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ECONOMIC VOLATILITY, ECONOMIC VULNERABILITY AND FOREIGN AID: EMPIRICAL RESULTS FOR THE SOUTH PACIFIC ISLAND NATIONS

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ABSTRACT

This paper presents empirical examination on the links between economic volatility, vulnerability and growth for the cross country evidence from the South Pacific island economies. We incorporate output volatility and vulnerability factors within an extended neoclassical framework by including a number of conditioning factors to seek an understanding of the endogenous variables and exogenous shocks that constraint the growth processes. Given the South Pacific region's remoteness, political instabilities, economic vulnerabilities and the characteristics of the island economies, the estimation of output volatility, vulnerability and growth nexus contribute to the debate to quantify and identify vulnerability of these nations. The results indicate that economic growth is negatively affected by output volatility. Low investment levels, lack of democracy increases risk and uncertainty causing output volatility and lower growth. Convergence between the economies is observed though at a slow pace. Economic vulnerability shows a negative effect originating from the shocks. Vulnerability tends to slow down the growth rates of the island nations and also reduces the speed of convergence between economies at different levels of development. To overcome output volatility and economic vulnerability the results support that in a stable political environment foreign aid contributes positively to economic vulnerability, output volatility and growth. The results provide a means to address those problems.

***Keywords*:** Economic Volatility, Vulnerability, Growth, Convergence, South Pacific Island Economies

JEL Classification: O10, O40, O47, O56

1. INTRODUCTION

There have been profound changes in the role of growth factors and policies in promoting economic growth. Output volatility, the characteristics of island nations, globalisation and the supply-side dynamics have impinged on long term economic growth. This paper presents empirical examination on the links between economic volatility, vulnerability and growth for the cross country evidence from the South Pacific Island Nations (SPINs). The political, institutional and cultural factors in the island countries are crucial in understanding their development goals. This is particularly so as many of these nations are fragile states affected by output volatility, economic vulnerability, political instability, low resource base and other growth problems besides major set-backs in terms of its uncertain economic policies, poor resource management, and social crises causing fragile groups of people vulnerable to external shocks. These effects have severely damaged a myriad of socio-economic and political factors that undermined growth elements, civil liberties of its citizens and thus, wellbeing. We incorporate vulnerability factors within an extended neoclassical framework by including a number of conditioning factors to seek an understanding of the endogenous variables and exogenous shocks that constraint the growth processes. The study contributes to the debate to quantify and identify vulnerability of the South Pacific island economies.

Various competing schools of thought have noted the requirements of factors of production along with recent endogenous growth factors, quality institutions, political and civil liberty, economic freedom to explain the performance of developing countries (Romer, 1986, Barro and Sala-i-Martin 1995, Easterly and Rabelo, 1993, Aghion and Howitt, 1998, Gavin and Hausmann, 1998, Keefer and Knack, 1998, Nelson and Singh, 1998, Mbaku, 1999, Fosu, 2002). Ray (1998) points out that there is no single factor for economic progress but that a combination of entities contribute to growth. The island countries have a higher degree of concern for its sluggish performance. Differences in socio-economic-political structures and performance are due to a complex range of factors, which consequently reflect poor growth dilemma, vulnerability and global challenges. The inherent economic vulnerability of the SPINs arises from exposure to adverse external shocks, structural handicaps, high degree of openness, export concentration, high dependence on imports, remoteness and high transport costs, natural disasters exacerbated by climate change and rising sea levels (Briguglio, 1995, Commonwealth Secretariat, 1997, Commonwealth Secretariat and World Bank, 2000, Armstrong and Read 2002, Gounder and Xayavong, 2002). Along with these factors the governments need to link political stability, economic policies and its timing and sequences of reforms to address various concerns of dangers of slow growth.

Many island countries have been associated with severe problems of high unemployment, inflation, inefficiencies, debt, poverty, natural disaster (prone to hurricane, cyclone, flooding) causing output volatility and economic vulnerability that hamper fragile groups. Overcoming these problems is associated with their different economic systems and political regimes. Alesina, *et al*., (1992) and Alesina and Perotti (1996) discuss extensively the macro-political-economic literature and the links between policy choices and growth. Gounder (2002, 2005) suggests that for the island economies besides growth determinants political stability, economic freedom and institutional structures based on a democratic system are vital for resource allocation, production and efficiency. So, presence of these factors smoothes the process for transition to a market economy which has been regarded to enhance economic performance. Achieving long term sustainable economic growth is thus crucial to raise capacity to supply increasingly diverse goods to its population based on industrialization, role

of agriculture, changing patterns of trade, increase application of human capital and knowledge to production and advancing technology to address output volatility.

The Development Plans utilised in many SPINS outline goals and targets to achieve growth. Each economic and social sector (agriculture, industry, services, health, education, housing etc.); allocation of resources and medium term policies and strategies are formulated for economic development. The basic development strategies are crucial to rebuild resilience as the concern in particular for island nation states is that they get disadvantaged in the emerging global economic order and some may be further marginalized in world trade, investment, commodities and capital markets (Wells, 1997). Vulnerability of small states in terms of economic and environmental threats and narrow range of policy options available to the state in response to global economic change also adds to the problems. At a fundamental level, economic achievements depend on its domestic resources and its international trade and competitiveness in the global market. At an analytical level, the overall performance of the nation depends on political-institutional-micro-macroeconomic factors.

