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# Temporal Causal Relationship between Stock Market Capitalization, Trade Openness and Real GDP: Evidence from Thailand

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## Abstract:

This study examines both short-run and long-run causal relationship between stock market capitalization, trade openness and economic growth in Thailand. Quarterly data over the period from the first quarter of 1993 to the fourth quarter of 2013 are used in the analysis. The results from this study show that there exists a unidirectional long-run causality running from stock market capitalization and trade openness to real GDP. In the short run, an increase in stock market capitalization causes economic growth while an increase in trade openness decreases it and vice versa. Furthermore, there exist short-run bidirectional negative causations between economic growth and trade openness. However, the short-run phenomena are temporary. Based upon the results from this study, policymakers should pay attention to measures that are able to enhance stock market capitalization and trade openness if the long-run target is to achieve high economic growth rate.

**Keywords:** Economic growth, market capitalization, trade openness, cointegration, causality

**JEL Classification:** F44, C22

## 1. Introduction

Capital markets can play an important role in the economic development process in developing countries. Besides, trade openness is believed to be one of crucial determinants of economic growth. Demircuc-Kunt and Levine (1996) indicate that emerging capital markets have become more integrated with world capital markets and find evidence that there exists a positive correlation between stock market development and economic growth. Beck and Levine (2004) find that both banks and stock markets promote economic growth in the panel data analysis. Chen and Lee (2006) find contradictory results in a cross-country study.

The cross-country studies might exaggerate the role of stock market in growth process. Arestis et al. (2001) use time series data from five developed countries to investigate the relationship between stock market development and economic growth. They find that banks are more powerful than stock markets in promoting growth. Liu and Hsu (2006) examine the role of financial development in the growth process of Taiwan, Korea and Japan. One main finding is that finance-aggregates have positive impacts on Taiwan's economy, but have negative impacts on Korean and Japanese economies. Ang (2009) finds that financial sector policies play an important role in promoting private investment, which in turn stimulates growth. This impact is more pronounced for Malaysia than for India. Chen et al. (2011) use panel data of 46

countries to examine the impact of banking sector and stock market development on economic growth. They find the U-shaped relation between banking sector development and growth, but the inverted U-shaped relation between stock market development and growth. Anwar and Cooray (2012) find that financial development and the quality of governance enhance the benefits from foreign direct investment and thus economic growth in South Asian economies.

There can be a link between stock market capitalization, one of various indicators of financial development, and trade openness. Law and Demetriades (2004) find that financial development of developing countries is facilitated when the countries are open to both capital flows and trade. Many studies also focus on the role of trade openness in the growth process. Lloyd and MacLaren (2000) find that openness with respect to trade in goods has a positive minimal effect on growth in East Asian economies. Yanikkaya (2003) finds evidence that countries with higher trade shares are likely to have higher economic growth. Tsen (2006) finds that economic growth and trade openness exhibit a positive bidirectional causality in China during the 1978-1999 period. Sarkar (2008) uses cross-country panel data of 51 developing countries to examine the relationship between trade openness and economic growth. The results show that only 11 rich and highly trade-dependent countries benefit from trade openness. In addition, time-series analyses of individual countries including the East Asian economies show no positive long-run relationship between openness and growth. Shahbaz (2012) finds that trade openness promotes long-run economic growth in Pakistan. For developed countries, recent evidence provided by Birinci (2013) shows that there exists positive bidirectional causality between trade openness and growth in OECD countries.

The present study attempts to examine both short-run and long-run relations between stock market capitalization, trade openness and real GDP in Thailand during 1993 and 2013. The bounds testing for cointegration is used to detect a long-run causality while the VAR Granger causality/Block exogeneity test is used for investigating short-run causations. The next section describes the materials and methods that are employed in the analysis. Section 3 presents main findings of this study. The last section gives concluding remarks.

