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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, stock market capitalization does not causes economic growth while trade openness negatively causes it. Furthermore, there exist short-run bidirectional negative causations between economic growth and trade openness. However, the short-run phenomena are temporary. The long-run relationship shows that both market capitalization and trade openness are important determinants of real GDP. 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. Demirguc-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 while 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

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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 counties 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:

$$\Delta lmc_t = a_{10} + a_{11} lmc_{t-1} + a_{12} ly_{t-1} + a_{13} lto_{t-1} + \sum_{i=1}^{p1} \beta_{1i} \Delta lmc_{t-i} + \sum_{j=0}^{p2} \gamma_{1j} \Delta ly_{t-j} + \sum_{k=0}^{p3} \phi_{1k} \Delta lto_{t-k} + \varepsilon_{1t} \quad (1)$$

$$\Delta lto_t = a_{20} + a_{21} lto_{t-1} + a_{22} ly_{t-1} + a_{23} lmc_{t-1} + \sum_{i=1}^{q1} \beta_{2i} \Delta lto_{t-i} + \sum_{j=0}^{q2} \gamma_{2j} \Delta ly_{t-j} + \sum_{k=0}^{q3} \phi_{3k} \Delta lmc_{t-k} + \varepsilon_{2t} \quad (2)$$

$$\Delta ly_t = a_{30} + a_{31} ly_{t-1} + a_{32} lmc_{t-1} + a_{33} lto_{t-1} + \sum_{i=1}^{r1} \beta_{3i} \Delta ly_{t-i} + \sum_{j=0}^{r2} \gamma_{3j} \Delta lmc_{t-j} + \sum_{k=0}^{r3} \phi_{3k} \Delta lto_{t-k} + \varepsilon_{3t} \quad (3)$$

where Δ 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 hypotheis $H_0 : a_{i1} = a_{i2} = a_{i3} = 0, i = 1,2,3$ is tested against the alternative hypothesis $H_a : a_{i1} \neq a_{i2} \neq a_{i3} \neq 0, i = 1,2,3$. In other words, the models in equations (1) – (3) are tested against the models without lagged level variables, which are the ARDL 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:

$$\Delta lmc_t = a_{10} + \lambda_1 ETC + \sum_{i=1}^{p1} \beta_{1i} \Delta lmc_{t-i} + \sum_{j=0}^{p2} \gamma_{1j} \Delta ly_{t-j} + \sum_{k=0}^{p3} \phi_{1k} \Delta lto_{t-k} + u_{1t} \tag{4}$$

$$\Delta lto_t = a_{20} + \lambda_2 ETC + \sum_{i=1}^{q1} \beta_{2i} \Delta lto_{t-i} + \sum_{j=0}^{q2} \gamma_{2j} \Delta ly_{t-j} + \sum_{k=0}^{q3} \phi_{2k} \Delta lmc_{t-k} + u_{2t} \tag{5}$$

$$\Delta ly_t = a_{30} + \lambda_3 ETC + \sum_{i=1}^{r1} \beta_{3i} \Delta ly_{t-i} + \sum_{j=0}^{r2} \gamma_{3j} \Delta lmc_{t-j} + \sum_{k=0}^{r3} \phi_{3k} \Delta lto_{t-k} + u_{3t} \tag{6}$$

where *ETC* is the error correction term, which is the one-period lag of residuals obtained from the ordinary least squares estimate of level relationship between the three variables. The coefficient λ_i is the speed of adjustment toward the long-run equilibrium. The models in equations (4) – (6) depict short-run dynamics of each long-run equation and show how fast any deviation from the long-run equilibrium will be corrected. 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 cointeration analysis.

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:

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

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

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

The optimal lag *p* can be determined by Akaike information criterion (AIC). If cointegration exists, the VAR representation can be augmented with the ECT of long-run relationship. In this case, both short-run and long-run causality can be tested by using Wald F-test. If cointegration does not exist, the VAR model will not be augmented with the ECT, and thus only short-run causality can be tests (see Granger, 1988).