The fragile states of the island economies experienced increased risks due to vulnerability that adversely affected output levels and economic growth. To meet its resource needs the island states rely heavily on foreign aid. Foreign aid has been utilised as a means to overcome output volatility and economic vulnerability. The concepts of output volatility-vulnerability-growth nexus are incorporated in the neoclassical growth models framework. The study is comprehensive in that we construct the output volatility and vulnerability variables that differ from the cross-section studies. In this panel data estimation for Fiji, Papua New Guinea (PNG), Samoa, Solomon Islands, Tonga and Vanuatu (only these island nations are taken due to data constraints) we calculate each country's volatility every 5-year period from 1971 to 2003 to see the variations in output growth over time. We also incorporate foreign aid and political factors in the presence of volatility and economic vulnerability to address economic growth problems. On the basis of the findings the results provide a means to address those problems.

2. ECONOMIC IMPLICATIONS AND GROWTH: THE SOUTH PACIFIC ISLAND NATIONS

The SPINs economic and social performance is assessed here in terms of the factors that may contribute to output volatility and vulnerability. These island states are scattered over a vast stretch of ocean that form part of Melanesia (PNG, Fiji, Solomon Islands, Vanuatu), Polynesia (Cook Islands, Niue, Tonga, Samoa) and Micronesia (Federated States of Micronesia, Kiribati, Marshall Islands, Tuvalu).[1] Some are very small tiny atolls and some are bigger in land area, share common characteristics in terms of atoll and tropical vegetation, proximity and similar based traditional chiefly system, colonization and its political structures, some ethnic/cultural similarities and have a wide diversity of physical and economic characteristics. The smaller nations have a large subsistence sector that make up the rural population, rely on few primary products, mainly depend on remittances for sustenance, and the resource poor isolated island atolls have a high dependency on external aid for development. They share almost all common problems of development.[2] Political and economic uncertainty, racial division, law and order problems, and ineptitude are growing problems for Vanuatu, Fiji and Solomon Islands (EIU, 2002, p. 7). Along with these factors are the effects of overpopulation, environmental degradation, natural disasters, economic weakness and corruption that add to governments' lack of capabilities becoming fragile, and some are not able to graduate out

from the least developed country status (Commonwealth Secretariat, 1997).

The economic and social development indicators presented in Tables 1 and 2 denote various different levels of development experienced by the SPINs. Fiji is relatively more affluent compared to other island economies. Its real Gross Domestic Product (GDP) per capita is higher than that of its island neighbours but PNG grew on average 2.3 percent per annum between 1990 and 1999 while Fiji grew at 1.2 percent. Other islands grew on average between 0.03 to 1.4 percent for the same period, except for Vanuatu that experienced a negative growth of 0.8 percent for the period 1990-99 (ADB, 2001). Fiji and Solomon Islands income per capita experienced a severe decline due to political crises (ibid). The implications of military coups and political unrest led to economic and social instabilities causing detrimental effects on the standard of living (i.e. poor health facilities, larger number of people living in poverty) and creating large groups of people that are vulnerable to aftermath of instabilities due to loss of assets, livelihoods, and no means to cope with impacts of adverse shocks. The SPINS have gone through substantial transformational and structural changes implementing economic and social reforms. But most of them now stand at the crossroads due to its political-economic crises and poor governance. In the recent years these nations have been faced with pressures on land issues; a low stock of skilled workers; private and foreign investment; high unemployment and squatter settlement; and ethnicity and conflict problems which impeded growth determinants that caused low capability to cope with vulnerability (Gounder, 2005).

Most of the island nations depend on tourism receipts as a major contributor to their export earnings with few primary export products such as copra, cocoa, garments, fish, gold, sugar and timber. With limited resources there is a heavy reliance on imports to meet domestic needs so they are heavily dependent on trade. Imports are generally higher than exports. Some have favoured nation status with Australia and New Zealand (South Pacific Regional Trade and Economic Cooperation) and with the European Union (Economic Partnership Agreements) that is part of the Cotonou Agreement (succeeds Lomė Convention) aimed at further integrating the region into international trading system. However, economic threats are closely linked to vulnerability of the islands via globalization, competitiveness, weak policies, money laundering and financial integrity (Commonwealth, Secretariat and World Bank, 2000). The composite vulnerability indices in Table 1 suggest that economic vulnerability has generally increased amongst the island nations. Such impacts constraint various economic activities, it thus follows that SPINs face more acute diseconomies of scale.

The high dependence on foreign aid for external resources denotes the vulnerability of the SPINs. For most of the island nations' foreign aid is a key factor in their economic growth processes to meet the foreign exchange gap, saving-investment gap and shortfall in resource needs. Aid makes up a large proportion of GDP and is allocated to the central government expenditure (Table 1). For smaller islands the existing levels of consumption and welfare can only be sustained through continuing foreign aid as the self-reliance is slipping away from the SPINs and their comparative lies not in the conventional factors such as cheap labour, copra production, fishing etc. but in the ability to attract aid, remittances or other finance.[3] The long-run commitment of aid donors to welfare of the island communities is crucial for sustainable development (Betram, 1993). Tourism has provided the islands with much needed revenue, yet high transportation costs have been a major obstacle. Limited export commodities and fluctuations in export earnings hampered by natural disasters hinder prospects for economic independence and self-sufficiency. The SPINs have implemented various donor assisted development projects and programs to create a sustainable standard of

living, but the results have been mixed. Australia and New Zealand have special relationships with the SPINs in terms of major trading partners, a larger share of capital flows (foreign investment, aid), and contribute to political, economic and social development of the islands via the regional bodies (namely, Forum Secretariat, Secretariat of the Pacific Community, Non-Government Organizations).[4]

