Foreign Aid and Economic Growth: A Cointegration Test for Cambodia

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Abstract: Recent studies have shown that foreign aid can have either a positive or a negative impact on economic growth. Due to this lack of general consensus the effectiveness of foreign aid for economic growth remains a contentious issue. This paper estimates a structural VECM for the period 1971-2009 and examines the long-run relationship between foreign aid and economic growth of an aid-dependent Asian economy, Cambodia. Johansen cointegration test indicates a significantly positive long-run effect of foreign aid on economic growth of Cambodia for the period of study.

Keywords: *Unit Root Test, VECM, Time-Series, Cointegration Test, Long-Run Effects*

1. Introduction

Cambodia, a South-East Asian developing economy, despite growing at nearly 3.5% annually during the last four decades and close to 8% on average during the past ten years, continues to remain heavily dependent on foreign aid; average annual foreign aid inflows into Cambodia during the period 1971-2009 amounted to over 9% of its GDP. Over the past few years, the country has become a member of some major trading blocs, most notably; the WTO and ASEAN amongst others, in order attract foreign investment and other forms of foreign capital for sustainable economic development in the region. Although there has been a steady inflow of foreign capital into Cambodia and many other developing economies with increasing trade liberalization and financial deregulation, there appears to be a lack of general consensus on the effectiveness of foreign aid for economic growth. Recent studies that have examined the role of foreign aid in stimulating long-run economic growth of aid-dependent economies through both country-specific and cross-sectional analyses have produced results that are mixed and mostly inconclusive; a re-examination of the effectiveness of foreign aid for economic growth has, therefore, gained increasing importance lately. This study investigates the long-run impact of foreign aid on economic growth of Cambodia. Trade openness and domestic investment are other variables included as potential determinants of economic growth. A review of empirical literature is provided in Section 2; the data source and model specification are discussed in Section 3; the results of the unit root test, cointegration test, long-run dynamics and model diagnostics are discussed in Section 4; concluding remarks and policy implications are presented in Section 5.

2. Literature Review

Studies have shown that foreign aid can have both positive and negative effects on long-run economic growth. Some notable studies that have reported a positive impact of foreign aid on economic growth include Murty et al. (1994), Levy (1998), Hansen and Tarp (2001) and Gounder (2001) amongst others. The positive effect is commonly attributed to loan conditionalities and good monetary, fiscal and trade policies (Burnside and Dollar, 2000). Studies that have reported a negative impact of foreign aid on economic growth include Nyoni (1998), Barro and Lee (2002), Mallik (2008). Foreign aid can work against development in countries with a bad policy environment (Burnside and Dollar, 2000) and very low human capital (Kosack and Tobin, 2006). Burke and Ahmadi-Esfahani (2006), on the other hand, reported an insignificant aid-growth relationship.

The Model: This study estimates the Mallik (2008) aid-growth model specification. The variables in the model are foreign aid, domestic investment, trade openness (as percentages of GDP) and real GDP. The variables are indexed as AID, INV, OPN and GDP. Annual data on the four variables (in natural logarithmic form) are used for the period 1971-2009. Foreign aid is the net total disbursements received from all donor countries. Domestic investment is the value of all fixed assets owned by the households, businesses and the government. It is measured as the difference between the new or existing assets and the disposed. The trade openness index is constructed by dividing the sum of exports and imports by nominal GDP. It indicates the degree of trade liberalization of an economy. Foreign aid, domestic investment and trade openness are measured in U.S. dollars at current prices and current exchange rates. Real GDP is measured in U.S. dollars at constant 2005 prices and exchange rates. It serves as a measure of economic growth over time. The data source is UNCTAD Statistics. A multivariate VECM following Johansen (1991, 1995) is estimated with k lags of the form:

$$(1) \quad \Delta Y_t = Z + \alpha \beta Y_{t-1} + \sum_{i=1}^{k-1} \Pi_i \Delta Y_{t-i} + \varepsilon_t$$

Where,

$$(2) \quad \Pi_i = - \sum_{j=i+1}^k A_j$$

In equation (1), Y_t is a 4 x 1 vector of endogenous variables $\ln GDP$, $\ln INV$, $\ln OPN$ and $\ln AID$; Z is a 4 x 1 vector of parameters; α and β are 4 x r matrices with rank r; ε_t is a vector of disturbances with mean zero. In equation (2), A_j is a 4 x 4 matrix of parameters.

