# Stock Market Development and Economic Growth: ARDL Causality in Thailand

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## Abstract

This paper endeavors to investigate the relationship between the stock market development and economic growth in Thailand. The 61 quarterly data during the time period form March, 1995 to June, 2010 utilized in this study are the growth rate of Gross Domestic Product (GDP) of Thailand, the growth rate of Market capitalization of Government Bonds (BO) and the growth rate of Market capitalization of the Stock exchange of Thailand (MC). Two stationarity tests namely, DF-GLS test and Ng-Perron test are employed to find the integrating order of the variables which the results reveal that all variables are stationary at their level form or they have the integrated of order zero, I(0). To test long-run robustness, ARDL bounds testing technique is applied. The finding reveals that there exist a positive relationship stock market development and economic growth in Thailand implying that stock market development is an important ingredient for economic growth in Thailand. The finding of the study suggests that there is a need of policies toward rapid development of the stock market in Thailand.

**Keywords:** ARDL, Stock Market Development, Economic Growth.

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## 1. Introduction

The stock market has been crucial and become an important wheel for economic growth since it does not provide only sources of external financing for firms and allocate capital to corporate sectors which improves resource allocation but also provide the change of stock price as a consequence of changing in wealth which can affect the demand for consumption and investment goods, thereby stimulating real economic activity and boost up economic growth. It appears that stock markets can stimulate economic growth in several ways. First, stock markets play an important role in allocation of capital to corporate sector which result in an increase in real economic activities (Shahbaz, et.al, 2008). Second, stock markets may encourage economic growth through increasing the liquidity of financial assets which seems to be crucial in developing countries. Third, stock markets provide investment opportunities by mobilising domestic savings which in turn promote wiser investment decisions (Caporale et.al, 2004). This can be seen through financial liberalization in a number of developing countries especially a country like Thailand during the past decade financial liberalization has been recognized as a significant part of an economic policy in developing countries. It is believed that the result of financial liberalization can attract both international and domestic capital which is expected to increase resources available for domestic investment.

There is plenty of research concerning the relationship between the stock market development and economic growth, including Bencivenga and Smith (1992), Atje and Jovanic (1993), Greenwood and Smith (1997) and Bell and Rousseau (2001). Bencivenga and Smith (1992) found that a new stock market can lead to economic growth by reducing holdings of liquid assets and increasing the growth rate of physical capital. Similarly, Atje and Jovanic (1993) concluded that stock markets have been long-run affected on economic growth and manipulate economic growth through a number of channels including liquidity, risk diversifications, acquisition of information about firms, corporate governance and savings mobilization. Greenwood and Smith (1997) also indicated that large stock markets can decrease the cost of mobilizing savings, thus facilitating investment in most productive technologies. Bell and Rousseau (2001) investigated the linkage among individual macroeconomic indicators and measure of financial development in India which reveals that the financial sector has been instrumental in promoting economic performance.

Therefore, the paper proceeds as follows, section two briefly provides the data and methodology, which consist of the unit root test by using the Dickey-Fuller Generalizes Least Square (DF-GLS) test and Ng-Perron (NP) test. Autoregressive models with distributed lags

(ARDL) then was used to estimate the relationship between the stock market development and economic growth in Thailand. Section three discusses the principle results of the econometrical test. The paper ends with conclusion.

*The main objective of the study is :*

To investigate the relationship between the stock market development and economic growth in Thailand.

## 2. Methodological Framework

### 2.1 The Model

This study aims to investigate the relationship between stock market development and economic growth in Thailand by using the following model;

$$GDP_t = f(GDP_{t-i}, MC_t, MC_{t-j}, BO_t, BO_{t-k})$$

where $GDP_{t-i}$ = The growth rate of the previous $i$ quarter of Gross Domestic Product of Thailand $(i=1,...p)$.

$MC_t$ = The growth rate of Market capitalization of the Stock exchange of Thailand for current quarter.

$MC_{t-j}$ = The growth rate of previous $j$ quarter of Market capitalization of the Stock exchange of Thailand $(j=1,...q)$.

$BO_t$ = The growth rate of Market capitalization of Thai Government Bonds for current quarter.

$BO_{t-k}$ = The growth rate of previous $k$ quarter of Market capitalization of Thai Government Bonds $(k=1,...r)$.

The growth rate of each variable at time t is calculated as follows:

$$G_t = \log(\frac{Y_t}{Y_{t-1}})$$

where $G_t$ is the growth rate of the variables, $Y_t$ and $Y_{t-1}$ are variables using in this study which are $GDP$, $MC$ and $BO$ for $t$ and $t\text{-}1$, respectively.