Table 1 Socio-Economic Indicators for the South Pacific Island Nations

Country		Real GDP per capita ($) Laspyres	Exports (% of GDP)	Imports (% of GDP)	Composite Vulnerability Index	Aid (% of GDP)	Human Development Index (HDI)
Fiji	1990	5168	62.34	67.16	7.05	3.08	0.724[c]
	2002	4571	60.17	64.46	5.12	3.27	0.744[d]
	2004	4919	72.90	68.00	4.73	2.46	0.758
Papua New Guinea	1990	3248	40.63	48.95	3.00	16.11	0.570[c]
	2002	4354	72.02	62.75	5.65	13.72	0.314[d]
	2004	4492	67.93	57.37	2.01	10.59	0.523
Samoa	1990	2763	20.50	45.95	9.71	9.99	0.747[c]
	2002	3070	33.93	57.38	4.50	8.06[a]	0.590[d]
	2004	3456	36.31	56.29	3.50	9.00	..
Solomon Islands	1990	2188	46.80	72.81	7.93	29.02	0.623[c]
	2000	2012	39.62	58.96	5.60	11.35	0.371[d]
	2004	1711	41.88	44.11	4.00	12.49	0.592
Tonga	1990	3095	33.87	65.10	3.72	22.11	..
	2000	3398	14.77	49.66	4.78	17.69	0.647[d]
	2004	3196	11.22	58.22	6.32	12.61	0.815
Vanuatu	1990	2679	49.50	76.68	5.68	24.37[b]	0.624[c]
	2000	3234	42.61	56.90	7.61	22.92	0.425[d]
	2004	2873	42.90	59.40	13.13	19.35	0.670

Source: UNDP (2006, 1999).
Note: [a] value is for 1995. [b] value is for 1986. [c] HDI value is for 1997. [d] HDI value is for 1998.

The least developed nations in the South Pacific region are some of the most economically and socially disadvantaged (Tisdell, 2000). The HDI values suggest that social statistics have seen some progress among the island economies. Life expectancy at birth, the adult literacy rate, and lower infant mortality rate have improved for Fiji, Samoa, Tonga, and Vanuatu (UNDP, 1999). Its social achievements are satisfactory but problems of safe drinking water, sanitation, health facilities and schools, and the food security in outer islands are inadequate. Large proportions of the South Pacific population live in poverty. Reduction in child morality, gender equality and empowerment, combating diseases (HIV/AIDS, malaria, other diseases), and environment sustainability require urgent attention.

Table 2 presents various economic output volatility indicators for 6 island nations, 5-year averages for the period 1971-75 to 2001-03. The index calculated for output volatility shows large deviation in per capita income growth. Higher deviation in the growth rate in income per capita has been mainly due to volatility in output production in the agriculture and manufacturing sectors. Due to higher costs structures in investment of the productive sectors, infrastructure and low levels of government services have hindered growth. Higher volatility index value shows more vulnerable the country is, thus SPINs face obstacles to development and require sustainable growth to overcome economic vulnerability. High degree of openness of the economy, as seen in the trade openness index, shows the country's vulnerability to external shocks. Such shocks on the exports impact both the price and quantity of exports which affect the export earnings. The fluctuations in exports to GDP ratio (Table 1) imply the absence of adequate stabilising measures as more open the economy the uncertainty in income and investment lowers growth.

The diversification index for each nation suggests that they depend on few exported primary commodities and had very marginal rise in just few countries. Higher imports and lower exports result in trade imbalance that has affected all SPINs. The nations rely on transfers from abroad, particularly inter-governmental transfers and workers' remittances. With the problems of high debt to GDP ratios some are severely indebted. Kaminarides and Nissan (1993) point out the severity of debt problems and its effects on small islands' economic development. The SPINs prone to national disasters over time has lessened their ability to recover from such vulnerability. Foreign aid and remittances have been crucial sources that provide nations and households to meet some of the consequences of vulnerability. Pelling and Uitto (2001, p. 49) point out that "change at the global level is found to be a source of new opportunities as well as constraints on building local resilience to natural disaster where much depends on the orientation of the state in global economic and political systems".

Table 2 Economic Output Volatility Indicators for the South Pacific Nations

Country		Output Volatility	Trade Openness Index	Diversification Index	Debt (% of GDP)	Natural Disaster (ratio)
Fiji	1971-75	5.94	113.83	0.49	8.95	0.22
	1976-80	6.04	96.26	0.51	12.29	0.12
	1981-85	6.02	94.97	0.51	32.48	0.49
	1986-90	14.17	114.04	0.56	32.10	0.29
	1991-95	3.30	121.51	0.61	17.32	0.21
	1996-00	3.81	140.09	0.55	9.74	0.33
	2001-03	2.29	141.93	0.55	9.50	0.04
Papua New Guinea	1971-75	6.84	76.09	0.51	45.31	0.00
	1976-80	26.45	86.34	0.53	28.05	0.00
	1981-85	4.30	87.59	0.57	63.07	0.02
	1986-90	3.72	87.59	0.60	67.45	0.00
	1991-95	12.00	103.39	0.63	61.08	0.09
	1996-00	7.46	88.79	0.61	59.13	0.16
	2001-03	0.77	93.61	0.63	73.92	0.00
Samoa	1971-75	0.87	95.93	0.43	25.00	0.00
	1976-80	2.38	98.35	0.46	30.95	0.00
	1981-85	5.98	81.86	0.47	43.85	0.01
	1986-90	5.80	86.09	0.47	44.00	0.57
	1991-95	6.06	109.33	0.48	75.05	0.49
	1996-00	3.19	106.52	0.46	65.40	0.00
	2001-03	2.33	106.52	0.48	62.91	0.00
Solomon Islands	1971-75	11.25	74.67	0.46	9.00	0.03
	1976-80	9.74	112.49	0.48	13.22	0.03
	1981-85	7.28	141.63	0.48	21.86	0.12
	1986-90	6.27	142.53	0.48	48.94	0.48
	1991-95	8.49	115.21	0.50	45.97	0.24
	1996-00	6.72	118.39	0.49	43.39	0.00
	2001-03	6.13	118.18	0.54	68.12	0.00
Tonga	1971-75	5.90	104.66	0.45	26.00	0.01
	1976-80	4.28	95.60	0.47	32.00	0.17
	1981-85	16.65	84.86	0.46	36.08	0.50
	1986-90	4.07	95.42	0.46	40.18	0.03
	1991-95	5.74	78.50	0.49	35.05	0.00
	1996-00	2.00	79.52	0.48	39.57	0.06
	2001-03	5.09	83.64	0.48	49.09	0.16
Vanuatu	1971-75	15.12	113.95	0.47	..	0.00
	1976-80	10.03	113.95	0.47	..	0.00
	1981-85	11.37	122.22	0.47	3.99	0.92
	1986-90	5.74	116.99	0.47	12.52	0.38
	1991-95	4.18	106.39	0.47	19.22	0.07
	1996-00	5.80	114.69	0.46	23.45	0.08
	2001-03	13.22	139.57	0.46	30.87	0.34

