

# Foreign Aid and Labor Productivity in Fiji: An Empirical Investigation within an Endogenous Production Framework

Hong Chen<sup>a</sup> and Baljeet Singh<sup>b</sup>

University of the South Pacific, Suva, Fiji

---

**Abstract:** This paper investigates foreign aid's impact on the Fijian economy using time series data for the period 1980-2011. The empirical model is estimated using two-stage least squares and three-stage least squares to consistently assess foreign aid's impact. Results provide conclusive evidence that foreign aid and domestic factors are important in explaining output in Fiji.

*Keywords:* foreign aid, labor productivity, endogeneity, simultaneous equations model

*JEL Classification:* F35, O47, C36

---

## 1. Introduction

There are extensive literature that identifies positive correlation between foreign aid and economic growth. In theory there are two channels through which aid causes economic growth. Firstly it finances saving investment gap, and secondly it provides foreign reserves to finance domestic imports particularly in developing countries where export base is relatively weak. Many developing countries lack domestic saving to finance domestic investment, hence foreign aid provides resources to finance critical domestic infrastructure and assist in up skilling human capital. Developing countries also suffer from unfavorable terms of trade while foreign aid assists to finance import bill particularly import of the capital input. Some of studies which found positive effect of aid on economic growth are Snyder (1993), Karras (2006), McGillivray et al. (2006), Feeny and Ouattara (2009), Fisher (2009) and Feeny and McGillivray (2011).

Contrarily the second stream of views believe that foreign aid can cause loss of self-reliance, give rise to unnecessary government expenditure, rent seeking, corruption, excessive capital output ratio and other inefficiency, and hence retard economic growth. For instance, Friedman (1958) argued that foreign aid fell short of achieving its anticipated goal as it contributed to large government sector of the local economies. Similarly, Bauer (1972) claimed that aid was directed through the recipient government and then to the local economies, and that politicians had incentive of using the aid for political motive rather than productive investment. Empirically, Levy (1984) in a study over Egypt for 1960-77 found that cost of foreign aid was more than the perceive benefits as most of aid was used to finance government consumption rather than capital investment. Tiwari (2011) identified negative effect of foreign aid on economic growth in 28 Asian countries in a panel framework. Yang et al. (2013), in a recent growth empirics study, found that more aid led to slower growth in 39 small economies over the period 1992-2008. Similar argument and empirical evidence can also be found in Boone (1996), Easterly (1999) and

Brautigam and Knack (2004). Furthermore, some studies found that foreign aid did not have significant impact, either positive or negative, on economic growth (Mosely 1980, Jensen and Paldam 2006, and Doucouliagos and Paldam 2009).

Intense debate over the aid-growth nexus gave birth to the third school of thoughts which argues that aid is only effective under certain conditions. For instance, Burnside and Dollar (2000) examined the relationship between aid, economic policies and growth of GDP per capita within a cross-country framework for a large number of countries. The authors argued that aid positively affected growth in presence of good government policies. Chatterjee and Turnovsky (2005) provided a theoretical framework and argued that growth effect of foreign aid depended on structural characteristics of the recipient country and whether aid was tied to investment activity. Islam (2005) found aid was more effective in countries with better political stability. Heckelman and Knack (2009) argued that aid's positive growth effect was conditioned on a favorable policy and institutional environment. Djankov et al. (2008) argued that if aid had no conditionalities attached, governments had little incentive to use aid effectively. Similar argument can be seen in studies such as Isham and Kaufman (2000), Collier and Dollar (2002), and Ali and Isse (2005).

However, the third view also receives criticism. A number of researchers found evidence against the claim of Burnside and Dollar (2000). For instance, Lensink and White (2000) argued that productivity of aid varied significantly from place to place and time to time as aid took place in many forms, e.g. building schools and infrastructure, emergency aid, training aid, etc, and that these different forms of aid would have varying impact on economic growth. They noted that studies based on pooling cross country data assumed productivity was constant for all countries and hence failed to effectively capture the aid-growth relationship. They further argued that Burnside and Dollar's study casted doubt on reliability of result as only limited robustness test were carried out. Dalgaard and Hansen (2001) argued that Burnside and Dollar formulated a growth model in which interplay between foreign aid and good policy was conceptually ambiguous, and that positive sign on aid-policy interaction in their model was due to omitted variables bias. Similar view is also shared by Ram (2004).

Almost all these studies discussed in the above context used cross-country regressions. While there is generally lack of consensus on effectiveness of foreign aid on economic growth from cross country regression analyses, it is imperative to conduct individual country studies within a sound theoretical framework to quantify foreign aid's impact on economic performance as it is likely to be recipient specific. A number of time-series studies can also be found in the literature. For instance, Mbaku (1993), based on a neoclassical framework, did not find evidence of positive growth effect of foreign aid in Cameroon over 1971-1990. However, Giles (1994) applied different time series techniques to Mbaku's Cameroon data and found evidence that foreign aid led growth in Cameroon.

Growth effect of foreign aid has also been assessed in the Pacific context. Feeny (2005) examined effect of foreign aid on economic growth in Papua New Guinea (PNG) over 1965-

1999 within an ARDL framework, but no evidence was found that foreign aid as a whole should enhance economic growth in PNG. In his study, though Feeny noted that investment was endogenous in his model specification and the importance of controlling for the endogeneity problem, but he did not make proper effort to control for endogeneity bias. This may have resulted in the biased finding that investment was not important in explaining economic growth in PNG. Feeny's conclusion on aid being exogenous for case of PNG may not be solid, because the analysis did not follow a standard procedure to address endogeneity. The ARDL model adopted in Feeny (2005), which simply includes lagged variables, is incapable in addressing the endogeneity issue since lagged variables are not sufficiently exogenous if corresponding variables are potentially endogenous, exactly as Feeny stated in the same study, the ARDL approach is not sufficient to correct for biased estimates caused by endogeneity.