## **2. Materials and Methods**

The dataset used in this study comprises quarterly data during 1993 and 2013. Nominal GDP, real GDP at 1998 prices, exports, imports, and consumer price index are obtained from Thailand's National Economic and Social Development Board. GDP, exports and imports are in billions of baht. The series of stock market capitalization expressed in billions of baht is obtained from the Stock Exchange of Thailand website. Real stock market capitalization is obtained by deflating nominal market capitalization with consumer price index. Trade openness is simply the share of the sum of exports and imports in nominal GDP. All series are transformed into logarithmic series. The sample size comprises 84 observations.

The present study adopts the asymptotic theory proposed by Pesaran et al. (2001) to test for the existence of level relationship between a variable and its regressors when the degree of integration of each variable is not certainly known. This bounds testing

procedure can provide unbiased long-run estimates and valid test statistics. The unrestricted error correction models of this ARDL procedure can be expressed as:

$$\Delta lmc_t = a_0 + a_1 lmc_{t-1} + a_2 ly_{t-1} + a_3 lto_{t-1} + \sum_{i=1}^{p1} \beta_i \Delta lmc_{t-i} + \sum_{j=0}^{p2} \gamma_j \Delta ly_{t-j} + \sum_{k=0}^{p3} \phi_k \Delta lto_{t-k} + \varepsilon_t \quad (1)$$

$$\Delta lto_t = a_0 + a_1 lto_{t-1} + a_2 ly_{t-1} + a_3 lmc_{t-1} + \sum_{i=1}^{p1} \beta_i \Delta lto_{t-i} + \sum_{j=0}^{p2} \gamma_j \Delta ly_{t-j} + \sum_{k=0}^{p3} \phi_k \Delta lmc_{t-k} + \varepsilon_t \quad (2)$$

$$\Delta ly_t = a_0 + a_1 ly_{t-1} + a_2 lmc_{t-1} + a_3 lto_{t-1} + \sum_{i=1}^{p1} \beta_i \Delta ly_{t-i} + \sum_{j=0}^{p2} \gamma_j \Delta lmc_{t-j} + \sum_{k=0}^{p3} \phi_k \Delta lto_{t-k} + \varepsilon_t \quad (3)$$

where  $\Delta$  denotes first difference operator,  $lmc$  is the log of real stock market capitalization,  $ly$  is the log of real GDP, and  $lto$  is the log of trade openness.

There are two steps in the bounds testing for cointegration. The first step is to estimate equations (1) – (3) using ordinary least squares method to determine the existence of a long-run relationship between the three variables. This is done by conducting an F test for the joint significance of the coefficients of lagged level variables. The null hypothesis  $H_0 : a_1 = a_2 = a_3 = 0$  is tested against the alternative hypothesis  $H_a : a_1 \neq a_2 \neq a_3 \neq 0$ . In other words, the models in equations (1) – (3) are tested against the models without lagged level variables, which are the ARDL(p1, p2, p3) models, to obtain the computed F-statistic. If cointegration exists, the computed F-statistic will be larger than the upper bound critical value. If cointegration does not exist, the computed F-statistic will be smaller than the lower bound critical value. The computed F-statistic that takes the value between the upper bound and lower bound critical values will lead to an inconclusive result. The existence of cointegration gives the error correction mechanism (ECM) expressed as:

$$\Delta lmc_t = a_0 + \lambda e_{t-1} + \sum_{i=1}^{p1} \beta_i \Delta lmc_{t-i} + \sum_{j=0}^{p2} \gamma_j \Delta ly_{t-j} + \sum_{k=0}^{p3} \phi_k \Delta lto_{t-k} + u_t \quad (4)$$

$$\Delta lto_t = a_0 + \lambda e_{t-1} + \sum_{i=1}^{p1} \beta_i \Delta lto_{t-i} + \sum_{j=0}^{p2} \gamma_j \Delta ly_{t-j} + \sum_{k=0}^{p3} \phi_k \Delta lmc_{t-k} + u_t \quad (5)$$