3. Results

The cointegrating relationships are identified within Johansen (1995) framework. If the number of cointegrating equations is r, then at least r^2 restrictions are necessary to determine the free parameters. In equation (1), the short-run coefficients are contained in matrix Π_i and the long-run coefficients in matrix β . The adjustment coefficients are contained in matrix α . The VECM in (1) is estimated with a linear time trend in the levels of the data. The analysis involves four steps: first, the Dickey Fuller-Generalized Least Squares (DF-GLS) unit root test proposed by Elliott et al. (1996) is performed to determine the stationarity of each variable; second, the Schwartz Bayesian Information Criterion (SBIC) is used to determine the optimum number of lags for VECM estimation; third, the Johansen cointegration test is performed with the optimum lag-length (selected by SBIC) in order to determine the existence of cointegrating relationships between the variables; finally, the VECM is estimated with the optimum lag-length and the rank of the cointegrating matrix in order to examine the long-run effects.

Unit Root Tests: The DF-GLS test is performed at levels and first differences (with trend) to determine the stationarity of each variable. The optimum lag-length is determined by either (1) the minimum of modified Akaike Information Criterion (MAIC) or Schwartz Criterion (SC) or (2) Ng-Perron Sequential t-test criterion. The DF-GLS test statistics and the optimum lag-length at which the test has been performed for each variable are reported in Table 1. As the results indicate, by taking the first difference, the null hypothesis of a unit root is rejected at one or more significance levels; the variables are, thus, integrated of order one.

Table 1: Unit Root Test Level Form

	DF-GLS with Trend	Optimum Lag
$\ln GDP$	- 1.02	1
$\ln INV$	- 1.31	1
$\ln OPN$	- 1.99	1
$\ln AID$	- 2.08	2

First Difference

	DF-GLS with Trend	Optimum Lag
$\Delta \ln \text{GDP}$	- 3.66**	1
$\Delta \ln \text{INV}$	- 5.54***	1
$\Delta \ln \text{OPN}$	- 3.08**	5
$\Delta \ln \text{AID}$	- 3.37**	4

Johansen Cointegration Test: Since the optimum lag-length selected by SBIC is one, the Johansen cointegration test is performed with one lag. The trace statistic of 8.55 (the bold faced entry in Table 2) is less than the 5% critical value of 15.41 corresponding to a maximum rank 2; thus, at least one cointegrating relationship is identified between the four variables. The test results are reported in Table 2.

Table 2: Johansen Cointegration Test

Maximum Rank	Eigenvalue	Trace Statistic	5% Critical Value
0	-	80.01	47.21
1	0.68	37.12	29.68
2	0.53	8.55	15.41
3	0.20	0.01	3.76

Long-Run Effects: Since the maximum rank of the cointegrating matrix identified by the Johansen test is two, two restrictions are placed on each cointegrating equation for estimating the free parameters. Following those restrictions, two coefficients are estimated for the real GDP equation – that of foreign aid and trade openness (the restrictions being placed on real GDP and domestic investment). Table 3 reports the coefficients for the equation describing the long-run relationship between foreign aid, trade openness and economic growth.

Table 3: Long-Run Dynamics

	Coefficients	$P > z $
$\ln \text{GDP}$	1	-
$\ln \text{INV}$	-	-
$\ln \text{OPN}$	- 0.92 (0.11)***	0.000
$\ln \text{AID}$	0.32 (0.07)***	0.000
constant	- 2.91	-

The results indicate that the long-run effect of foreign aid is significantly positive on economic growth. For every 1% rise in foreign aid (in proportion to GDP), real GDP of the nation rises by 0.32%. According to Burnside and Dollar (2000), foreign aid can have a significantly positive impact on economic growth of countries with good monetary, fiscal and trade policies and better institutions. According to Mallik (2008), a larger fraction of foreign aid when utilized for the expansion of production capacities in domestic industries may also result in a positive aid-growth relationship. The cointegration test results further indicate that the long-run effect of trade openness on economic growth is significantly negative. Numerous studies have illustrated that the impact of trade openness on economic growth is largely ambiguous and the results vary according to the specific form of the openness index being adopted in the study. In general, there is mixed evidence of the effectiveness of trade openness for economic growth. For instance, Dollar (1992), Sachs and Warner (1995) and Edwards (1998) found significantly positive growth effects of trade openness. Harrison (1996) and Rodríguez and Rodrik (2001), on the other hand, expressed doubts on the significance and robustness of the relationship between economic growth and trade openness. Due to market and institutional imperfections, if greater trade openness causes underutilization of resources and specialization in the technologically less advanced and non-increasing