Aid's effect on economic growth for Fiji was extensively studied in Gounder (2001). Gounder considered various forms of foreign aid, such as total aid, grant aid, loan aid, technical cooperation grant aid, bilateral and multilateral aid flows, in the neoclassical Solow growth model, but found non-robust results particularly on the effects of domestic resource factors namely investment, labor force and exports. The implausible findings by Gounder (2001) can be caused by reasons as follows. The first reason is the inappropriate model specification and incorrect estimation technique. In Gounder's work, the ARDL cointegration test framework was employed to assess aid's impact. However, without looking at the cointegration rank, she continued the analysis using the single equation framework with the pre-assumption that there was only unidirectional causality. Secondly, endogeneity of aid is widely discussed in the aid-growth nexus literature. See, for example, Mosley (1980), Ali and Isse (2005) and Feeny (2005). However, Gounder did not discuss on this issue and directly took ARDL estimation results for short-run and long-run effects. Thirdly, Gounder's analysis was based on a relatively small sample of 29 observations (1968-1996), which is likely to yield instable results. All these led to inconsistent and biased estimates of the overall regressors included in Gounder's analysis.

Given the above quick glance of existing literature, the current study makes a significant contribution to the aid's impact literature, particularly on looking at individual aid recipient countries using time series data, by taking into account the insight that foreign aid might be endogenous due to the possible bidirectional causation between foreign aid and economic growth, and therefore carefully testing for and controlling for the endogeneity problem in order to yield consistent estimates.

This paper uses time series data for the period 1980-2011 to examine whether foreign aid causes economic output in case of Fiji. Evidenced by the Johansen cointegration test that there are more than one cointegration relationship among variables under study, Hausman test and Hansen J test are further employed to identify endogenous variables in the model assessing GDP per capita in Fiji. Instrumental variables estimators such as two-stage least squares and three-stage least squares are therefore employed to correctly assess aid's impact.

The rest of the paper is organized as follows: Section 2 provides a brief overview of Fiji. Section 3 describes the model and data. Section 4 discusses methodology, in particular on how to detect and control for endogeneity. Section 5 summarizes empirical findings. And Section 6 draws conclusions and policy suggestions.

## **2. A Brief Overview of Fiji**

As a former colony of Great Britain, Fiji gained independence in 1970 and chose a parliamentary system of government. Fiji is one of the most populated and developed South Pacific island countries. It is classified as middle income country by the World Bank. However, four military coups have established this nation as one of the most politically unstable countries in the Pacific region.

The Fijian economy comprises of subsistence and commercial sector and it is one of the largest industrialized economies among the Pacific island countries (PICs). On average Fiji has performed well in terms of human development index in the Asia-Pacific region. Fiji is also likely to achieve most of its millennium development target except for eradicating extreme poverty. Relative to other small Pacific island economies, Fiji has a greater manufacturing capacity and reasonably developed human resources.

The economy of Fiji is greatly reliant on the exploitation of natural resources such as tourism, agriculture (primarily sugar, coconut, ginger, rice and other staple food), forestry, fisheries and mining. The economy is also supported by numerous small imperatives like manufacturing trade and retail sector. Trade is essential for Fiji because it promotes the economy and helps reduce poverty.

Over the last four decades, economic growth in Fiji has been mixed with short series of both excessive and at times sharply reduced outputs. During the course of first decade, Fiji generally experienced a modest positive economic growth after independence. However after the 1987 coup, Fiji has recorded very low economic growth rate on average, and various reform policies instituted by the government have failed to produce high economic growth achieved in 1970's. The private and public sector investment remains relatively low, and the sluggish economic performance remains problematic. Fiji's economic growth has now generally lagged behind other PICs. Once an envy of the Pacific, the Fijian economy only managed an average real GDP growth of 1.28 percent over the past decade 2001-2010.<sup>1</sup> Moreover, poverty in Fiji increased from 15% in 1976/1977 to 34.4% in 2008/2009 largely attributed to poor economic performance and series of devaluation of Fiji dollar.<sup>2</sup>

With regards to foreign aid inflows, like many developing countries, Fiji has been receiving development assistance (including grants, concessional loans, technical assistance and other official flows such as international fund credits). Bilateral aid makes more than 90 percent of total aid with Australia and Japan as the major donors. Development assistance has contributed

substantially to the growth of Fiji's economy. The principal inputs have been into infrastructure, but some of development assistance flows have probably given higher returns at the margin. Development assistance contributes to develop labor force's skills by improving education level and providing training in Fiji and abroad. However, as a matter of fact, among the PICs, Fiji received lowest foreign aid per capita in the region.

Table 1 presents the trends of official development assistance and official aid (ODA & OA) received by Fiji over 1970-2011. Average ODA & OA per capita at 2005 constant prices declined dramatically yet with fluctuations from US\$155.23 in 1970-1979 to US\$60.16 in 2000-2011. It is clear that the total amount as well as per capita amount declined substantially over time since 1970s.

### 3. Model and Data

To investigate whether foreign aid helps to enhance the Fijian economic performance, a neoclassical production function is employed in the current study:

$$GDP = A_0 e^{\gamma X} K^\alpha L^{1-\alpha} \quad (1)$$

where  $GDP$  is aggregate gross domestic products,  $K$  is physical capital,<sup>3</sup>  $L$  is labor input, and  $X$  is a vector of factors that contribute to enhancing either efficiency or technology. Foreign aid is one of the  $X$ s. We shall note that human capital is not considered in the model given incomplete time series data on human capital measures including schooling years, secondary school enrolment rate, R&D and number of patents. Total population, rather than officially reported labor force, is used as labor force in the current paper due to the fact that the informal sector plays a significant role in the Fijian economy.