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 to 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

	Level of variables		*First difference of variables*		
Variables	*Test A*	*Test B*	*Test A*	*Test B*	*Integration*
lmc (Market cap.)	-1.29 [3] (0.63)	-1.93 [3] (0.75)	-9.38 [2] (0.00)***	-9.35 [2] (0.00)***	I(1)
ly (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)
lto (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

	Computed F	*ARDL model*	$\chi^2_{(2)}$
(1) *lmc, ly, lto*	1.53	(2,1,1)	0.779 (p=0.678)
(2) *lto, ly, lmc*	1.63	(2,1,1)	4.996 (p=0.082)
(3) *ly, lmc, lto*	6.25	(2,1,0)	0.337 (p=0.845)

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 6.25 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(2,1,0) 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, and thus the impact of trade openness on real GDP can be distorted.

It is apparent that stock market capitalization and trade openness exert the positive impacts on real GDP in the long run. 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), Lloyd and MacLaren (2000), but confirms the results of Yanikkaya (2003). Panel B of Table 3 shows the estimate of the short-run dynamics from the ECM representation. 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 sizes of these coefficients are minimal. In addition, one-period lagged change in stock market capitalization has a small impact on economic growth. The significance of lagged

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 Äly_t as dependent variable	
Δly_{t-1}	-0.152 (-1.757)
Δly_{t-2}	-0.410 (-4.687)***
Δlmc_t	0.045 (2.206)**
Δlmc_{t-1}	0.039 (1.824)*
Δlto_t	-0.081 (-1.917)*
ECT	-0.182 (-3.932)***
Adjusted R^2	0.479
Diagnostic tests:	
Functional form:	5.246 (p=0.025)
Serieal correlation (LM): $\chi^2_{(2)}$	5.137 (p=0.077)
Normality of residuals: JB	20.046 (p=0.000)
Heteroskedasticity: ARCH(1)	1.224 (p=0.269)

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 in the residuals, the residuals are normally distributed, and correct specification of the functional form. ***, ** 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.

change in market capitalization justifies the choice of selected lag length. The estimated conditional ECM equation fails to pass the functional form misspecification test at the 5 percent level of significance. This indicates that there might be some asymmetries or non-linear effects in the adjustment of real GDP process, which a linear specification cannot take into account. Furthermore, the presence of non-normality in the residuals might be due to a small or moderate sample size. The inferences about the estimated coefficients in terms of F-tests and t-tests should be reasonably accurate because the variance of the residuals is constant, which is confirmed by the ARCH test. Overall, the estimated ECM equation has some desirable features.

The highly significant coefficient of the ECT is minus and has the absolute value of less than one. This indicates that any deviation from long-run equilibrium will be rapidly corrected. The results of short-run and long-run causality among variables are reported in Table 4.

Table 4
Results of Granger causality tests

Dependent variable	*Short-run causality*			*Long-run causality*
	Δlmc	*Δto*	*Δly*	*ECT*
Δlmc	-	0.966 [-] (0.444)	1.012 [-] (0.000)	-
Δlto	0.434 [+] (0.931)	-	2.726** [-] (0.017)	-
Δly	1.304 [+] (0.267)	5.095***[-] (0.000)	-	13.590*** (0.000)

Note: The optimal lag length of seven is determined by AIC. The Wald F-statistic is reported with the probability of accepting the hull hypothesis. [+] and [-] indicate positive and negative causation, repectively. *** and ** denote significance at the 1 and 5 percent level.

The Wald coefficient restriction tests identify the short-run causations between the three variables when cointegration does not exist in Models 1 and 2 as reported in Table 2. In Model 3, the existence of cointegration allows for testing both short-run and long-run causations. The results show that there is unidirectional causality running from market capitalization and trade openness to output growth in the long run. In the short run, market capitalization imposes insignificantly positive impact on output growth, trade openness imposes significantly negative impact on it. Furthermore, output growth significantly imposes negative affect on 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 Wald F-statistic.

The Granger causality/Block exogeneity test is also conducted to examine which variables are exogenous in the model. The optimal lags of seven are determined by AIC. The results are shown in Table 5.

Table 5
Results of VAR Granger causality/Block exogeneity Wald test

Dependent variable	*Δlmc*	*Δlto*	*Δly*
$\chi^2_{(7)}$ for joint test	14.955 (0.381)	22.068 (0.077)*	51.082 (0.000)***

Note: 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.

The results show that market capitalization is the most exogenous variable in the model because it is not affected by trade openness and real GDP. Besides, trade openness is weakly 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 model is used to perform Granger causality tests. 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, stock market capitalization does not cause economic growth while trade openness negatively causes economic growth. 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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