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The impact of trade openness on the incomes of four South East Asian countries before and after the Asian financial crisis

Vatthanamixay Chansomphou
Graduate School for Internatinal Development and Cooperation, Hiroshima University

Masaru Ichihashi
Graduate School for Internatinal Development and Cooperation, Hiroshima University

Abstract

The purpose of this study is to present a robust estimation of trade openness in four South East Asian countries—Indonesia, Malaysia, the Philippines, and Thailand—before and after the Asian financial crisis, using time series analysis. We use the co-integration technique with a structural break developed by Carrion-i-Silvestre and Sanso (2006) to estimate the elasticity of trade openness that affects GDP per capita in the long run. The results show that the trade openness of Thailand performs better than that of the other three sampled countries both before and after the crisis. For Indonesia and Malaysia, trade openness also has a significant positive influence on income per capita, but this impact is relatively smaller than that of Thailand. The trade openness of the Philippines seems to perform better than that of Malaysia before the crisis, but after the crisis, trade openness lowers income per capita. Therefore, we think that Thailand might be a good example of how to make trade work for other developing countries.

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Contact: Vatthanamixay Chansomphou - vatthanamixay@hiroshima-u.ac.jp, Masaru Ichihashi - ichi@hiroshima-u.ac.jp.
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1. INTRODUCTION

The impact of trade openness on economic growth has been discussed by policymakers and academics for more than half a century. However, economists have paid more attention to this issue since many developing countries switched their trade policies from being inward-oriented to being outward-oriented. The rapid pace of development in many developing countries, especially newly industrializing countries, has grown confidence that trade openness can spur growth. In parallel to the changing face of economic structures, voluminous theoretical and empirical studies on the trade–growth relationship have also been carried out. Many such studies have claimed that trade openness positively influences growth (see Edwards, 1992, 1997; Sachs and Warner, 1995; Wacziarg, 2001). Others have warned, however, that it might be too early to conclude the positive effects of trade. Extensive discussion on this issue can also be found in the works of Krugman (1994), Rodrik (1995a, 1995b), and Thirlwall and Pacheco-López (2008).

The debate is still ongoing, and different studies have considered various aspects and factors in examining the trade–growth nexus. One aspect that has attracted particular attention is the impact of trade liberalization on growth. The studies in this vein have often taken into account the effect of regime shift on trade openness. On one hand, studies such as Santos-Paulino (2002), Santos-Paulino and Thirlwall (2004), and Wacziarg and Welch (2008) have employed a dummy variable to capture the effect of trade liberalization (regime shift) on export–import performance. On the other hand, some researchers have rather examined the effect of trade liberalization on economic convergence and growth (i.e., Slaughter, 2001; Parikh and Shibata, 2004). Although these studies have concluded the positive impact of trade liberalization on growth based on the significance of the dummy variable, they have not provided information on how the effect of trade openness changes after a regime shift occurs.

In this paper, we take a different approach to analyze the trade–growth relationship, by considering the different effects of trade openness on economic performance before and after a financial crisis. We assess four South East Asian countries, namely Indonesia, Malaysia, the Philippines, and Thailand, that encouraged trade and financial liberalization during the 1980s in the hope of accelerating their levels of economic growth. Not long after liberalizing trade, they became the fastest growing economies in the world because of the improvement in their trade openness policies (Athukorala, 2004).[1] However, these economies were affected severely by the eruption of the Asian financial crisis in mid-1997, and their growth rates of per capita income have since slowed considerably (see Figures 1, 2, 3, and 4 at the end of this paper).

[1] See also Jomo and Tan (2006), Lim and Bautista (2006), and Nidhiprabha (2006).

To serve our objective, we use a time series analysis to analyze the impact of trade openness in each sampled country. Specifically, we employ a co-integration technique that detects the presence of a structural break, as developed by Carrion-i-Silvestre and Sanso (2006). This method is suitable for analyzing small sample sizes and overcoming the endogeneity problem of variables. The remainder of the paper is organized as follows. Section 2 outlines the conceptual model and estimation methodology. Section 3 provides the empirical results, and Section 4 presents the conclusion.