$$\Delta ly_t = a_0 + \lambda e_{t-1} + \sum_{i=1}^{p1} \beta_i \Delta ly_{t-i} + \sum_{j=0}^{p2} \gamma_j \Delta lmc_{t-j} + \sum_{k=0}^{p3} \phi_k \Delta lto_{t-k} + u_t \quad (6)$$

where  $e_{t-1}$  is the error correction term (ETC), which is the one-period lag of residuals obtained from the ordinary least squares estimate of level relationship between the three variables. The coefficient  $\lambda$  is the speed of adjustment toward the long-run equilibrium. The models in equations (4) – (6) depict short-run dynamics and show how fast any deviation from the long-run equilibrium will be corrected. The significance of the coefficient of the ETC also indicates a long-run causality between

the three variables. The main advantage of the conditional ARDL procedure in testing for cointegration is that re-parameterization of the model into the equivalent vector error correction model is not required compared with other techniques of cointegration tests.

The ECM representations expressed in equations (4) – (6) show short-run relationship between changes in levels of the three variables and their lags, but they do not obviously exhibit short-run causality in the sense of Granger (1969) causality test. To test for the directions of short-run causations between the three variables, one can use a vector autoregression (VAR) model performed on stationary series (their first differences) to detect causations between stationary variables. The VAR representation can be expressed as:

$$\Delta lmc_t = \alpha_{10} + \sum_{i=1}^p \beta_{1i} \Delta lmc_{t-i} + \sum_{i=1}^p \gamma_{1i} \Delta ly_{t-i} + \sum_{i=1}^p \phi_{1i} \Delta lto_{t-i} + v_{1t} \quad (7)$$

$$\Delta lto_t = \alpha_{20} + \sum_{i=1}^p \beta_{2i} \Delta lto_{t-i} + \sum_{i=1}^p \gamma_{2i} \Delta ly_{t-i} + \sum_{i=1}^p \phi_{2i} \Delta lmc_{t-i} + v_{2t} \quad (8)$$

$$\Delta ly_t = \alpha_{30} + \sum_{i=1}^p \beta_{3i} \Delta ly_{t-i} + \sum_{i=1}^p \gamma_{3i} \Delta lmc_{t-i} + \sum_{i=1}^p \phi_{3i} \Delta lto_{t-i} + v_{3t} \quad (9)$$

The optimal lag  $p$  can be determined by Akaike information criterion (AIC). If causality exists, at least one of lagged independent variables in equations (7) – (9) must be significant. The standard Granger causality test gives the F-statistics that show whether or not causations exist. An alternative approach is Granger causality/Block exogeneity Wald tests to examine the directions of causality. This is performed in the specified VAR model.

### 3. Empirical Results

In testing for cointegration using the ARDL approach mentioned in the previous section, testing for unit root of series in questions is not required. However, this approach is not suitable if any series is integrated of order two, i. e., it is I(2) series. According to Choi and Chung (1995), the more powerful test for relatively small sample size is the PP tests proposed by Phillips and Perron (1998). The results of unit root tests are reported in Table 1.

The results in Table 1 show that market capitalization series is integrated of order one, I(1), while the series of real GDP and trade openness seem be either I(0) or I(1) series. The tests in first differences of all series show that the order of integration does not exceed one. Therefore, The ARDL procedure is suitable for cointegration test.