Dividing both sides of Equation (1) by labor force yields GDP per capita as a function of the capital-labor ratio:

$$GDPPC = A_0 e^{\beta X} KPC^\alpha \quad (2)$$

where  $GDPPC$  is GDP per capita ( $GDP/L$ ),  $KPC$  is physical capital per capita ( $K/L$ ). Take natural logarithms of the preceding equation to have a linear form of production function:

$$\ln GDPPC = a + \alpha \ln KPC + \beta X + \varepsilon \quad (3)$$

In the current study we have identified two controlling factors for the  $X$  vector, namely, foreign aid and trade openness. Key time series used in this study therefore include

- $\ln GDPPC_t$ , the natural logarithmic GDP per capita at 2005 prices;
- $\ln KPC_t$ , the natural logarithmic capital stock per capita at 2005 prices;

- $\ln AIDPC_t$ , the natural logarithmic per capita net official development assistance and official aid received at 2005 prices; and
- $TRADER_t$ , trade-to-GDP (%).

Other relevant series that are utilized to explain the above key time series include

- $\ln DCTP_t$ , the natural logarithmic domestic credit to private sector at 2005 prices;
- $\ln GNIPC_t$ , the natural logarithmic gross national income per capita at 2005 prices;
- $\ln EXR_t$ , the natural logarithmic exchange rate (Fijian dollars per US dollar); and
- $realr$ , real interest rate (percent).

The sample covers a period of 1980-2011. Apart from gross fixed capital formation, which is used to estimate capital stock, is obtained from the World Bank database and Fiji Bureau of Statistics, the other series are obtained from the World Bank database. Sample statistics for core variables are summarized in Table 2.

## 4. Methodology

### 4.1 Long-run Effects and Short-run Disequilibrium

To avoid spurious regression results when investigate the long-run relationship(s) between GDP per capita and other series defined in the above, we use Phillips-Perron unit root test for each series' integration order and Johansen test for cointegration relationship(s). The two tests are described in the Appendix.

If we don't find evidence for cointegrating relationships, we can only assess short-run effect from a vector autoregressive model. If we find evidence of cointegrating relationships, long-run effect can be obtained by estimating the following model,

$$\ln GDPPC_t = a + \alpha \ln KPC_t + \beta_1 \ln AIDPC_t + \beta_2 TRADER_t + \varepsilon_t \quad (4)$$

And short-run disequilibrium can be examined through a vector error correction model (VECM):

$$\Delta \ln GDPPC_t = \phi + \sum_{j=1}^P \zeta_j \Delta \ln GDPPC_{t-j} + \sum_{i=1}^K \sum_{j=0}^P \xi_{ij} \Delta X_{j,t-i} + \eta \hat{\varepsilon}_{t-1} + e_t \quad (5)$$

where  $X_j$  refers to  $KPC$ ,  $AIDPC$  and  $TRADER$ , and  $\hat{\varepsilon}_{t-1}$  is one lag of the cointegrating error estimated from Equation (4). The maximum number of lags  $p$  can be determined by using Akaike information criterion, Schwarz criterion or Hannan-Quinn criterion. Long-run equilibrium between  $Y$  and  $X$ s will be evidenced by a negative sign of the error correction

coefficient  $\eta$ , which captures the adjustment rate at which a short-run disequilibrium can be corrected.

## 4.2 Endogeneity

It is likely that an economy's performance and domestic macroeconomic environment can have influence on capital input, and the same for foreign aid. This should be taken into account when we investigate capital input and aid's impact on the Fijian economy. In terms of econometric modeling, this can be firstly evidenced by multiple cointegration relationships, and secondly by tests for endogeneity. Therefore, following cointegration test, testing for the endogeneity problem and correcting for it are important in quantitative analysis, because least squares estimators in the presence of endogeneity problem will result in biased and inconsistent estimates. Instrumental variables (IVs) estimators should be applied instead if endogeneity is detected.

IVs estimation procedure is essentially two steps of least squares regression. Suppose in Equation (4)  $X_K$  is an endogenous variable, i.e.  $X_K$  is correlated with the error  $\varepsilon_t$ , the first stage least squares regression will have  $X_K$  as the dependent variable, while independent variables include all exogenous  $X_{i,i \neq K}$  as internal instrumental variables and other variables not incorporated in Equation (4),  $Z_s$ , as external instrumental variables:

$$X_{K,t} = \gamma_0 + \sum_{i=1}^{K-1} \gamma_i X_{i,t} + \sum_{l=1}^L \theta_l Z_{l,t} + v_t \quad (6)$$

The first stage produces a predicted series of  $X_K$ ,  $\hat{X}_K$ . The second stage of least squares estimation of Equation (4) with  $\hat{X}_K$  replacing  $X_K$  yields  $\varepsilon_t^*$  which is now uncorrelated with regressors including  $\hat{X}_K$ . The second stage regression will yield unbiased estimates given the other assumptions of a classical linear regression model are met. The whole estimation procedure is therefore called two-stage least squares (2SLS) estimation.