2. ESTIMATING THE IMPACT OF TRADE LIBERALIZATION ON ECONOMIC GROWTH

2.1 Conceptual framework

Let us consider a Cobb–Douglas production function:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \tag{1}$$

where Y is production, A is technology level, K is capital stock, and L is labor force. t indicates time.

We then assume that the level of technology is a function of trade openness and financial development. Financial development is based on two factors. First, most empirical works based on endogenous growth theory have tended to assume that financial development is among the major factors that affect long-run growth. Second, and more importantly, we include this variable to ensure the existence of co-integration among the variables. The level of technology can thus be written in the following form:

$$A_t = B \cdot (OPEN_t)^{\theta_1} \cdot (FIN_t)^{\theta_2} \tag{2}$$

where B is a time-invariant constant, $OPEN$ is the index of trade openness, and FIN is the index of financial development. Substituting (2) into (1) yields:

$$Y_t = B \cdot (OPEN_t)^{\theta_1} \cdot (FIN_t)^{\theta_2} \cdot K_t^{\alpha} L_t^{1-\alpha} \tag{3}$$

Because we do not have the data on the capital stock of our sampled countries, for empirical purposes we follow Mallick (2002) by assuming that:

$$\dot{K}_t = I_t - \delta K_t$$

At the steady state, $\dot{K}_t = 0$; therefore, $K^* = \frac{1}{\delta} I^*$. Substituting this into the production function (3), we can write the steady-state income per capita as:

$$Y^* = B \cdot (OPEN^*)^{\theta_1} \cdot (FIN^*)^{\theta_2} \cdot \frac{1}{\delta^{\alpha}} (I^*)^{\alpha} (L^*)_t^{1-\alpha} \quad Y^* = \frac{1}{\delta^{\alpha}} (I^*)^{\alpha} (A_t L_t^*)^{1-\alpha} \tag{4}$$

where asterisk (*) refers to the steady-state level of the variable.

Dividing both sides by L^* and taking logs, the model can be expressed as:

$$\log(y)^* = C + \theta_1 \log(OPEN)^* + \theta_2 \log(FIN)^* + \alpha \log(i)^* \tag{5}$$

where $C = \log(\frac{B}{\delta^{\alpha}})$, which is a constant term. y is income per capita and i is aggregate investment per capita.

Equation (5) implies that the steady-state income per capita is determined by the levels of trade openness, financial development, and investment per capita.

2.2 Econometric methodology

2.2.1 Estimation of long-run relationship with the presence of a structural break

In this section, we introduce the test of co-integration for the series with a structural break developed by Carrion-i-Silvestre and Sanso (2006). With the presence of one or many structural breaks, the standard tests of co-integration fail to capture the existence of co-integration. Carrion-i-Silvestre and Sanso (2006) suggested the use of the dynamic ordinary least squares (DOLS) approach developed by Stock and Watson (1993) to estimate the models with the possibility of a structural break and the presence of endogenous regressors. In addition, the use of DOLS is superior to other time series techniques in that it is efficient even when the variables are integrated in different orders. Furthermore, it can tackle the simultaneity among the regressors and can be used for small sample sizes (Stock and Watson, 1993).

In order to serve our purpose, we adopt the model with regime shift proposed by Carrion-i-Silvestre and Sanso (2006) to test for co-integration with the possibility of a structural break. The DOLS of Stock and Watson (1993) with a structural break (DOLS with regime shift model) applied to our model can be written as:

$$\log(y_t) = \mathbf{AX_t} + \gamma_1 DU_t + \mathbf{BX_t} \times DU_t + \sum_{j=-n}^{j=+n} \boldsymbol{\beta}_{\mathbf{j,k}} \Delta \mathbf{X_{t-j}} \tag{6}$$

where

$\mathbf{A} = [C, \theta_1, \theta_2, \alpha]'$ is a vector of long-run coefficients.