returns sectors, then economic growth may decline over time (Chang, Kaltani and Loayza, 2009). If trade-to-GDP ratio is adopted as a measure of trade openness as in this study, then an increase in trade openness will most likely result in a decline in economic growth as long as imports exceed exports (due to a rise in trade deficit). For Cambodia, throughout the period 1971-2009, imports exceeded exports on average by nearly 10.25% of GDP. For an economy that is so heavily dependent on imports, greater openness to international trade that results in a substantial increase in imports relative to exports may lead to a decline in economic growth over time.

Model Diagnostics: The VECM diagnostics are reported in Table 4. For a model with 4 endogenous variables and 2 cointegrating equations, the eigenvalue stability condition (ESC) estimate show that the VECM has imposed no more than 2 unit moduli; thus, the stability condition is satisfied. The LM chi-square test statistic of 13.16 is less than 10% critical value of 23.52; thus, the model fails to reject the null hypothesis of no autocorrelation at lag order at the 10% significance level. This also rules out the possibility of any model misspecification. The Jarque-Bera chi-square test statistic of 1.65 is less than the 10% critical value of 4.61, and the skewness and kurtosis chi-square test statistics of 0.02 and 1.63, respectively, are less than the 10% critical value of 2.71; thus, the model fails to reject the null hypothesis of normally distributed errors at 10% significance level. The ECM coefficient of -0.14 has the expected negative sign and is also statistically significant at 1% level, thereby indicating rapid adjustment toward long-run equilibrium.

Table 4: Model Diagnostics

Test Statistic	χ^2	P > z
LM Lag 1	13.16	0.661
Jarque Bera	1.65	0.439
Skewness	0.02	0.899
Kurtosis	1.63	0.202
Short-Run Dynamics	Adjustment Coefficient	P > z
ECM _{t-1}	- 0.14 (0.03)***	0.000
R ² : 0.51		
VECM Unit Moduli for Eigenvalue Stability: 2		

4. Conclusion

Using dynamic cointegration analysis this paper has examined the long-run effectiveness of foreign aid for economic growth of a heavily aid-dependent Asian economy, Cambodia. The Johansen cointegration test identified cointegrating relationships between the variables. The long-run effect of foreign aid on economic growth is significantly positive. As studies have shown, aid contributes to positive economic growth if it is channelized toward expansion of productivity in domestic industries such that it boosts output and economic growth. The long-run effect of trade openness on economic growth is, however, significantly negative. The negative correlation between trade openness and economic growth may be observed for countries that are heavily dependent on imports. If imports continue to exceed exports with greater openness to international trade over a considerable period of time, then the growth effects of trade openness will most likely be negative due to a rise in trade deficit that lowers real GDP. Based on the results of this study it is suggested that foreign aid, in general, will most likely have a significantly positive impact on economic growth of aid-dependent economies if it is directed toward the expansion of growth promoting industrial sectors. If trade-to-GDP ratio is used as a measure of trade openness, then greater participation in international trade when complemented with export promotion industrial policies and development of import-substituting manufacturing industries will expectedly raise economic growth of Cambodia and other aid-dependent economies in the long-run. This study focused on Cambodia. As a more general case it might be interesting to extend the cointegration analysis adopted in this study from country-specific to panel analysis for a group of heavily aid-dependent economies.

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Endnotes

1. *, **, *** in tables 1, 3 and 4 indicate coefficients and test statistics that are significant at 10%, 5% and 1%, respectively.
2. the LM chi-square test statistic reported in Table 4 corresponds to 16 degrees of freedom.
3. the Jarque Bera chi-square test statistic reported in Table 4 corresponds to 2 degrees of freedom.
4. the skewness and kurtosis chi-square test statistics reported in Table 4 correspond to 1 degree of freedom.