Source: Summers and Heston (2002), World Bank (2005), UNCTAD (2005) hand book of international trade and development, EM-DAT dataset.

Notes: .. not available. Except for output volatility values all other values of the variables are taken as five year average and some missing values have been estimated based on previous years' values. Output Volatility is calculated as the standard deviation of annual rate of growth of per capita GDP. Openness is exports plus imports divided by percentage of GDP (Laspeyres). Debt/GDP is external debt to GDP. Natural Disaster is the ratio of number of people affected to total population. Diversification index is UNCTAD's diversification index (based on number of commodities exported).

The output volatility and economic vulnerability effects reduce the capacity of the Pacific Island countries, thus a severe problem facing the islands is whether the nations' have the capacity to attain development goals and meet the Millennium Development Goal (MDG) of reducing poverty by half by 2015. An obstacle to this goal is the exclusion of some ethnic communities from the benefits of development. Besides, there is growing inequality and

conflicts arising out of extreme manifestations as seen in Fiji, PNG, Solomon Islands and Tonga. As political instability and social strife have affected the performance of these countries, enhancing growth is vital to maintain social harmony and good governance. "There is a danger that the gains made in the quality of life of the people in many Pacific Islands in the last generation may be eroded in the next 15 years" (Naidu, 2005, p.1). Therefore, quality institutions are necessary to mitigate adverse effects of volatility and external shocks to address the problems of fragile groups. The issues raised here are incorporated in the models.

3. EMPIRICAL MODELS, DATA, METHODOLOGY AND RESULTS

This section presents empirical models, data and methodology used to examine the variation in output volatility and economic vulnerability in 6 South Pacific Island Nations for the period from 1971 to 2003.[5] The study uses the Generalized Method of Moments (GMM) to estimate the determinants and effects of output volatility, vulnerability and growth.[6] We also utilised two-stage least squares regression with panel corrected standard errors (see Beck and Katz, 1995) when no lags of the dependent variable are used in estimating equation (2). The data series used in the estimations meet the conditions noted by Beck and Katz (1995), i.e. the number of observations per country (T=32) is greater than the number of countries (N=6). The estimation uses a parsimonious approach, and starts by including multiple lags on all variables by dropping the insignificant variables in the final model.

Empirical Models, Data and Results

(A) Constructing the Output Volatility and Composite Vulnerability Index

To estimate output volatility and economic vulnerability the preferred model specification has been based on macroeconomic factors and the island characteristics. As a first step we construct the output volatility and vulnerability indices for each island nation taking into consideration those factors that constraint the growth processes. Given the South Pacific region's remoteness, impact of natural disasters, export dependency, external debt, few primary products in the export commodities and the characteristics of the island economies, the estimations of output volatility, economic vulnerability and growth nexus contribute to the identification of vulnerability of these nations.[7] Output volatility is calculated as the standard deviation of annual growth rates of GDP per capita of every five year averages for 6 island nations from 1971 to 2003. These values are then used as the basis for constructing composite vulnerability index (CVI).

For constructing composite vulnerability index Atkins *et al*., (2000) and Wells (1997) regression procedures have been followed. In the regression method, output volatility is taken as a proxy of volatility of a country, as GDP volatility manifests vulnerability of a country. The output volatility considered here depends on various economic and natural factors such as trade openness (TO), export dependence (ED), export diversification (DI), external debt (Debt) and natural disaster (ND). The log of output volatility values are regressed on the log of other explanatory variables mentioned above. The coefficients on the explanatory variables in the estimated equation (1) are then used to compute composite vulnerability index. The preferred model for the regression is as follows:

$$\log(\mathrm{OV}_{i,j}) = \beta_0 + \beta_1 \log(ND_{i,j}) + \beta_2 \log(Debt_{i,j}) + \beta_3 \log(To_{i,j}) + \beta_4 \log(ED)_{i,j} + \beta_5 \log(DI_{i,j}) + \varepsilon_{i,j} \quad (1)$$

where, i = 1, 2,….., N number of countries and j = 1,2,….,T, and T is time from 1971 to 2003. $\varepsilon_{i,j}$ is the error term which is assumed to be uncorrelated with mean zero and constant variance-covariance matrices $\sigma_1^2 I_n$.