$\boldsymbol{\beta} = [\beta_1, \beta_1, \beta_1]'$ is a vector of coefficients of led and lagged $\Delta\mathbf{X}$.

$\mathbf{B} = [\delta_1, \delta_2, \delta_3]'$ is a vector of the coefficients of $\mathbf{X_t} \times DU_t$.

$\mathbf{X_t} = [1, \log(OPEN), \log(FIN), \log(i)]$ is a vector of independent variables.

DU is dummy variable that captures the structural break effect. This variable takes the value of 1 during the period after the crisis occurred, and 0 otherwise.

To test the existence of co-integration, Carrion-i-Silvestre and Sanso (2006) proposed a test of the null hypothesis (H_0), which is reversed to other methods of the test of co-integration, against the alternative hypothesis (H_A) of no co-integration, as follows:

H_0: There is co-integration among variables.

H_A: There is no co-integration among variables.

They proposed the use of the Lagrange multiplier (LM) statistic to test the null hypothesis of co-integration. If the computed LM statistic is greater than is the critical value, the null hypothesis is rejected. The LM statistic (*SC*) is given by:

$$SC(\lambda) = T^{-2}\hat{\omega}^2 \sum_{t=1}^{T} S_t^2 \tag{7}$$

where

$\lambda = T_b / T$ (T_b is the time period after the break occurred; T is the total time period).

$S_t = \sum_{j=1}^{t} \hat{e}_j, \{\hat{e}_t\}_{t=1}^{T}$, $\hat{e}_t$ is the estimated residual derived from equation (6).

$\hat{\omega}^2$ is a consistence estimator of the long-run variance of $\{\hat{e}_t\}_{t=1}^{T}$. The long-run variance can be estimated using the Bartlett kernel method. The critical values of the LM statistic can be obtained from Carrion-i-Silvestre and Sanso (2006) (Table 2, Model D).

2.2.2 The effects before and after the crisis

After the co-integration test is performed, and if co-integration exists among the variables, the long-run relationship can be found by assuming that, at the steady state, $\Delta\mathbf{X} = 0$. The long-run relationship of the variables is thus:

$$\log(y_t) = \mathbf{AX_t} + \gamma_1 DU_t + \mathbf{BX_t} \times DU_t$$

Before the crisis, the effect of a one-unit change in the variable is:

$$\frac{\partial \log(y_t)}{\partial \mathbf{X}} = \mathbf{A}$$

After the crisis, the effect of a one-unit change in the variable is:

$$\frac{\partial \log(y_t)}{\partial \mathbf{X}} = \mathbf{A} + \mathbf{B}$$

3. EMPIRICAL RESULTS

All data employed in this study (except the domestic credit provided to the private sector in Indonesia) are annual data from World Bank (2011). The data on Malaysia, Thailand, and the Philippines cover the period 1960–2009. For Indonesia, the data cover 1976–2009 (because of the lack of data on the domestic credit provided to the private sector before 1976). GDP and investment are at constant 2000 prices. These data are then divided by total population to turn them into a per capita format. The proxy for trade openness is the ratio of trade (imports plus exports) to GDP. The proxy for financial development is the ratio of domestic credit provided to the private sector to

GDP. For Indonesia, the data on domestic credit provided to the private sector come from the Asian Development Bank's key indicators of developing Asian and Pacific region countries.

Before estimating the long-run relationship of equation (5) using the Stock–Watson DOLS model, we check for the existence of a unit root in the series. We use Akaike Information Criteria and Schwarz Information Criteria to choose the optimum lag. Both suggest the use of a one-year lag for all variables. The results of the unit root test are reported in Table A1 in the Appendix. The test reports that all series are non-stationary at level, but are stationary after the first difference, which implies that they are integrated in the order 1, I(1).