The choice of an instrumental variable  $Z$  should be made based on the fact that it makes 2SLS estimators more efficient than least squares estimators. This requires that  $Z$  should be a strong instrument, namely, it is strongly correlated with  $X_K$  but not correlated with  $\varepsilon_t$ . 'When using a weak instrument, the instrumental variables estimator can be badly biased, even in large samples, and its distribution is not approximately normal.' (Hill *et al* 2011, p411) Strength of instrumental variables can be assessed in the first stage regression by testing whether external instrumental variables  $Z_s$  jointly have statistically significant effect on  $X_K$ , which can be decided by an  $F$  or  $Chi$ -sq test. Instrumental variables estimation in a general model, where there are more than one endogenous explanatory variable, also requires that the number of external instrumental variables,  $L$ , should be no less than the number of endogenous explanatory variables,  $B$ . When  $L = B$ , there are just enough IVs to conduct the IV estimation, and parameters are just indentified,

i.e. parameters can be just consistently estimated; when  $L > B$ , the model is said to be overidentified, i.e. we have more instrumental variables than are necessary for the IV estimation. There are a few tests have been developed in the literature to test for overidentification of instruments, i.e. a joint null hypothesis that the excluded instruments are valid instruments. Among those tests, the Sargan test applies when errors are homoskedastic, while Hansen's  $J$ -test applies when errors are heteroskedastic.  $Sargan\ stat = u'Pu/(u'u/N)$ , where  $u$  is the residuals from the IV estimation,  $P = Z \cdot inv(Z'Z) \cdot Z'$ ,  $Z$  is full set of excluded instruments,  $N$  is the number of observations.  $Sargan\ stat$  follows *Chi-squared* distribution with  $L - B$  degrees of freedom (Wooldridge 2002, p123). Under the assumption of conditional homoskedasticity, Sargan's statistic becomes Hansen's  $J$  statistic (Hayashi 2000, p227).

The question now is how to test whether an explanatory variable  $X_K$  is endogenous. Tests for this purpose are under the null that  $X_K$  is exogenous, i.e.  $H_0: X_K$  is uncorrelated with  $\varepsilon_t$ ,  $cov(X_K, \varepsilon) = 0$ . The logic of the tests is to see whether the estimated residual from Equation (6),  $\hat{v}_t$ , is significant in the following auxiliary equation:

$$\ln GDPPC_t = a + \sum_{i=1}^k \beta_i X_{i,t} + \omega \hat{v}_t + \varepsilon_t \quad (7)$$

where  $X_i$  refers to  $KPC$ ,  $AIDPC$  and  $TRADER$ . The null of exogeneity is now equivalent to test for significance of  $\hat{v}_t$ , i.e.  $H_0: \omega = 0$ . This can be tested using the  $t$  test in Equation (7). In a general model where there are more than one variable is tested for endogeneity, an  $F$  test can be used to test for the null of joint significance of the coefficients on the included residuals. There are several forms of the test which is generally called the Hausman test in the literature.

## 5. Empirical Results

### 5.1 Functional Form

Phillips-Perron unit root tests show that all series utilized in the current study are individually integrated of order one, and the Johansen cointegration test suggests that there are at maximum three cointegrating relationships among them. The OLS estimation of Equation (4) was tested for autocorrelation, heteroskedasticity, functional form, normality of the residuals and multicollinearity. No problems were identified except autocorrelation and heteroskedasticity. An autoregressive model is accordingly developed and to be estimated with an estimator which should be able to yield statistics robust to heteroskedasticity:

$$\ln GDPPC_t = a + \alpha \ln KPC_t + \beta_1 \ln AIDPC_t + \beta_2 \ln TRADER_t + \beta_3 \ln GDPPC_{t-1} + \varepsilon_t \quad (8)$$

## 5.2 Endogeneity and Validity of Instruments

The existence of three cointegration relationships among variables in Equation (4) indicates the presence of endogeneity problem. Instrumental variables estimators are employed to identify and control for the endogeneity problem. The choice of instruments should be made with great caution, because coefficients on problematic regressors are sensitive to instruments chosen, particularly in the current case that there is more than one endogenous regressor in the equation (see evidence in the context below). Apart from variables included in Equation (8) that are used as instruments, external relevant variables which are not included in the equation are also taken into account to explain endogenous regressors. Relevancy of included external instruments is individually checked by the Lagrange multiplier test of redundancy.

Overidentification of instruments and endogeneity are firstly tested individually by investigating models where only one regressor is tested for endogeneity in each model, and then jointly by investigating a general model where all identified endogenous regressors are jointly tested for endogeneity. Since the errors from Equation (8) are heteroskedastic, the Hansen J test is adopted to test for the null that external instruments are uncorrelated with the error term in Equation (8) and can be consistently estimated.

Table 3 summarizes Hansen J statistics for overidentification of external instruments. Since the observed Sargan statistics are all less than *Chi-sq* critical value for 1 degree of freedom at the 5% level, we do not reject the null, either individually or jointly. Therefore there is strong evidence that external instruments for corresponding potentially problematic variables are valid instruments.

Table 4 presents Durbin-Wu-Hausman test statistics for null of exogeneity. The Durbin-Wu-Hausman test compares the IV estimates and OLS estimates to determine whether they are close enough. If they are, there is insufficient evidence to reject the null hypothesis of exogeneity of regressor(s). As shown in Table 4, since the observed Durbin-Wu-Hausman *Chi-sq* statistics for endogeneity test on  $TRADER_t$  and  $\ln GDPPC_{t-1}$ , 1.195 and 1.067, are respectively less than the critical value for 1 degree of freedom at the 5% level, 3.84, we fail to reject the null that these three explanatory variables are individually uncorrelated with  $\varepsilon_t$ . Therefore, there is enough evidence that  $TRADER_t$  and  $\ln GDPPC_{t-1}$  in Equation (8) are exogenous. However, the Durbin-Wu-Hausman *Chi-sq* statistics for  $\ln KPC_t$  and  $\ln AIDPC_t$ , 3.322 and 5.832, are respectively greater than the 10% and 5% critical values for 1 degree of freedom of 2.706 and 3.841, we reject the null that these two explanatory variables are exogenous. A joint null that  $\ln KPC_t$  and  $\ln AIDPC_t$  are simultaneously exogenous is further rejected by the joint exogeneity test, since the observed Durbin-Wu-Hausman statistic of 6.642 exceeds the 5% critical value for 2 degrees of freedom at the 5% level, 5.991.