The general estimated output volatility regression is as follows:

$$\log(\mathrm{OV}_{i,j}) = 6.204 + 0.227 \log(ND_{i,j}) + 0.200 \log(Debt_{i,j}) - 2.970 \log(TO_{i,j}) + 1.589 \log(ED)_{i,j} - 2.961 \log(DI_{i,j}) \quad (1a)$$

The composite vulnerability index of a country is the predicted value of output volatility which is calculated by imputing the five year average values of each explanatory variable in equation (1a), which gives the predicted volatility index for the country for that five year period. For example, the output volatility index and the composite volatility index for Fiji during the period 1971-75, have been calculated as follows:

$$\log(\mathrm{OV}_{F,01}) = 6.204 + 0.227 \log(0.22) + 0.200 \log(0.09) - 2.970 \log(50.3) + 1.589 \log(46.618) - 2.961 \log(0.49) \quad (1b)$$

The predicated value of log(OV) = 1.958. To calculate composite vulnerability index for Fiji we took the antilog of the predicated value of Fiji's log(OV), i.e. $\mathrm{CVI}_{(\mathrm{Fiji},\ 1971\text{-}75)} = 7.095$. The figures in parenthesis are the computed values of that variable for a country in that particular period. Following the same procedure the composite vulnerability index for every five year period for 6 countries have been obtained from 1971 to 2003. The coefficient of each explanatory variable expresses the expected sign and its impact on output volatility – see regression results reported in Appendix Table A1. The empirical models are presented in the penultimate section.

(B) Empirical Models for Growth-Output Volatility-Economic Vulnerability Nexus

In the next stage we estimate the growth-output volatility and growth-economic vulnerability relationship with the conditional factors of the island nations. The estimated specification to measure growth-output volatility links is as follows:

$$\mathrm{PPPY}_{i,t} = \alpha_o + \alpha_1(\mathrm{OV}_{i,t}) + \alpha_2(\mathrm{IS}_{i,t}) + \alpha_3(\mathrm{HK}_{i,t}) + \alpha_4(\mathrm{PG}_{i,t})\ \alpha_5(\mathrm{GES}_{i,t}) + \alpha_6(\mathrm{DEMO}_{i,t}) + \alpha_7(\mathrm{OPEN}_{i,t}) + \alpha_8(\mathrm{IPPPY}_i) + \alpha_9(\mathrm{PPPY}_{i,t-1}) + u_{i,t} \quad (2)$$

Equation (2) has been re-estimated with composite vulnerability index variable to measure the impact of economic vulnerability-growth nexus. To estimate the impact of external assistance to address the probelms of output volatility and economic vulnerability foreign aid is included in the specification as follows:

$$\mathrm{PPPY}_{i,t} = \gamma_o + \gamma_1(\mathrm{CVI}_{i,t}) + \gamma_2(\mathrm{IS}_{i,t}) + \gamma_3(\mathrm{AID}_{i,t}) + \gamma_4(\mathrm{PG}_{i,t})\ \gamma_5(\mathrm{GES}_{i,t}) + \gamma_6(\mathrm{DEMO}_{i,t}) + \gamma_7(\mathrm{OPEN}_{i,t}) + \gamma_8(\mathrm{IPPPY}_i) + \gamma_9(\mathrm{PPPY}_{i,t-1}) + v_{i,t} \quad (3)$$

Equations (2) and (3) include the log of the dependent and explanatory variables. The details of the data and the sources used in the estimation are presented in the Appendix Table A2. The variables denoted are as follows:

PPPY is the purchasing power parity GDP per capita
OV is output volatility
CVI is the composite vulnerability index
IS is the investment to GDP share
HK is the human capital
PG is the population growth rate
GES is the government expenditure share to GDP
DEMO is the political and civil liberty index (as democracy)
OPEN is the trade openness index
AID is the aid to GDP ratio
IPPPY is the initial purchasing power parity GDP per capita
u and v are the error terms assumed to be uncorrelated with mean of zero and constant variance-covariance matrices $\sigma_1^2 I_n$ and $\sigma_2^2 I_n$, respectively.

(C) Empirical Results

This section presents the estimated results for the links between economic volatility, vulnerability and growth for the cross country evidence from the South Pacific Island economies for the period 1971 to 2003.

(i) Output Volatility-Growth Nexus Results

The correlations between economic growth and output volatility (column 1) and with economic vulnerability (column 2) are reported in Table 3. For the 6 SPINs measured over the period 1973 to 2003, the results in Table 3 show a negative and statistically significant relationship between economic growth and output volatility. Thus, the economic performance of the SPINs is more volatile in terms of per capita GDP growth over time. Ramey and Ramey (1995) in examining a sample of 92 developing countries point out those countries with higher volatility have lower growth. In estimating the relationship between economic growth and economic vulnerability, the estimated coefficient CVI in column 2 also indicates an inverse relationship.

Table 3 Relationship between Growth and Output Volatility/Vulnerability

Independent Variable	**(1)**	**(2)**
Constant	0.068*** (3.610)	0.074*** (2.910)
Output Volatility (OV)	-0.026*** (2.590)	
Composite Vulnerability Index (CV1)		-0.030** (2.102)
Lag per capita income growth log($PPPY_{t-1}$)	0.992*** (9.796)	0.994*** (8.140)
	Wald test: $F_{(2,183)} = 73.51$	Wald test: $F_{(2,183)} = 73.51$

Note: ***, ** significant at the 1, and 5 percent level.

The estimated results suggest that SPINs are adversely affected by year-to-year volatility in growth rates that lower economic growth besides economic vulnerability characteristics that also lower growth. Given these negative impacts of output volatility and economic vulnerability on the SPINs growth, the next step takes into consideration the relationship

between growth, volatility, vulnerability and other conditioning factors and characteristics of the island nations. In particular, we include the factors of productions with issues of governance (i.e. political instability), fiscal behaviour (government expenditure) and openness of the economy (openness index).