3.1 Long-run relationship and co-integration

After testing for the order of integration in the series, we proceed by estimating the co-integration of the variables. The estimation results of equation (5) using DOLS are reported in Table A2. Before discussing the long-run relationship among the variables, we present the existence of co-integration among the variables. Table 1 reports the test of co-integration using the LM statistic.

The results of the LM statistic show that the null hypothesis of co-integration cannot be rejected at a 99% significant level for all countries. This indicates that long-run relationships among the variables for all countries exist.

Table 2 shows that, for Indonesia, trade openness and investment per capita are significant at 5% and 1%, respectively. For Malaysia, trade openness, financial development, and gross investment per capita are significant at 5%, 1%, and 1%, respectively. For the Philippines, trade openness, financial development, and gross investment per capita are significant at 1%, 5%, and 1%, respectively. For Thailand, trade openness, financial development, and gross investment per capita are significant at 1%.

Table 1: Residual-based co-integration test using the LM method

Variable	Indonesia	Malaysia	Philippines	Thailand
Computed LM statistic	0.0576	0.0353	0.0551	0.0460
Critical value of LM statistic at 99%	0.0660	0.0821	0.0821	0.0821
Using $\lambda = T_b/T$	0.3	0.2	0.2	0.2

Note: Critical values are from Table 2, Model D, of Carrion-i-Silvestre and Sanso (2006). ***, **, and * indicate rejecting the null hypothesis of co-integration at 90%, 95%, and 99%, respectively. The number of regressors is three for all countries.

Table 2: Long-run relationship among the variables

Dependent variable: *log(y)*

Variable	Indonesia (Sample size: 31)		Malaysia (Sample size: 50)		Philippines (Sample size: 50)		Thailand (Sample size: 50)	
Intercept	3.167***	(4.833)	5.372***	(16.802)	4.060***	(12.675)	5.574***	(20.787)
log(OPEN)	0.279**	(2.158)	0.128**	(2.138)	0.201***	(5.818)	0.357***	(4.132)
log(FIN)	0.047	(0.830)	0.160***	(5.226)	-0.117**	(-2.379)	0.299***	(9.419)
log(i)	0.681***	(6.518)	0.374***	(7.369)	0.520***	(10.114)	0.292***	(7.393)
$D_{98\text{-}09}$	-0.623	(-0.714)	-0.377	(-0.526)	-1.115	(-0.822)	-0.253	(-0.622)
$D_{98\text{-}09}$*log(OPEN)*	0.206	(0.949)	-0.123	(-0.567)	-0.572**	(-2.225)	0.465***	(3.143)
$D_{98\text{-}09}$*log(FIN)*	-0.237	(-1.180)	-0.883***	(-12.341)	-0.441***	(-3.358)	0.007	(0.060)
$D_{98\text{-}09}$*log(i)*	0.118	(0.819)	0.132	(1.422)	0.136	(0.537)	0.049	(0.752)

Note: The figures in parentheses are t-statistics. Critical values follow standard t-statistics. Asterisks (*), (**), and (***) indicate significance at 10%, 5%, and 1%, respectively. *y* is GDP per capita, *OPEN* is the proxy for trade openness, *FIN* is the proxy for financial development, and *i* is gross investment per capita. $D_{98\text{-}09}$ is the dummy variable, which takes the value of 1 during 1998–2009, and 0 otherwise.

The dummy variable, which captures the shift of intercept, is not significant for all countries. The interaction terms of the dummy variable for trade openness, financial development, and investment per capita for Indonesia are all insignificant. For Malaysia, the interaction term for the dummy variable for financial development has a negative sign and is significant at 1%. For the Philippines, the interaction terms of the dummy variable for trade openness and financial development have negative signs and are significant at 5% and 1%, respectively. For Thailand, the interaction term of the dummy variable for trade openness shows a positive sign and is significant at 1%.

Table 3: The effect (elasticity) of trade openness on income per capita in the sampled countries

	Indonesia	Malaysia	Philippines	Thailand
Before the crisis	0.279	0.128	0.201	0.357
After the crisis	0.279	0.128	-0.319	0.822

Note: The figures are computed from the coefficients of the long-run relationship estimation reported in Table 2.