### 5.3 Long-run effects and short-run disequilibrium

Our analysis finds that  $\ln GDPPC_t$ ,  $\ln KPC_t$  and  $\ln AIDPC_t$  are endogenous in the model assessing foreign aid's impact on per capita GDP for Fiji. Based on information summarized in Tables 3 and 4, foreign aid's impact should therefore be estimated through the following simultaneous equations system:

$$\ln GDPPC_t = a_y + \alpha_{GDP} \ln KPC_t + \beta_{GDP,1} \ln AIDPC_t + \beta_{GDP,2} TRADER_t + \beta_{GDP,3} \ln GDPPC_{t-1} + \varepsilon_{GDP,t} \quad (9)$$

$$\ln KPC_t = a_K + \alpha_K \ln GDPPC_{t-1} + \beta_{K,1} \ln KPC_{t-1} + \beta_{K,2} realr_t + \varepsilon_{K,t} \quad (10)$$

$$\ln AIDPC_t = a_A + \alpha_A \ln GDPPC_t + \beta_{A,1} \ln GNIPC_t + \beta_{A,2} \ln DCTP_t + \varepsilon_{A,t} \quad (11)$$

Two-stage least squares and three-stage least squares (3SLS) estimators are employed to assess per capita GDP in Fiji. Differences between 2SLS and 3SLS estimators are as follows: (1) The 2SLS estimation is based on estimating a reduced form equation, it therefore does not provide clear idea of channels for aid's impact. However, it is important to identify how foreign aid affects the economy 'before something reasonable can be said about the aid policy-growth relationship' (Lensink and White 2000, p4). The 3SLS estimator is able to provide intuition regarding how foreign aid affects the other control factors in the growth equation and how these factors in turn affect foreign aid. (2) The 3SLS estimation is based on estimating the equations simultaneously, it therefore allows more accurate allocation of internal and external instruments for individual endogenous regressors and hence yields more consistent estimates. Our analysis finds only slight difference between the 2SLS and 3SLS estimates in accordance to the differences between the two estimation techniques, which can therefore be taken as extra evidence of correct specification of our model. Moreover, evidence of robust estimates is also found by using different sets of explanatory variables in the main equation (9).<sup>4</sup>

Table 5 summarizes estimation results from 2SLS and 3SLS regressions, where long-run relationships among per capita GDP, per capita capital and per capita foreign aid are consistently estimated.

To answer research questions proposed in the above context, we find strong evidence of long-run effect of foreign aid on poverty reduction in Fiji. The 2SLS and 3SLS estimators yield similar estimates for the  $\ln GDPPC$  equation. Discussion of results is based on the 3SLS estimator since it provides estimates for the  $\ln KPC$  and  $\ln AIDPC$  equations simultaneously. Specifically, a 10 percent increase in foreign aid per capita will increase GDP per capita by around 0.62 percent  $(=(1+0.1)^{0.065}-1)$ , given other factors remaining unchanged. This effect is statistically significant at the 10% level. More importantly, we note that there is strong evidence that foreign aid is associated with Fiji's economic performance, per capita gross national income, and

domestic investment environment for the private sector. Recognition of this makes assessing economic effect of foreign aid more intuitive with regards to searching for solutions to enhance aid's positive impact.

We also note that there is inverse effect of GDP per capita on capital per capita. Controlling for this inverse effect yields the capital share of 0.274, suggesting a 10 percent increase in capital stock per capita leads to around 2.65 percent  $(=(1+0.1)^{0.274}-1)$  increase in output per capita.

Moreover, openness measured by trade-to-GDP is found to have some influence on reducing poverty in Fiji. The magnitude of 0.003 suggests that a 10 percentage point increase in trade-to-GDP promotes GDP per capita by around 3.05 percent  $(=EXP(0.003*10)-1)$ . This effect is highly statistically significant at the 1% level.

Short-run effects of aid on per capita GDP in Fiji and short-run disequilibrium can be further identified by assessing the vector correction model Equation (5) with two lags of each explanatory variable included. The final VEC model for the  $\ln GDPPC$  equation is reported as follows:

$$\begin{aligned} \Delta \ln \hat{GDPPC}_t &= 0.009 + 0.74 \Delta \ln KPC_t - 0.70 \Delta \ln KPC_{t-2} + 0.03 \Delta \ln AIDPC_t \\ t-stat &= (1.02) \quad (2.03) \quad (-2.29) \quad (1.02) \\ &+ 0.001 \Delta TRADER_t - 0.65 \hat{\varepsilon}_{t-1} \\ t-stat &= (1.69) \quad (-3.62) \\ n = 31 \quad \bar{R}^2 &= 0.3488 \end{aligned} \tag{12}$$

As we shall see, in the short run, changes in foreign aid do not lead to changes in GDP per capita, while changes in capital per capita and trade-to-GDP do affect economic growth. The error correction term is highly significant, suggesting that growth of per capita GDP reacts to the cointegrating error. The coefficient of -0.65 indicates that the annual adjustment of per capita GDP will be about 65% of the deviation of per capita GDP in previous year from its cointegrating relationship, that is, on average 65% of disequilibrium will be corrected within one year.

## 6. Conclusions

Foreign aid is an important external financing source for small developing countries to enhance education and transport infrastructure. However, as noted by many researchers such as Burnside and Dollar (2000), foreign aid is effective in promoting economic growth only when recipient countries have good macroeconomic policy environment. Fiji as a small island country has received a relatively big amount of official development aid relative to its gross domestic products. Yet, following same trend of global development aid flows, foreign aid flows to Fiji have been declining from since 1970s, with average ratio of official development assistance and

official aid in GDP reduced from 6.03 percent in 1971-1980 to 1.69 percent in 2001-2010. This should raise attention regarding how to efficiently utilize foreign aid.