(ii) Output Volatility, Economic Vulnerability-Growth Nexus Results

The estimated results are reported in Table 4 for the nexus between growth, volatility, vulnerability and the conditioning factors. As seen in Table 3 (columns 1 and 2), once again the results between growth and output volatility and economic vulnerability (columns 3 and 4) indicate a negative relationship affecting growth despite estimating with the conditioning factors. The results in Column (3) take into consideration the factors of production, factors for governance, fiscal response, democracy and openness with output volatility impact. The estimated results show that output volatility still has a negative impact on growth. The investment share declines and affects growth adversely, i.e. the IS coefficient is significant at the 1 percent level. With output volatility the marginal product of capital declines, thus affecting growth. Cordina (2004) in estimating economic vulnerability in both developed and developing countries notes that total factor productivity is more volatile in developing countries and has a lower per capita consumption level as resources are allocated to counteract vulnerability. Initial human capital (IHK) and population growth rates (IPG) positively impact on steady state growth in the SPINs. Inclusion of the government expenditure share (GES) positively contributes to growth. The positive contribution of GES may be used in the consumption and is not large enough to overcome output volatility.

Openness of the economy contributes to growth, this finding is similar to Easterly and Kraay (2000) where they find that terms of trade-based openness on balance has, however, a positive net pay-off for growth. Growth is dependant on the past performance of per capita income. The results of democracy (DEMO) variable that measures the level of political rights and civil liberty shows that lack of democracy adversely affected growth of the island nations. Fiji, Solomon Islands and Vanuatu have been affected by political instability, particularly in the post- 1980s period, thus negatively impacting on growth. The results provide support for the view that weakness in political rights and civil liberty increased risk to economic growth and performance. The findings are similar to that of Alesina *et al*., (1992, 1996) that more instability leads to lower growth. Political instability may in fact be an important source of volatility in output growth. State failure contributes to output volatility and economic vulnerability. The results for convergence amongst of 6 SPINs growth indicate that the notion of convergence is slow and has a very weak relationship for convergence between economies at different levels of development.

Table 4 Relationship between Growth, Output Volatility/Vulnerability

Independent Variables	(3)	(4)
Constant	-2.600*** (4.558)	-2.32*** (6.00)
Output Volatility (OV)	-0.063* (1.78)	
Composite Vulnerability Index (CVI)		-0.02* (1.713)
Investment Share (IS)	-0.466*** (5.130)	-0.379*** (3.983)
Initial Human Capital Share (HK)	0.230*** (9.791)	0.242*** (10.081)
Initial Population Growth rate (PG)	29.303*** (3.649)	40.321*** (5.220)
Initial PPP GDP per capita (IPPPY)	0.056*** (5.703)	0.054*** (5.607)
Government Expenditure Share (GES)	0.028** (6.614)	0.038*** (6.176)
Political & Civil Liberty (Democracy – DEMO)	-0.229*** (2.464)	-0.178* (1.794)
Openness (OPEN)	0.235* (1.677)	
Number of Instruments	15	15
Number of Countries	6	6
Number of Observations	186	162
Sample Period	1973-2003	1977-2003
Adjusted R^2	0.97	0.97
Wald test	$F_{(8,177)}$ =65.19	$F_{(7,154)}$ =71.34

Note: ***, **, * significant at the 1, 5 and 10 percent level.

The estimates in Column (4) show negative effect of economic vulnerability on growth. Including the composite vulnerability index variable with other conditioning factors and factors of production (as in Column 3) show similar impacts on growth. The estimated CVI coefficient is negative and statistically significant suggesting that island nations' growth are adversely affected by economic vulnerability characteristics. Thus, effects of natural disaster, debt, export dependence, trade openness and narrow export commodities reduce economic growth of 6 SPINs. Lack of investment (IS) and democracy (DEMO) adversely affect growth. Government expenditure coefficient is positive, however it does not reduce output volatility or external shocks as most expenditure is part of government consumption. The results suggest that island nations are fragile and the effects of economic vulnerability cause vulnerable groups and rise in poverty levels. The adverse shocks through openness, narrow export commodities, natural disasters, and debt reduce the income earning opportunities that affect a large group of people in the rural areas.[8] Lack of assets and other means to cope with the impact of adverse shocks due to political instability also causes poverty, squatter settlements, higher level of school drop-outs, prostitution, HIV/AIDS, etc. Island nations in the South Pacific have experienced a decline in human development indicators and poverty has increased as dismal economic and social performances of most nations will be unable to meet the MDG of reducing poverty by half by 2015.[9] The human capital, population growth and openness of the economy positively contribute to growth.

The adverse shocks and measures of fragility and vulnerability as seen in Tables 3 and 4 suggest that appropriate actions are required to overcome these problems. In doing so what options are available to the fragile island states given their poor economic performance and being affected by external shocks? To answer this question, the next step includes the variable that provides means to cope with the impact of adverse shocks. Column (5) presents the estimated results for variables similar to Table 4 and includes foreign aid variable. Given that island nations rely heavily on foreign aid to meet its resource needs and in particular during the period of economic vulnerability such as hurricanes, cyclones, droughts, the flow of aid increases to these SPINs to assist the affected people. In such a condition to measure the impact of foreign aid on economic growth is crucial to capture whether aid contributes to growth of the island nations. In particular, the study by Hughes (2003) on the role of Australian aid to the South Pacific, without any empirical investigation, suggests that aid has failed the Pacific and does not positively contribute to the island nations.[10]

In examining the role of aid to overcome the impact of adverse shocks we estimate the equations by including the share of aid to GDP ratio with economic vulnerability (Columns (5) and (6)) and with output volatility (Column 7) and the conditioning factors. It should be noted that during the period of stable and good governance aid increases to the islands, it provides resources to overcome economic vulnerability. Aid flows to the island nations were reduced during the period of political instabilities and uncertainties but increased as governments' implemented democratic legislations and governance.[11] The results in Table 5 Column (5) indicate that inclusion of foreign aid reduces the shocks of economic vulnerability and contributes positively to growth. It is seen that aid is effective in the islands due to its problems of external shocks. The results clearly indicate that aid flows to island nations support growth (Columns (5) and (6)) and reduces economic vulnerability as opposed to the results seem in Columns (3) and (4) (Table 4) where output volatility and vulnerability adversely affect growth without aid and political instability negatively affects growth.

