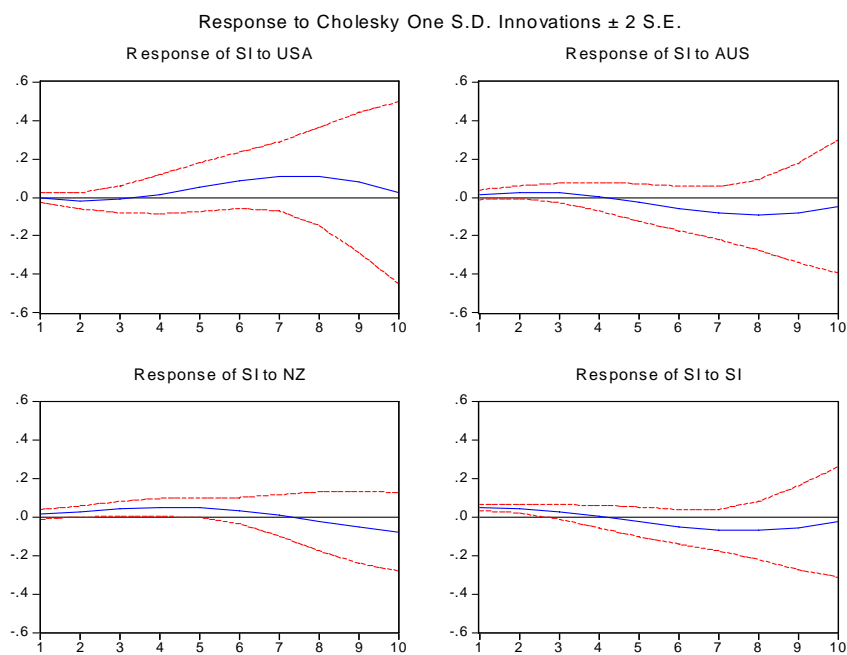
Figure 5: Tonga: Results of Impulse Response Function Analysis

Response to Cholesky One S.D. Innovations ± 2 S.E.
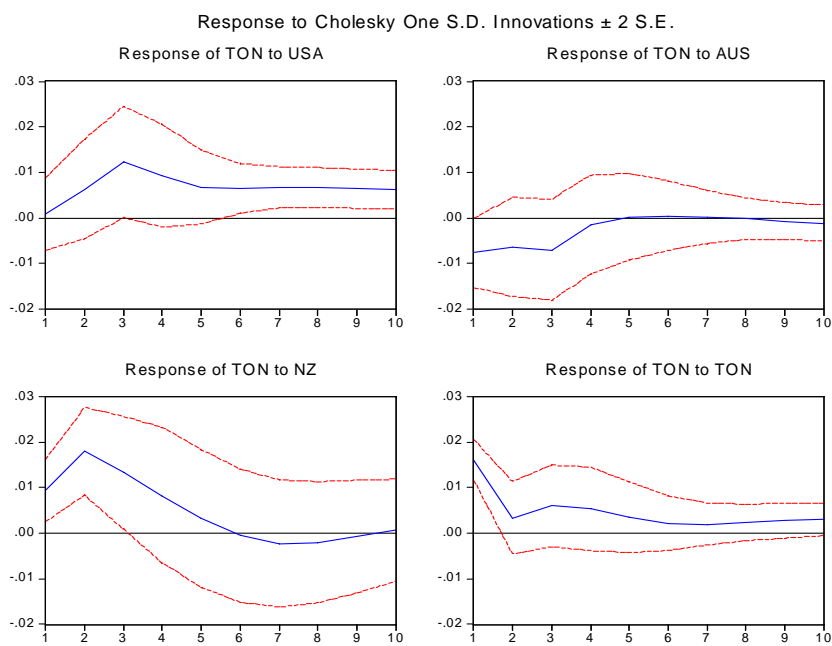
Figure 6: Vanuatu: Results of Impulse Response Function Analysis