**Table 1** Results of PP tests for all variables: 1993Q1-2013Q4

Variables	Level of variables		First difference of variables		
	Test A	Test B	Test A	Test B	Integration
<i>lmc</i> (Market cap.)	-1.29 [3] (0.63)	-1.93 [3] (0.75)	-9.38 [2] (0.00)***	-9.35 [2] (0.00)***	I(1)
<i>ly</i> (real GDP)	-0.66 [35] (0.85)	-3.64 [6] (0.03)**	-18.56[44] (0.00)***	17.05[44] (0.00)***	I(1) or I(0)
<i>lto</i> (Trade openness)	-2.10 [27] (0.25)	-3.64 [5] (0.03)**	-19.19[81] (0.00)***	-27.51[61] (0.00)***	I(1) or I(0)

**Note:** Test A includes intercept only while Test B includes intercept and a linear trend. The number in bracket is the optimal bandwidth. \*\*\*, \*\* and \* denote significance at the 1, 5 and 10 percent level, respectively. The number in parenthesis is the probability of accepting the null hypothesis of unit root. I(1) or I(0) indicates that at least one test shows the series is I(0).

The models in equations (1) – (3) are used for testing the existence of level relationship between stock market capitalization, trade openness and real GDP using parsimonious models. The results from bounds testing for cointegration are shown in Table 2.

**Table 2** Results from bounds testing for cointegration: 1993Q1-2013Q4

	Compute F	ARDL model	$\chi^2_{(2)}$
(1) <i>lmc</i> , <i>ly</i> , <i>lto</i>	1.53	(2,1,1)	0.779 (p=0.678)
(2) <i>lto</i> , <i>ly</i> , <i>lmc</i>	1.63	(2,1,1)	4.996 (p=0.082)
(3) <i>ly</i> , <i>lmc</i> , <i>lto</i>	5.05	(2,1,1)	2.878 (p=0.238)

**Note:** The LM test for serial correlation in the specified ARDL models is represented by  $\chi^2_{(2)}$ . Three variables: *lmc*, *ly* and *lto* denote market capitalization, real GDP and trade openness, respectively.

The results from bounds tests indicate that cointegration exists only in Model 3 with real GDP as the dependent variable. The computed F-statistic of 5.05 is greater than the critical value of 4.85 at the 5 percent level of significance (Table CI (iii) Case III in Pesaran et al., 2001). The other two models with market capitalization and trade openness as the dependent variable give the computed F-statistics that are smaller than the lower bounds critical value at the 10 percent level of significance.

Since the ARDL(2,1,1) model does not exhibit serial correlation as demonstrated by  $\chi^2_{(2)}$  of the LM test, the long-run relationship and short-run dynamics are estimated. The results are shown in Table 3.

Panel A of Table 3 shows the estimate of long-run relationship between real GDP, market capitalization and trade openness. The dummy variable of the 1997 financial crisis is not included because it distorts the results. As a matter of fact, the crisis could cause fluctuations in real effective exchange rate, which in turn could affect exports and imports. This can be seen from movements in trade openness.

**Table 3** Results of long-run and short-run dynamics estimates of the impact of stock market capitalization and trade openness on real GDP, 1993Q1-2013Q14

**Panel A.** Long-run estimation with  $ly_t$  as dependent variable

	Coefficient
$lmc_t$	0.196 (10.515)***
$lto_t$	0.522 (11.548)***
Constant	2.739 (13.052)***
Adjusted $R^2$	0.828

**Panel B.** ECM estimation with  $\Delta ly_t$  as dependent variable

$\Delta ly_{t-1}$	-0.145 (-1.560)
$\Delta ly_{t-2}$	-0.407 (-4.556)***
$\Delta lmc_t$	0.046 (2.192)**
$\Delta lmc_{t-1}$	0.039 (1.817)*
$\Delta lto_t$	-0.081 (-1.901)*
$\Delta lto_{t-1}$	0.010 (0.206)
$e_{t-1}$	-0.177 (-3.454)***
Adjusted $R^2$	0.473
Serial correlation (LM): $\chi^2_{(2)}$	5.137 (p=0.077)

**Note:** The number in parenthesis is t-statistic. p is the probability of accepting the null hypotheses that there is no serial correlation, no heteroskedasticity, and residuals are normally distributed. \*\*\*, \*\* and \* denote significance at the 1, 5 and 10 percent level, respectively. Three variables:  $lmc$ ,  $ly$  and  $lto$  denote market capitalization, real GDP and trade openness, respectively.