This result is crucial for the island nations and the donor countries that aid is effective that supports growth and reduces economic vulnerability. The findings of this study confirm the results presented by Chauvet and Guillaumont (2002) for 53 developing countries that aid and vulnerability term is positively significant, thus aid is more effective in countries facing adverse shocks. Interestingly, the size of government expenditure share (GES) coefficients increases with the inclusion of aid and are positive and significant at the 1 percent level. In Columns (3) and (4) without foreign aid the estimated GES coefficient is positive and significant but the magnitude of the coefficient is much smaller compared to with foreign aid. With the flow of aid the government expenditure share increases that provides the much needed resources to the SPINs to mitigate the effects of external shocks. The investment share is positive and significant with aid in the equation that contributes to growth. As a substantial amount of aid is allocated to public investment the results imply that aid supplements government investment to reduce economic vulnerability. Population growth contributes positively to growth.

In the next step the role of aid and other conditioning factors are included to measure the impact on output volatility. The results obtained in Column (7) are similar to the estimated results in Column (6 with CVI measure) that aid smoothes off the negative effects of output volatility with increasing government expenditure, investment capital and openness of the economy. The magnitudes of all these coefficients are larger than those estimated without foreign aid (see Columns (3) and (4)). Thus, it can be said that effects of output volatility is

reduced by foreign aid that contributes positively to economic growth in the island nations experiencing output shocks. Also, with flow of foreign aid, political stability and democracy contributes positively to growth as it increases the government expenditure and government resources to address the problems of output volatility and economic vulnerability. Volatility in output also declines as the openness of the economy supported by foreign aid, government expenditure, investment, human capital and lower levels of risks and uncertainly through political and civil liberty. Political instability negatively affects growth and causes output volatility. Thus, as good governance has to prevail for aid to assist the countries to recover from poor economic performance to speed up growth enhancement and return to stability. The evidence shows that good governance in a democratic environment in fragile states can overcome the problems of economic vulnerability and output volatility with the assistance of foreign aid.

Table 5 Relationship Between Growth, Vulnerability and Foreign Aid

Independent Variables	**(5)**	**(6)**	**(7)**
Constant	-16.186*** (11.739)	-17.357*** (11.807)	-23.743*** (10.053)
Output Volatility (OV)			0.415*** (2.876)
Composite Vulnerability Index (CVI)	0.924*** (4.380)	0.942*** (4.581)	
Investment Share to GDP (IS)	0.864*** (3.114)	0.837*** (2.970)	0.954*** (3.243)
Government Expenditure Share to GDP (GES)	3.345** (7.715)	3.021*** (6.906)	3.079*** (6.898)
Population Growth Rate (PG)	18.539** (1.967)	21.615** (1.939)	22.980** (2.02)
Aid to GDP (A/GDP)	0.431*** (3.916)	0.504*** (4.515)	0.519*** (4.514)
Political & Civil Liberty (Democracy)– (DEMO)		0.661** (2.018)	0.583* (1.749)
Openness (OPEN)		0.013*** (2.926)	1.780*** (3.435)
Number of Instruments	7	8	8
Number of Countries	6	6	6
Number of Observations	198	198	198
Sample Period	1973-2003	1973-2003	1973-2003
Adjusted R²	0.472	0.489	0.467
Wald test	$F_{(7,177)} = 65.34$	$F_{(7,176)} = 70.42$	$F_{(7,176)} = 71.65$

Note: ***, **, * significant at the 1, 5 and 10 percent level.

4. CONCLUSION

This paper examines the macroeconomic growth and output volatility impact as well as the links between growth and economic vulnerability. In a sample of the South Pacific Island economies, the empirical findings show these states lower growth levels have been adversely affected by output volatility. Including various control variables we find that investment to GDP share has a negative impact on the relationship. The negative effect of volatility has been due to uncertainty in the investment share and also due to political instability. Lack of democracy increases risk and uncertainty causing volatility and lower growth. The results support the investment-based theories of the link between volatility and growth in the island nations. Political instability leads to lower growth may in fact be an important source of volatility. The government spending though is positive does not smooth out output volatility. Without foreign assistance the South Pacific economies will require a higher GDP in order to increase their ability to withstand external shocks. However, their low capacity reflects an appropriate aid policy that can have differential effects on different segments of local communities. Convergence between the economies is observed though at a slow pace. Contributions of human capital and terms of trade-based openness of the economy have positive net effects on growth.

In examining the impact of external shocks in the economic growth framework there is evidence of negative effect of economic vulnerability on growth originating from the shocks. Low investment share caused by this volatile production factor falls as its marginal productivity declines. The steady state growth is affected by such vulnerability that would reduce welfare of the fragile group. Vulnerability tends to slow down the growth rates of the island nations and also reduces the speed of convergence between economies at different levels of development. To address the problems of overcoming output volatility and economic vulnerability external assistance has been the means that island nations have relied on. To measure the effectiveness of aid where islands face external shocks the results for addressing volatility and vulnerability provide evidence that stable political environment and good governance are necessary where aid contributes positively to mitigate the effects of external shocks and output volatility. The results indicate a positive relationship between aid and growth in the Pacific. Foreign aid also provides the necessary resources for government expenditure, investment and human capital that tend to assist the effects of poor economic performance, reduces output volatility and economic vulnerability. The policy makers have to note that there is a potential to enhance economic growth and achieve some level of self-sufficiency, but that will depend on a number of preconditions being fulfilled, where good governance has to prevail to recover from poor economic performance and external shocks, sound macroeconomic management and policies to release the initiatives as foreign aid speeds up growth enhancement by overcoming external shocks and return to stability.