The current study used the neoclassical production function where official development aid and official aid is incorporated to explain per capita GDP in Fiji. The empirical analysis evidences significant contribution of capital input, openness and foreign aid to the Fijian economy, with the recognition that capital input and foreign aid are endogenous. We further identified that donors' decision on amount of official development aid to Fiji is subject to Fijian's economic performance, per capita gross national income and domestic investment environment for the private sector. Recognition of this shall be well established before we assess aid's impact on the Fijian economy, only through which we are able to tell how aid works effectively to enhance the economy. Our finding suggests that foreign aid not only works to reduce poverty directly, but also supplements insufficient domestic private investment.

Under the situation that official development aid flows are declining worldwide, which becomes an overwhelming global trend, the Fijian government should think of an alternative foreign financing source to maintain the benefits brought by official development aid. An alternative could be foreign investment, which is also greatly influenced by the Fijian domestic investment environment and governance level.

## Endnotes

The authors would like to thank the editor and anonymous referees for helpful comments.

- a. Corresponding author: Hong Chen, Senior Lecturer, School of Economics, University of the South Pacific, Laucala Bay Road, Suva, Fiji. Email: chen\_h@usp.ac.fj.
- b. Baljeet Singh, Lecturer, School of Economics, University of the South Pacific, Laucala Bay Road, Suva, Fiji. Email: singh\_bl@usp.ac.fj.
1. Unless stated, figures presented in this study come from authors' calculation based on data from World Bank database and Fiji Bureau of Statistics.
2. Data source: Ministry of Finance (2009) Joint Annual Report 2007 on the Development Cooperation between Republic of Fiji Islands and the European Commission, page 6.
3. Physical capital stock is estimated based on gross fixed capital formation using the perpetual inventory method. The benchmark capital stock in 1963 is estimated by eight times of multiplying gross fixed capital formation in 1963, and depreciation rate is set to 6 percent per year.
4. As argued by Lensink and White (2000, p4) that 'A regression coefficient is said to be robust if it does not change too greatly as either model specification or sample are change.' Auxiliary regressions for stability tests are not reported but available upon request.

## References

- Ali, A.M. and H.S. Isse.** 2005. "An Empirical Analysis of the Effect of Aid on Growth," *International Advances in Economic Research*, 11, 1–11.
- Burnside, C. and D. Dollar.** 2000. "Aid, Policies and Growth," *American Economic Review*, 90 (4), 847-858.
- Bauer, P.T.** 1972. "Dissent on Development: Studies and Debated in Development Economics," Cambridge: *Harvard University Press*.
- Boone, P.** 1996. "Politics and Effectiveness of Aid," *European Economic Review*, 40, 289-329.
- Brautigam, D. A. and S. Knack.** 2004. "Foreign Aid, Institutions, and Governance in Sub-Saharan Africa," *Economic Development and Cultural Change*, 13, 255-285.
- Chatterjee, S. and S.J. Turnovsky.** 2005. "Financing Public Investment through Foreign Aid: Consequences for Economic Growth and Welfare," *Review of International Economics*, 13(1), 20-44.
- Collier, P. and D. Dollar.** 2002. "Aid Allocation and Poverty Reduction," *European Economic Review*, 46 (8), 1475–1500.
- Dalgaard, C.J. and H. Hansen.** 2001. "On Aid, Growth and Good Policies," *Journal of Development Studies*, 37 (6), 17-41.
- Djankov, S., J.G. Montalvo, and M. Reynal-Querol.** 2008. "The Curse of Aid," *Journal of Economic Growth*, 13, 169-194.
- Doucoulagos, H. and M. Paldam.** 2009. "Conditional Aid Effectiveness: A Meta-Analysis," *Journal of International Development*, 21 (7), 1582-1601.
- Easterly, W.** 1999. "The Ghost of Financing Gap: Testing the Growth Model Used in International Financial Institutions," *Journal of Development Economics*, 60, 423-438.
- Feeny, S.** 2005. "The Impact of Foreign Aid on Economic Growth in Papua New Guinea," *Journal of Development Studies*, 41 (6), 1092-1117.
- Feeny, S. and M. McGillivray.** 2011. "Scaling-Up Aid: Will the 'Big Push' Work?" *The World Economy*, 34 (1), 54-73.
- Feeny, S. and B. Ouattara.** 2009. "What Type of Economic Growth Does Foreign Aid Support?" *Applied Economic letters*, 16, 727-730.
- Fischer, A.M.** 2009. "Putting Aid in Its Place: Insights from Early Structuralists on Aid and Balance of Payments and Lessons for Contemporary Aid Debates," *Journal of International Development*, 21, 856-867.
- Friedman, M.** 1958. "Foreign Economic Aid: Means and Objectives," *Yale Law Review*, 47, 24-38.
- Giles, J.** 1994. "Another Look at the Evidence on Foreign Aid Led Economic Growth," *Applied Economics Letters*, 1, 194-199.
- Gounder, R.** 2001. "Aid-Growth Nexus: Empirical Evidence from Fiji," *Applied Economics*, 33, 1009–19.