Table 4: The effect (elasticity) of financial development on income per capita in the sampled countries

	Indonesia	Malaysia	Philippines	Thailand
Before the crisis	0	0.160	-0.117	0.299
After the crisis	0	-0.723	-0.558	0.299

Note: The figures are computed from the coefficients of the long-run relationship estimation reported in Table 2.

Table 5: The effect (elasticity) of investment per capita on income per capita in the sampled countries

	Indonesia	Malaysia	Philippines	Thailand
Before the crisis	0.681	0.374	0.520	0.292
After the crisis	0.681	0.374	0.520	0.292

Note: The figures are computed from the coefficients of the long-run relationship estimation reported in Table 2.

The computed elasticity of trade openness, financial development, and gross investment per capita are reported in Tables 3, 4, and 5, respectively. It must be noted that in computing the before- and after-crisis impacts, we assumed that when the coefficient is insignificant, the effect is zero. Regarding the effect of trade openness on income per capita, it can be seen that for Indonesia and Malaysia, there is no change in the magnitude of the elasticity before and after the crisis (with a magnitude of 0.279 for Indonesia and 0.128 for Malaysia). This implies that the eruption of the crisis did not affect how trade openness contributed to the improvement in income per capita. For the Philippines, before the crisis occurred, trade openness has a positive impact with a magnitude of 0.201. By contrast, after the crisis, this impact becomes negative, with a magnitude of -0.319. This implies that after the crisis, trade in the Philippines not only shows no contribution to production, but also deteriorates it. For Thailand, its magnitude of trade openness elasticity is bigger than those seen in other countries, and the impact after the crisis improves significantly. The magnitude increases from 0.357 to 0.822. This increase implies that Thailand responded better to the crisis. Relying on trade to improve the level of income per capita seems to be one of the most prominent economic strategies.

For Indonesia, financial development does not seem to influence income. For Malaysia, financial development has a slightly positive impact before the crisis, but a huge impact after the crisis. Financial development in the Philippines also shows a negative impact both before and after the crisis; after the crisis, the negative impact magnifies remarkably. These levels of impact might imply that the unstable financial systems in both countries had strong negative influences on income after the crisis. In contrast to the other three sampled countries, Thailand seems to be more stable financially, which contributes positively to income improvement, both before and after the crisis.

Gross investment per capita has a positive influence on the incomes of all countries, and this does not change after the crisis. Indonesia has the highest magnitude of investment elasticity (0.681) followed by the Philippines, Malaysia, and Thailand, with magnitudes of 0.520, 0.374, and 0.292, respectively.

4. CONCLUSION

The purpose of this study was to present a robust estimation of trade openness in four South East Asian countries before and after the Asian financial crisis, using a time series analysis method. We presumed that the effect of trade openness on per capita income was different in each country depending on its individual economic structure and trade policy. We used the co-integration technique with a structural break developed by Carrion-i-Silvestre and Sanso (2006) to estimate the long-run elasticity of per capita income with respect to trade openness before and after the crisis.

Based on the results of the estimation, we found that trade openness worked better in Thailand than it did in the other three sampled countries, both before and after the crisis. For Indonesia and Malaysia, trade openness also had a significant positive impact on per capita income, but this impact was relatively smaller than that seen for Thailand. The trade openness of the Philippines seemed to perform better than that of Malaysia before the crisis, but after the crisis, it reduced per capita income dramatically. In conclusion, we think that learning from Thailand about how to make trade work might help other developing countries.