It is apparent that stock market capitalization and trade openness exert the positive impacts on real GDP. A one percent increase in stock market capitalization causes a 0.20 percent increase in real GDP. This result confirms the findings by Demirguc-Kunt and Levine (1996) and Shahbaz (2012). Similarly, a one percent increase in trade openness causes a 0.52 percent increase in real GDP. This finding does not support the evidence provided by Sarkar (2008). Panel B of Table 3 shows the estimate of the short-run dynamics from the ECM representation. In the short run, the relationship between a change in stock market capitalization and economic growth is significantly positive while the relationship between a change in trade openness and economic growth is significantly negative. However, the size of the coefficient is minimal. In addition, only lagged change in stock market capitalization has a small impact on economic growth. The significant negative coefficient of the error correction term,  $e_{t-1}$ , is minus and has the absolute value of than one. This indicates that any deviation from long-run equilibrium will be rapidly corrected. The significance of the coefficient of the error correction term also indicates a long-run causality running from stock market capitalization and trade openness to real GDP.

The Granger causality/Block exogeneity test is also conducted to examine short-run causality between the three variables. The optimal lags of seven are determined by AIC. The results are shown in Table 4.

**Table 4** Results of VAR Granger causality/Block exogeneity Wald test

Dependent variable	$\Delta lmc$	$\Delta lto$	$\Delta ly$
$\Delta lmc$	-	6.971 [+] (0.432)	15.983 [+] (0.025)**
$\Delta lto$	6.971 [-] (0.432)	-	27.097 [-] (0.000)***
$\Delta ly$	7.142 [-] (0.414)	19.088 [-] (0.008)***	-
$\chi^2_{(7)}$ for joint test	14.955 (0.381)	22.068 (0.077)*	51.082 (0.000)***

**Note:** The sign in bracket denote a positive or negative causation. The number in parenthesis is p-value. \*\*\*, \*\* and \* denote significance at the 1, 5 and 10 percent level, respectively. Three variables: *lmc*, *ly* and *lto* denote market capitalization, real GDP and trade openness, respectively.

This test identifies the short-run causations between the three variables. The results show that a unidirectional causality runs from market capitalization and trade openness to output growth. While market capitalization imposes a negative impact on output growth, trade openness imposes a positive impact on it. Furthermore, output growth negatively affects trade openness. Therefore, bidirectional causations between trade openness and output growth are observed in the short run. This finding is similar to the finding by Birinci (2013), but with the opposite sign of causations. Stock market capitalization is not affected by both trade openness and output growth as evidenced by the joint Wald statistic. Stock market capitalization is thus the only exogenous variable.

#### 4. Concluding Remarks

This study attempts to investigate the temporal causal relationship between stock market capitalization, trade openness and economic growth in Thailand. Both short-run and long-run causality tests are conducted. Quarterly data over the period from the first quarter of 1993 to the fourth quarter of 2013 are used in the analysis. In testing for a long-run causal relationship, the ARDL bounds test is adopted to determine whether the coefficient of the error correction term is significantly negative and takes the absolute value of less than one. For the short-run causality analysis, the VAR Granger causality test is employed. The results from this study show that there exists a unidirectional long-run causality running from stock market capitalization and trade openness to real GDP. In the short run, an increase in stock market capitalization causes economic growth while an increase in trade openness decreases it and vice versa. Furthermore, there exist short-run bidirectional causations between economic growth and trade openness, i.e., trade openness imposes a negative impact on economic growth and economic growth imposes a negative impact on trade openness. However, the short-run phenomena are temporary. Based upon the results from this study, policymakers should pay attention to measures that are able to enhance stock market capitalization and trade openness if the long-run target is to achieve high economic growth rate.



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