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Appendix Table A1 Results of Output Volatility for the South Pacific Island Nations

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant	6.204	2.827	2.194	0.038
Natural Disaster (Log (ND))	0.227	0.064	3.522	0.002
Debt (Log (D))	0.200	0.152	1.312	0.201
Trade Openness (Log (TO))	-2.970	0.992	-2.993	0.006
Export Dependence (Log(ED))	1.589	0.480	3.313	0.003
Diversification Index (Log(DI))	-2.961	1.130	-2.621	0.015
$R^2 = 0.489$, $F_{(5,25)}$ statistic = 4.601^{***}, Wald test = $\chi^2_5 = 22.980^{***}$, Observations (N) = 31				

Note: *** significant at the 1 percent level.

Appendix Table A2 Description of Variables and Data Sources

Variables	Data Source
Purchasing Power Parity Income (PPP GDP)	Heston, A., Summers, R. and Aten, B. (2002) *Penn World Table Version 6.1*.
Investment Share of GDP (%)	Heston, A., Summers,R. and Aten, B. (2002) *Penn World Table Version 6.1*.
Government Expenditure Share of GDP: Real Government & public consumption (%)	Heston, A., Summers,R. and Aten, B. (2002) *Penn World Table Version 6.1*.
Human Capital: Educational Attainment Data, - average schooling years in the total population over age 25.	**Barro**, R.J. and Lee, J.W. (1993) "International Comparisons of Educational Attainment", *NBER Working Paper No. 4349*, 1993.
Population Growth rate (%)	Heston, A., Summers, R. and Aten, B. (2002) *Penn World Table Version 6.1*.
Aid to GDP Ratio (%)	World Bank (2005) *World Development Indicators*, OECD (2005) *Geographical Distribution of Financial Flows to Aid Recipients*.
Democracy Index: political right and civil liberty index.	Freedom House http://www.freedomhouse.org/ *dataset*., 2006
Natural Disaster - Number of people affected to total population	Centre for Research on the Epidemiology of Disasters (2006), *EM-DAT data set*, Belgium.
Debt – External debt to GDP ratio (%)	World Bank (2006) World Debt Tables 2006,
Trade openness (index)	Heston, A., Summers, R. and Aten, B. (2002) *Penn World Table Version 6.1*.
Export dependence – value of good & services exported to GDP ratio (%)	World Bank (2005) World Development Indicators.
Export diversification – no. of commodities exported	UNCTAD (2002) *Handbook of International Trade & Development Statistics CD-ROM Tables*.

Endnotes

[1] For the larger resource rich islands of Melanesia there is a great potential to achieve economic independence and some level of self-sufficiency, but that "will depend on a number of preconditions being fulfilled, including sound macroeconomic management and enlightened commercial policies that help release the initiative and energies of the private sector" (Bauer, Siwatibau and Kasper, 1991, p.21).

[2] A discussion on the problems associated with the South Pacific Island states have been noted in the studies by Briguglio (1995), Commonweatlth Secretariate (2000) and Gounder and Xayavong (2002). Most of the SPINs are behind in terms of development and face grave difficulties in further attempts to develop (Cole 1993).

[3] Foreign aid is a source used for economic and social projects. Also, a feature that is most pertinent to Fiji, Samoa, Tonga and Vanuatu is the high remittances by overseas resident workers that forms a large part of the country's balance of payments.

[4] A key objective is to support development of national capacities in the economic and social development driven by national and local needs through governmental development objectives (Commonwealth Secretariat, 1997).

[5] The island countries included in the study are Fiji, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu. Inclusion of the lags of the independent variables lead to the period estimated for 32 years, i.e. 1971 to 2003.

[6] Two problems often occur when estimating in pooled cross-sectional time-series data regression, namely those of heteroscedasticity and autocorrelation. To correct for heteroscedasticity the estimation employs robust standard errors. To avoid the problem of autocorrelation the model includes lags of the dependent variable. Given the estimation period and time series procedures we have included up to four lags to control for autocorrelation in the estimation. See also Arellano and Bond (1991) for the estimation procedures.

[7] Easter (1999) notes that vulnerability manifest in a significantly greater volatility of GDP growth rates in small states, where lack of diversification, trade dependence and the impact of natural disasters affect growth. See also Atkins *et al*., (2000) on the issue of economic vulnerability effects.

[8] Over the last two decades, more people fell below the poverty line in Fiji. The quality of social indicators, such as HDI in Fiji, was relatively higher than other island nations, but its world ranking of HDI has slipped from 44th in 1996 to 66th in 1998 to 92nd in 2003 (UNDP, 2001, 2005). In comparison, Tonga and Samoa are ranked way ahead of Fiji with Tonga in 54th place and Samoa at 74th place in 2003 (UNDP, 2005). The Human Poverty Index shows that Fiji slipped in its ranking from 41st in 2001 to 49th in 2003 amongst developing nations (ibid). The presence of low incomes are seen to be contributing towards vertical and horizontal inequality, a larger number of households living in poverty, high drop out rates in primary and secondary schools, increased crime rates, destitution and depression (Gounder 2005).

[9] Following a recent poverty study by the United Nations Development Programme the Fiji Government released a *Fiji Poverty Report* in 1997 that generated great concern and anxiety with its findings that 25 percent of Fiji's households live in poverty in 1991 compared to 10 percent in 1977. The households in poverty are unable to afford an adequate basic standard of living due to varying degrees of hardships based on lack of access to opportunities. Poverty levels increased to 34.4 percent in 2002-03.

[10] Hughes (2003) concludes that the relationship between aid and growth is inverse in the Pacific as elsewhere based on the descriptive data. She makes the policy recommendation to the Australian Government to reduce aid flows to the South Pacific.

[11] This has been the case of Fiji, Solomon Islands and Vanuatu over time. See Table 2 for the actual flow of aid to GDP ratio in 1990, 2002 and 2004.