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6. APPENDIX

Table A1: **Augmented Dickey–Fuller unit root test**

Variable	Computed t-statistics			
	Indonesia	Malaysia	Philippines	Thailand
log(y)	-1.486	-1.033	-1.027	-1.349
log(OPEN)	-2.070	-0.504	-2.203	-0.273
log(FIN)	-1.954	-2.107	-2.106	-1.533
log(i)	-1.641	-1.636	-2.397	-2.264
△*log(y)*	-4.154***	-5.624***	-3.083***	-3.880***
△*log(OPEN)*	-7.798***	-5.094***	-5.868***	-6.634***
△*log(FIN)*	-4.040***	-4.598***	-4.596***	-3.934***
△*log(i)*	-5.519***	-4.810***	-5.135***	-5.171***

Note: Asterisks (*), (**), and (***) indicate significance at 10%, 5%, and 1%, respectively. The critical values are taken from McKinnon (1996). △ represents the first difference. *y* is GDP per capita, *OPEN* is the proxy for trade openness, *FIN* is the proxy for financial development, and *i* is gross investment per capita.

Table A2: The estimated results of equation (5) using the Stock–Watson DOLS method

Dependent variable: *log(y)*

Variable	Indonesia (Sample: 31)	Malaysia (Sample: 50)	Philippines (Sample: 50)	Thailand (Sample: 50)
Intercept	3.167*** (4.833)	5.372*** (16.802)	4.060*** (12.675)	5.574*** (20.787)
log(OPEN)	0.279** (2.158)	0.128** (2.138)	0.201** (5.818)	0.357*** (4.132)
log(FIN)	0.047 (0.830)	0.160*** (5.226)	-0.117*** (-2.379)	0.299** (9.419)
log(i)	0.681*** (6.518)	0.374*** (7.369)	0.520*** (10.114)	0.292*** (7.393)
$D_{98\text{-}09}$	-0.623 (-0.714)	-0.377 (-0.526)	-1.115 (-0.822)	-0.253 (-0.622)
$D_{98\text{-}09}$*log(OPEN)*	0.206 (0.949)	-0.123 (-0.567)	-0.572** (-2.225)	0.465*** (3.143)
$D_{98\text{-}09}$*log(FIN)*	-0.237 (-1.180)	-0.883***(-12.341)	-0.441*** (-3.358)	0.007 (0.060)
$D_{98\text{-}09}$*log(i)*	0.118 (0.819)	0.132 (1.422)	0.136 (0.537)	0.049 (0.752)
△*log(OPEN)*$_t$	-0.176** (-2.311)	0.082 (0.914)	0.063 (0.708)	-0.176** (-2.311)
△*log(OPEN)*$_{t-1}$	-0.157** (-2.090)	0.061 (0.621)	0.095 (1.076)	-0.157** (-2.090)
△*log(OPEN)*$_{t+1}$	0.163** (2.250)	0.110 (1.023)	0.181* (1.824)	0.163** (2.250)
△*log(FIN)*$_t$	-0.145* (-1.807)	-0.074 (-1.452)	-0.157* (-1.921)	-0.145* (-1.807)
△*log(FIN)*$_{t-1}$	-0.099 (-1.410)	-0.065 (-1.323)	-0.108 (-1.254)	-0.099 (-1.410)
△*log(FIN)*$_{t+1}$	0.110 (1.287)	0.055 (0.887)	-0.147* (-1.718)	0.110 (1.287)
△*log(i)*$_t$	-0.064 (-1.585)	-0.131*** (-2.754)	-0.159** (-2.397)	-0.064 (-1.585)
△*log(i)*$_{t-1}$	-0.036 (-0.867)	-0.083** (-2.026)	-0.071 (-1.015)	0.084* (-1.840)
△*log(i)*$_{t+1}$	0.084* (1.740)	0.139*** (2.657)	0.122 (1.578)	0.111** (2.037)
Adjusted R^2	0.998	0.997	0.937	0.998
Durbin–Watson stat	0.862	1.076	1.176	0.862

Note: Asterisks (*), (**), and (***) indicate significance at 10%, 5%, and 1%, respectively. △ represents the first difference, *y* is GDP per capita, *OPEN* is the proxy for trade openness, *FIN* is the proxy for financial development, and *i* is gross investment per capita.