Response to Cholesky One S.D. Innovations ± 2 S.E.
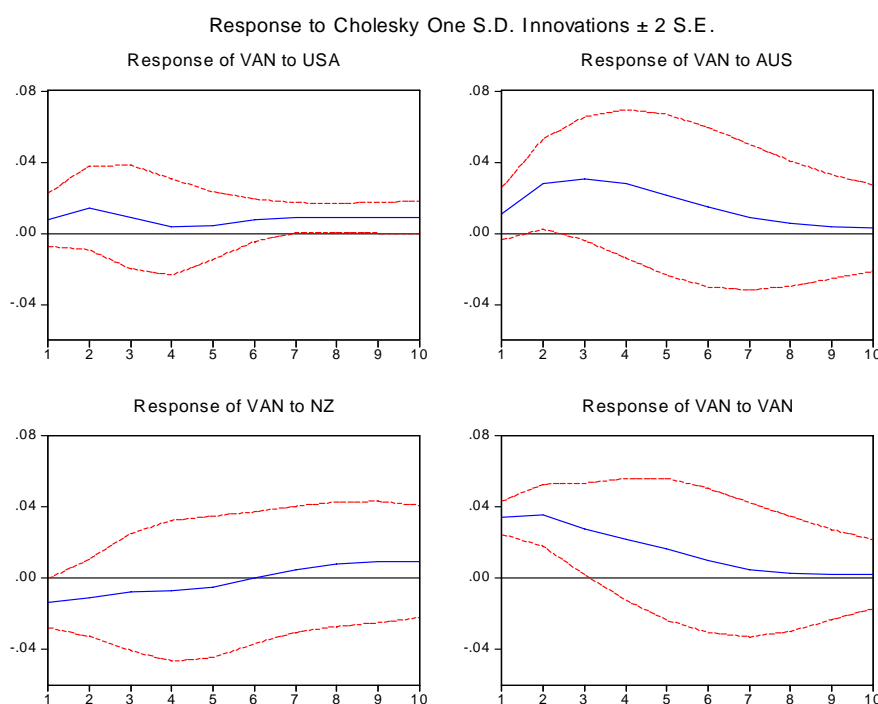
V Conclusions and Policy Recommendations

Utilizing the GDP data series covering a 29-year period (1981-2008), this paper undertook a study on the macroeconomic interdependence of PICs. By employing variance decomposition and impulse response function analyses, the study examined the effects of shocks in global and regional outputs on PICs economic growth.

We find that domestic determinants are more important in the short-run, as the country-specific shock has been found to be dominant over regional and global shocks. However, we find generally that regional shocks are much more important than global shocks in the short-run. Specifically, the global shock (USA) is the most important shock in regard to Fiji, PNG, Solomon Islands and Tonga, while shocks to regional outputs (Australia and New Zealand) are more dominant in Samoa, Tonga and Vanuatu.

In the long run, global output shock represented by the USA output shock is the most important when compared to shocks to outputs of Australia and New Zealand in Fiji, PNG, Solomon Islands and Tonga (more than 30 per cent at the 10-year-ahead forecast).

The policy directions are clear. Since domestic shocks in the short-run are the most important factor responsible for the variability in domestic output, all PICs have to focus on reforms. Negative effects of domestic shocks can be

minimized by prudent fiscal policies and careful public financial management. Additionally, supportive monetary policies would also contribute to maintaining price and exchange rate stability.

As regards the long-term prospects, the proposed economic integration efforts would bring about greater quantum of trade in goods and services between PICs and the two major countries in the region. Greater trade visualized under PACER would further strengthen the existing, close economic ties with Australia and New Zealand.

The PICs' commitment to openness is well known. The European Union, US and Japanese markets would continue to be important for exports, sources for tourism earnings and inward remittances. Global shocks would, therefore, not only continue to play a significant part and the intensity of their impact would grow. As a corollary, influence of domestic shocks would gradually diminish relative to regional and global forces. Until then, regional integration, which now appears to be an aspiration, should be vigorously pursued.

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