### 2.2 Data

Data was obtained from the bank of Thailand and Ecowin database. GDP (expressed as million of Thai BHT) was obtained from Ecowin and the data of stock development including Market capitalization of the Stock exchange of Thailand and Market capitalization of Thai Government Bonds were obtained form the bank of Thailand.

### 2.3 Analysis

*In this study, the key steps of an analysis are defined as follows :*

- **The unit root test**

Two type of unit root tests namely Dickey-Fuller Generalizes Least Square (DF-GLS) test and Ng-Perron (NP) test were used to check the stationarity of variables.

- **ARDL bounds testing technique**

Autoregressive models with distributed lags (ARDL) is employed to estimate the causality relationship between stock market development and economic growth of Thailand.

#### 2.3.1 The Unit Root Test

A unit root test is required to test whether the variables in this study stationary or non-stationary and what are the order of integrated of these variables. Thus, we employ two types of the stationarity tests namely, the Dickey-Fuller Generalizes Least Square (DF-GLS) test and Ng-Perron (NP) test.

##### 2.3.1.1 Dickey-Fuller Generalizes Least Square (DF-GLS) test

DF-GLS test was developed by Elliot et al. (1996) which is called de-trending test. It is similar to Augmented Dickey-Fuller (ADF) test. However, it has an advantage over the ADF test when there are a small number of observations. This de-trending is done by taking the explanatory variables out of the data (see, Elliott, Rothenberg and Stock, 1996). The following equation is then estimated to test for a unit root in the variable:

$$\Delta y_t^d = \alpha y_{t-1}^d + \sum_{p=1}^{m} \beta_p \Delta y_{t-p}^d + v_t \qquad (2.3.1)$$

where $\Delta$ is the difference operator, $y_t^d$ is the Generalised Least Squares de-trended value of the variable, $\alpha$ and $\beta_p$ are coefficients to be estimated and $v_t$ is the independently and identically distributed error term. As in the case of the ADF test, a test for a unit root of the variable $y$ involves examination of whether the coefficient of the AR(1) term, in this case

$\alpha$ , in equation (2.1) is $\alpha = 0$ or the series is non-stationary against the alternative of $\alpha \neq 0$ or the series is stationary. In making inferences, the critical values tabulated in Elliott, Rothenberg and Stock (1996) are used.

*Following DF-GLS test established by Elliot et al. (1996), then equation (2.1) can be specified as:*

$$\Delta GDP_t^d = \alpha_{GDP}\, GDP_{t-1}^d + \sum_{p=1}^{m} \beta_{GDP,p}\, \Delta GDP_{t-p}^d + v_{GDPt} \qquad (2.3.2)$$

$$\Delta MC_t^d = \alpha_{MC}\, MC_{t-1}^d + \sum_{p=1}^{m} \beta_{MC,p}\, \Delta MC_{t-p}^d + v_{MCt} \qquad (2.3.3)$$

$$\Delta BO_t^d = \alpha_{BO}\, BO_{t-1}^d + \sum_{p=1}^{m} \beta_{BO,p}\, \Delta BO_{t-p}^d + v_{BOt} \qquad (2.3.4)$$

**2.3.1.2 Ng-Perron (NP) test**

Ng-Perron (2001) developed four statistical tests by utilizing GLS de-trended data sets $D_t^d$ . The calculated values of these tests based on the forms of Philip-Perron (1988) $Z_\alpha$ and $Z_t$ statistics, Bhargava (1986) $R_1$ statistics, Elliot, Rotherberg and Stock (1996) that created best optimal statistics. The terms are defined as follows:

$$k = \sum_{t=2}^{T} (D_{t-1}^d)^2 / T^2$$

*While de-trended GLS tailored statistics are as given below:*

$$MZ_a^d = [T^{-1}(D_t^d)^2 - f_0] / (2k)$$

$$MZ_t^d = MZ_a \times MSB$$

$$MSB^d = (k/f_0)^{1/2}$$

$$MP_t^d = \{[\overline{C^k}^2 - \overline{C}^{T^{-1}} (D_t^d)^2]/f_0, \text{ and, } (\overline{C^k}^2 + (1-\overline{C})T^{-1}(D_t^d)^2/f\}_0$$

If $x_t = \{1\}$ in first case, and $x_t = \{1,t\}$ in second.