- Heckelman, J.C. and S. Knack.** 2009. "Aid, Economic Freedom, and Growth," *Contemporary Economics Policy*, 27 (1), 46-53.
- Isham, J. and D. Kaufman.** 2000. "How Policies and Institutions Affect Project Performance," in Gilbert and Vines (eds.), *The World Bank: Structure and Policies*, New York: Cambridge University Press, p. 228-265.
- Islam, M.** 2005. "Regime Changes, Economic Policies and the Effect of Aid on Growth," *Journal of Development Studies*, 41 (8), 1467-1492.
- Jensen, P. S. and M. Paldam.** 2006. "Can the Two New Aid-Growth Models Be Replicated?" *Public Choice*, 127 (1/2), 147-175.
- Karras, G.** 2006. "Foreign Aid and Long-Run Economic Growth: Empirical Evidence for A Panel of Developing Countries," *Journal of International Development*, 18, 15–28.
- Lensink, R. and H. White.** 2000. "Assessing Aid: A Manifesto for Aid in the 21<sup>st</sup> Century?" *Oxford Development Studies*, 28 (1).
- Levy, V.** 1984. "The Savings Gap and the Productivity of Foreign Aid to A Developing Economy: Egypt," *Journal of Developing Areas*, 19, 21-34.
- Mbaku, J.M.** 1993. "Foreign Aid and Economic Growth in Cameroon," *Applied Economics*, 25, 1309-1314.
- McGillivray, M., S. Feeney, N. Hermes, and R. Lensink.** 2006. "Policy Arena: Controversies over the Impact of Development Aid: It Works; It Doesn't; It Can, But that Depends," *Journal of International Development*, 18, 1031-1050.
- Mosley, P.** 1980. "Aid, Savings and Growth Revisited," *Oxford Bulletin of Economics and Statistics*, 42 (2), 79–95.
- Ram, R.** 2004. "Recipient Country's 'Policies' and the Effect of Foreign Aid on Economic Growth in Developing Countries: Additional Evidence," *Journal of International Development*, 16, 201-211.
- Snyder, D.W.** 1993. "Donor Bias towards Small Countries: An Overlooked Factor in the Analysis of Foreign Aid and Economic Growth," *Applied Economics*, 25, 481-488.
- Tiwari, A.K.** 2011. "Foreign Aid, FDI, Economic Freedom and Economic Growth in Asian Countries," *Global Economy Journal*, 11 (3), 1-26.
- Yang, Y.Z., H. Chen, S. Singh, and B. Singh.** 2013. "The Pacific Speed of Growth: How Fast Can It Be and What Determines It?" IMF Working Paper No. 13/04.

**Table 1. Official Development Assistance and Official Aid Received by Fiji over 1970-2011 (2005 Constant Prices)**

Period	ODA & OA (US\$1,000)		Per Capita ODA & OA (US\$)	
	Amount	% change	Amount	% change
1970-1974	77793.31	n.a.	143.14	n.a.
1974-1979	100214.50	28.82	167.31	16.88
1980-1984	93794.24	-6.41	141.40	-15.49
1985-1989	82294.13	-12.26	114.30	-19.16
1990-1994	76014.45	-7.63	102.08	-10.69
1995-1999	52045.38	-31.53	65.84	-35.50
2000-2004	44172.13	-15.13	54.10	-17.84
2005-2009	53201.84	20.44	63.68	17.70
2010-2011	57499.97	8.08	66.53	4.48

**Table 2. Summary Statistics of Key Variables over 1980-2011**

	Mean	Standard deviation	Minimum	Maximum
$GDPPC_t$ (2005 constant prices,	3130.04	374.37	2553.52	3698.37
$KPC_t$ (2005 constant prices, US\$)	6712.19	1087.10	5361.69	8806.60
$AIDPC_t$ (2005 constant prices,	88.75	36.28	35.16	176.21
$TRADER_t$ (%)	112.02	14.37	81.14	135.42

**Table 3. Hansen J Test for the Null Hypothesis of Overidentification of External Instruments**

	External Instruments	$\chi^2$ stat	$p$ -value
<i>Individual endogeneity test</i>			
$\ln KPC_t$	$\ln KPC_{t-1}, \ln GDPPC_{t-2}, realr$	1.684	0.431
$\ln AIDPC_t$	$\ln GNIPC_t, \ln DCTP_t, Polity2$	0.760	0.383
$TRADER_t$	$\ln EXR_t, TRADER_{t-1}$	1.619	0.203
$\ln GDPPC_{t-1}$	$\Delta \ln GDPPC_{t-2}, \Delta \ln KPC_{t-1}$	0.504	0.478
<i>Joint endogeneity test</i>			
$\ln KPC_t$ and $\ln AIDPC_t$	$\ln KPC_{t-1}, \ln GNIPC_t, \ln DCTP_t, Polity2$	1.300	0.522

5% level critical values:  $Chi\text{-}sq(1) = 3.841$ ,  $Chi\text{-}sq(2) = 5.991$

10% level critical values:  $Chi\text{-}sq(1) = 2.706$ ,  $Chi\text{-}sq(2) = 4.605$

**Table 4. Durbin-Wu-Hausman Test for the Null Hypothesis of Exogeneity**

Variable	$\chi^2$ stat	p-value
<i>Test for individual endogeneity</i>		
$\ln KPC_t$	3.322	0.068
$\ln AIDPC_t$	5.832	0.016
$TRADER_t$	1.195	0.274
$\ln GDPPC_{t-1}$	1.067	0.302
<i>Test for joint endogeneity</i>		
$\ln KPC_t$ and $\ln AIDPC_t$	6.642	0.036

5% level critical values: *Chi-sq* (1) = 3.841, *Chi-sq* (2) = 5.991  
10% level critical values: *Chi-sq* (1) = 2.706, *Chi-sq* (2) = 4.605

**Table 5. Long-Run Relationships among GDP, Capital Stock and Foreign Aid in Fiji over 1980-2011**

Regressors	$\ln GDPPC_t$	$\ln GDPPC_t$	$\ln KPC_t$	$\ln AIDPC_t$
	(2SLS)	(3SLS)	(3SLS)	(3SLS)
	Coeff. (z-stat)	Coeff. (z-stat)	Coeff. (z-stat)	Coeff. (z-stat)
Constant	-0.055 (-0.10)	0.042 (0.05)	-0.304 (-1.55)	16.491 (3.84) ***
$\ln KPC_t$	0.271 (2.99) ***	0.274 (2.44) ***		
$\ln AIDPC_t$	0.070 (2.56) ***	0.065 (1.77) *		
$TRADER_t$	0.003 (4.45) ***	0.003 (3.23) ***		
$\ln GDPPC_{t-1}$	0.635 (6.55) ***	0.623 (4.51) ***		
$\ln KPC_{t-1}$			0.830 (22.78) ***	
$\ln GDPPC_{t-2}$			0.228 (4.79) ***	
<i>Real interest rate<sub>t</sub></i>			-0.002 (-3.17) ***	
$\ln GDPPC_t$				-3.283 (-3.74) ***
$\ln GNIPC_t$				1.099 (5.55) ***
$\ln DCTP_t$				0.263 (1.79) *
Sample size	32	32	32	32
Centred $R^2$	0.9048	0.9070	0.9913	0.7400
Root MSE	0.0366	0.0362	0.0142	0.2059

Note: \*, \*\*, \*\*\* represent variables are significant at 10%, 5% and 1% level respectively.