Figure 1: Indonesia's trade and economic growth

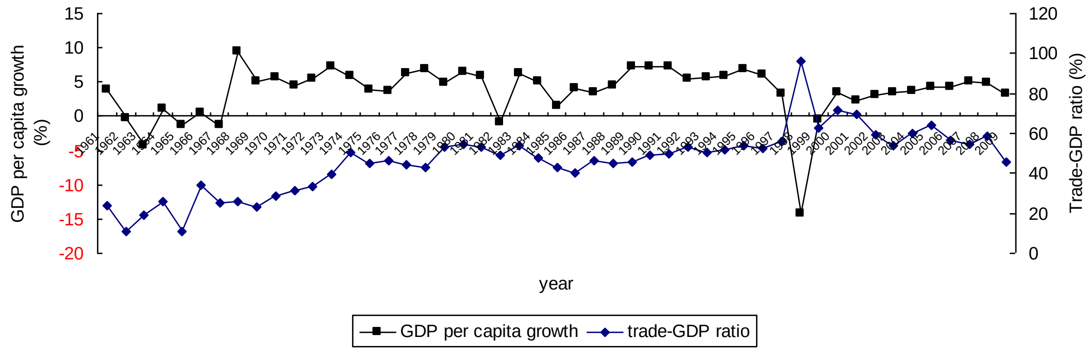

Figure 2: Malaysia's trade and economic growth

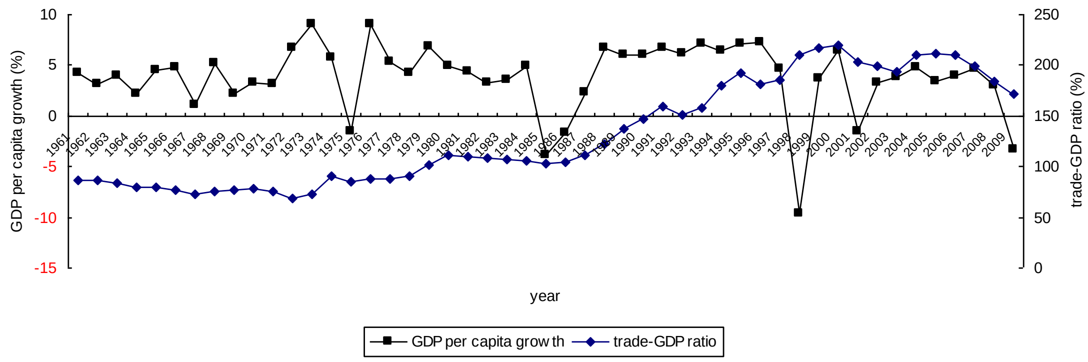

Figure 3: The Philippines' trade and economic growth

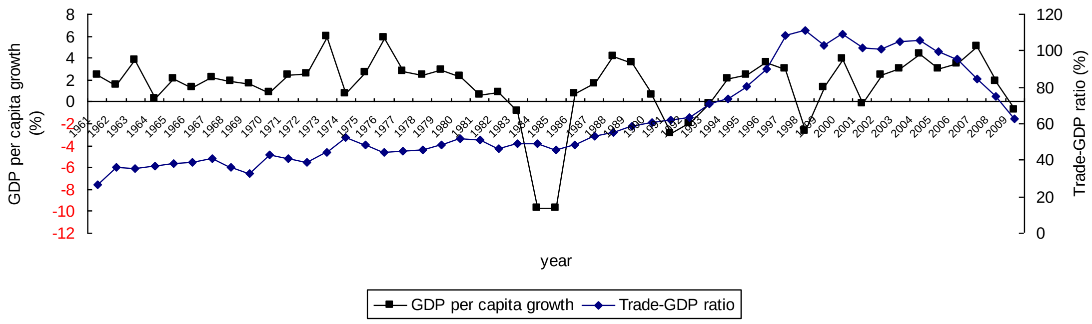

Figure 4: Thailand's trade and economic growth