NP test is a non-parametric approach to correct the residual autocorrelation. The regression of this test was estimated.

$$\Delta y_t^d = (\delta - 1)\, y_{t-1}^d + \sum_{p=1}^{m} \phi_p\, \Delta y_{t-p}^d + u_t \qquad (2.3.5)$$

The null hypothesis of equation (2.3.5) is $H_0 : \delta = 1$ or the series is non-stationary. *Following NP test (2001), then equation (2.3.5) can be specified as:*

$$\Delta GDP_t^d = (\delta_{GDP} - 1)\, GDP_{t-1}^d + \sum_{p=1}^{m} \phi_{GDP,\,p}\, GDPy_{t-p}^d + u_{GDPt} \qquad (2.3.6)$$

$$\Delta MC_t^d = (\delta_{MC} - 1)\, MC_{t-1}^d + \sum_{p=1}^{m} \phi_{MC,\,p}\, \Delta MC_{t-p}^d + u_{MCt} \qquad (2.3.7)$$

$$\Delta BO_t^d = (\delta_{BO} - 1)\, BO_{t-1}^d + \sum_{p=1}^{m} \phi_{BO,\,p}\, \Delta BO_{t-p}^d + u_{BOt} \qquad (2.3.8)$$

**2.3.2 Autoregressive Models with Distributed Lags (ARDL)**

The relationship between the stock market development and economic growth in Thailand was conducted by Autoregressive models with distributed lags (ARDL). One of the reasons for preferring the ARDL is that ARDL can also be used to examine the relationship the stock market development and economic growth in Thailand in previously. In addition, ARDL is more robust and perform better for small sample size than other cointegration technique. ARDL can be written as follows;

$$GDP_t = \omega_0 + \sum_{i=1}^{p} \alpha_i\, GDP_{t-i} + \beta_0\, MC_t + \sum_{j=1}^{q} \beta_j\, MC_{t-j} + \gamma_0 BO_t + \sum_{k=1}^{r} \gamma_k BO_{t-k} + \varepsilon_t \qquad (2.3.9)$$

where $GDP$ = The growth rate of Gross Domestic Product of Thailand.

$MC$ = The growth rate of Market capitalization of the Stock exchange of Thailand.

$BO$ = The growth rate of Market capitalization of Government Bonds.

$t$ = Time $(t=1,...,n)$.

$\varepsilon_t$ = Independently distributed random error term, with zero mean and constant variance at time $t$.

$\omega_0, \alpha_i, \beta_0, \beta_j, \gamma_0, \gamma_k$ = The parameters to be estimated.

## 3. Empirical Results

In this section, DF-GLS test and NP test were employed to test the stationarity of the variables then ARDL was used to estimate the relationship of the stock market development and economic growth of Thailand. The 61 quarterly data during the time period from March, 1995 to June, 2010 was used to determine the relationship between stock market development and economic growth in Thailand. Table 2.1 shows the descriptive statistic test of the variables.

**Table 2.1 Descriptive Statistics of the variables**

| *Variables* | *Mean* | *Median* | *Maximum* | *Minimum* | *Std. Dev.* | *Skewness* | *Kurtosis* | *Jarque-Bera* | *Probability* |
|---|---|---|---|---|---|---|---|---|---|
| GDP | 0.007 | 0.006 | 0.094 | -0.082 | 0.044 | 0.366 | 2.503 | 1.988 | 0.370 |
| MC | 0.012 | 0.023 | 0.408 | -0.429 | 0.164 | -0.155 | 3.670 | 1.385 | 0.500 |
| BO | 0.060 | 0.022 | 1.557 | -0.272 | 0.270 | 4.045 | 21.178 | 1006.232 | 0.000 |

### 3.1 Unit root test

For the stationarity testing, we employed DF-GLS test and Ng-Perron test rather than ADF test. The reason for using these two techniques is that DF-GLS and Ng-Perron are more powerful and more suggestive tests than ADF test when there are small sample size since ADF test is not reliable for small sample (Dejong et al, 1992 and Harris, 2003). The stationarity test results are shown in table 3.1

**Table 3.1 Result of The Augmented Dickey Fuller (ADF) test,Dickey-Fuller Generalizes Least Square (DF-GLS) test and Ng-Perron (NP) test**

| *Variables* | *DF-GLS test* | *NP test* | | | | |
|---|---|---|---|---|---|---|
| | | *MZa* | *MZt* | *MSB* | *MPT* | *Lag* |
| GDP | -3.378** [4] | -0.773 | -0.421 | 0.545*** | 61.844 | [3] |
| MC | -6.250***[0] | -28.626*** | -3.782*** | 0.132*** | 3.191*** | [0] |
| BO | -3.812***[0] | -18.983** | -3.080** | 0.162** | 4.804** | [0] |

*Note: The number in bracket is the optimal lag length and bandwidth.*
*Optimal lag length for ADF test is determined by AIC.*
*Modified AIC is used determined the lag length in DF-GLS and NP tests.*
***,*** denotes the 5% and 1% level of significance, respectively.*

The stationarity test results base on DF-GLS test and NP test in table 3.1 show that both DF-GLS test and NP test display the null hypothesis can be rejected for the growth rate of Market capitalization of the Stock exchange of Thailand (MC) and the growth rate of Market capitalization of Government Bonds (BO) implying that MC and BO are stationary at their level form at 1% and 5% significant level.