## Appendix

### A.1 Unit Root Test

To avoid spurious regression result when investigate the long-run relationship(s) between GDP per capita and other series defined in the above, we first test for unit root of each variable using the following equation:

$$\Delta V_t = \alpha + \delta T + \rho V_{t-1} + \sum_{i=1}^m \rho_i \Delta V_{t-i} + u_t \quad (\text{A1})$$

where  $\Delta$  is the first difference operator,  $V$  is each individual variable, and  $T$  is time trend. Inclusion of constant  $\alpha$  and/or time trend should be based on the observation that whether the series has a drift or time trend. The number of lagged difference terms to include should be enough to make the error term serially uncorrected. Evidence of unit root for each variable is found if the null hypothesis of  $\rho = 0$  is not rejected, otherwise we have evidence that  $V$  is stationary, i.e.  $I(0)$ . If  $V$  is non-stationary, we test for unit root of first difference of  $V$ , and  $V$  is said to be integrated of order one, i.e.  $I(1)$  if  $\Delta V$  is stationary. This test is called the augmented Dickey-Fuller (ADF) test, which proposes  $\tau$ -statistic. Phillips and Perron (1988) use the Newey–West (1987) heteroskedasticity- and autocorrelation-consistent covariance matrix estimator, and propose two alternative statistics ( $\tau$ -statistic and  $\rho$ -statistic) which are robust to serial correlation. The critical values for the Phillips–Perron test are the same as those for the ADF test.

Using the formula  $\text{int}\{4(n/100)^{2/9}\}$  three Newey–West lags are used to calculate the standard error. We find that the Phillips-Perron test statistics for levels of variables under consideration are greater than the 5 per cent critical value, and therefore the null of unit root is not rejected for all variables. We find test statistics are less than 5 per cent level critical values for the first differences of variables, and therefore the null of unit root is reject in favor of the alternative of stationarity. This leads us to conclude that all variables described in the above are each integrated of order one, i.e.  $I(1)$ .

**Table A1. Phillips-Perron Test for Unit Root**

	Level ( $V_t$ )				First difference ( $\Delta V_t$ )			
	Newey- West lags	Trend	$\tau$ -stat	5% critical value	Newey- West lags	Trend	$\tau$ -stat	5% critical value
<i>lnGDPPC</i>	2	constant	-0.496	-2.980	2	none	-7.996	-1.950
<i>lnKPC</i>	2	trend	-1.291	-3.572	2	none	-2.717	-1.950
<i>lnAIDPC</i>	2	constant	-1.914	-2.980	2	none	-5.757	-1.950
<i>TRADER</i>	2	constant	-1.938	-2.980	2	none	-5.910	-1.950
<i>realr</i>	2	constant	-1.192	-2.980	2	none	-4.997	-1.950
<i>lnGNIPC</i>	2	constant	-2.603	-2.980	2	none	-4.740	-1.950
<i>lnDCTP</i>	2	constant	-0.589	-2.980	2	none	-4.319	-1.950

## A.2 Cointegration Test

If variables under study are integrated of order one, we shall further find out whether there are cointegration relationships among these variables. We use Johansen's (1988, 1991) approach, which uses the maximum likelihood procedure to determine the presence of cointegrating vectors. This procedure is based on the following vector autoregressive (VAR) model:

$$\Delta V_t = C + \sum_{i=1}^p \Gamma_i \Delta V_{t-i} + \Pi V_{t-1} + \varepsilon_t \quad (\text{A2})$$

Here,  $V$  is a  $(K + 1) \times 1$  vector of  $I(1)$  variables and  $C$  is a constant. The information on the coefficient matrix between the levels of the stock price series is decomposed as  $\Pi = \gamma\delta'$ , where the relevant elements of the matrix are the adjustment coefficients and the  $\delta$  matrix contains the cointegrating vectors. Johansen and Juselius (1992) recommend the trace test and the maximum eigenvalue test statistics to determine the number of cointegrating vectors.

Before undertaking the Johansen test for cointegration, we must first perform the lag specification tests. In other words, the first step in our cointegration analysis is to determine the number of lags,  $p$ , of our VAR model, which can be decided by using Akaike information criterion, Schwarz criterion or Hannan-Quinn criterion. We report the results for cointegration based on the trace statistic in Table A2. When testing the null hypotheses of no cointegration ( $r = 0$ ), maximum one cointegration ( $r \leq 1$ ) and maximum two cointegrations ( $r \leq 2$ ), trace statistics exceed corresponding 5% critical values leading to rejection of the null hypotheses. However, the trace statistic for the null of maximum three cointegration relationships ( $r \leq 3$ ) is less than the 5% critical value. Therefore, we can conclude that there are at maximum three cointegrating relationships among variables under study.

**Table A2: Cointegration with Trends in the VAR**

$H_0$	$H_1$	Trace	5% Critical Value
$r = 0$	$r = 1$	64.45	47.21
$r \leq 1$	$r = 2$	40.93	29.68
$r \leq 2$	$r = 3$	18.51	15.41
$r \leq 3$	$r = 4$	1.24*	3.76