Although only MSB statistical test of NP test reveals that the null hypothesis can be rejected for GDP, DF-GLS test reveals that the null hypothesis can be rejected at 1% and 5% level of significant. Therefore, we can conclude that GDP is stationary at its level form.

Overall the stationarity evidences show that all variables are stationary at their level form or they have the integrated of order zero, I(0).

### 3.2 The autoregressive models with distributed lags (ARDL) estimates

The relationship and direction of causal relationship between the stock market development and economic growth in Thailand is estimated by Autoregressive models with distributed lags (ARDL), shown in table 3.2

**Table 3.2 The autoregressive models with distributed lags (ARDL) estimates.**

| *Variable* | *Coefficient* | *t-Statistic* | *Standard error* |
|---|---|---|---|
| C | 0.011 | 2.614 | 0.004 |
| $GDP_{t-1}$ | -0.168 | -1.210 | 0.139 |
| $GDP_{t-2}$ | -0.529*** | -4.633 | 0.114 |
| $GDP_{t-3}$ | -0.194 | -1.457 | 0.133 |
| $GDP_{t-4}$ | 0.432*** | 3.650 | 0.118 |
| MC | 0.026** | 1.693 | 0.015 |
| $MC_{t-1}$ | 0.081*** | 5.485 | 0.015 |
| $MC_{t-2}$ | 0.022 | 1.266 | 0.018 |
| $MC_{t-3}$ | 0.057*** | 3.505 | 0.016 |
| $MC_{t-4}$ | -0.005 | -0.281 | 0.018 |
| BO | -0.065*** | -5.604 | 0.012 |
| $BO_{t-1}$ | 0.043*** | 2.777 | 0.015 |
| $BO_{t-2}$ | 0.000 | 0.031 | 0.012 |

*Note: **,*** Significant at critical value at 5% and 1% significance level, respectively.*

The results of the relationship between stock market development and economic growth can be written as;

$$GDP_t = -0.529^{***} GDP_{t-2} + 0.432^{***} GDP_{t-4} + 0.026^{*} MC_t + 0.081^{***} MC_{t-1} + 0.057^{***} MC_{t-3} - 0.07^{***} BO_t + 0.04^{***} BO_{t-1} \quad (3.1)$$

Equation (3.1) presents the relationship between stock market development and economic growth, according to the results that $GDP_{t-4}$, $MC_t$, $MC_{t-1}$, $MC_{t-3}$ and $BO_{t-1}$ have significant positive impact on $GDP_t$, whereas $GDP_{t-2}$ and $BO_t$ have significant negative impact on $GDP_t$. The analysis of the results show that in long-run economic growth in Thailand is strongly influence from previous GDP and financial liberalization on stock market development in Thailand.

## 4. Conclusion

This paper attempts to explore the causal relationship between the stock market development and economic growth by utilizing ARDL. The data set depended on the availability of the data series which is taken from Ecowin database, during March 1995 to June 2010 period.

For the stationarity test, we have DF-GLS test and Ng-Perron test to find the integrating order of the variables utilized in the study. The stationarity evidences reveal that all variables are stationary at their level form or they have the order of integration zero, I(0).

The causality and relationship between stock market development and economic growth is estimated by ARDL. The findings reveal that the market capitalization has the positive impact on economic growth implying that greater stock market liquidity or the ability to trade the equity easily reduce the downside risk and cost of investing in projects. Thus, more liquidity in stock market may accelerate the growth of market capitalization, thereby stimulating the economic activities and improving resource allocation. Consequently, this can boost economic growth in Thailand.

The finding confirms the causality between stock market development and economic growth in case of Thailand and indicates that stock market development leads to economic growth at least for the period under study of the consideration, which suggests that the stock

market development through financial liberalization policy has become an important wheel for economic growth of Thailand. Therefore, it is suggested that Thailand needs to continue the development of its stock market through government policy. The policy should facilitate investment as well as increase stock market liquidity which in turn increases incentive of investors.

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