Stock Market and Economic Development: a Causality Test

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ABSTRACT

An attempt has been made in this paper to examine the existence of causality relationship between stock market and economic growth based on the time series data for the year 1988 to 2005 using Granger causality test. The study finds the empirical evidence of long-run integration and causality of macroeconomic variables and stock market indicators even in a small capital market of Nepal. The causality has been observed only in real terms but not in nominal variables. In econometric sense, it depicts that the stock market plays significant role in determining economic growth and vice versa. Interestingly, the causation is evident with a lag of 3 to 4 years. Also, the paper reveals the importance of stock market development for fostering economic development.

Key words**: s**tock market, financial system, *Granger-causality* test

THE ROLE OF FINANCIAL SYSTEM is considered to be the key to economic growth. A well-developed financial system promotes investment by identifying and financing lucrative business opportunities, mobilizing savings, allocating resources efficiently, helping diversify risks and facilitating the exchange of goods and services (Mishkin 2001). A growing body of literature has affirmed the importance of financial system to economic growth.

Stock market development has assumed a developmental role in global economics and finance following the impact they have exerted in corporate finance and economic activity. Paudel (2005) states that stock markets, due to their liquidity, enable firms to acquire much needed capital quickly, hence facilitating capital allocation, investment and growth. Stock market activity is thus rapidly playing an important role in helping to determine the level of economic activities in most economies. However, controversy does exist on the role of stock market as an indicator of future economic activity. In the light of the controversy, it seems relevant to conduct a research in this topic. The traditional valuation model of stock prices and the "wealth effect" provide theoretical justification for stock prices to act as indicator of economic growth (Comincioli 1996). According to fundamental valuation models, stock prices depend on expectations about the future economy. Therefore, expected changes in real economy cause the values of stock prices. According to wealth effect, however, changes in stock prices cause the variation in the real economy.

In Nepalese context, the government has initiated liberal economic policies since the mid 1980s. The Nepalese financial system has undergone rapid structural changes in the last two and half decades. It has been revealed that the Nepalese financial system is basically bank-dominated. Capital markets and stock markets have not been developed in full scale of operations and the banking institutions, particularly the commercial banks, appear to be the major financial intermediaries in satisfying financing need of productive units of the economy.

The Nepalese stock market is relatively small, illiquid and thinly traded. Despite the size and illiquid nature of the stock markets, their continued existence and development could have important implications for economic activity. For instance, Pardy (1992) has noted that even in less developed countries capital markets are able to mobilize domestic savings and allocate funds more efficiently.

Thus stock markets can play a role in inducing growth in less-developed countries. Empirical investigations into the link between stock market development and economic growth is therefore important.

1. Literature Review

The link between stock markets and economic growth pivots on a major strand of finance-growth hypothesis (Schumpeter 1932, McKinnon 1973) with an insight into how financial intermediation facilitates economic growth. Studies on the link between stock markets and growth have varied in methods and results. Spears (1991) reports that in the early stages of development, financial intermediation induced economic growth in Sub-Saharan Africa. Atje and Jovanic (1993) using cross-sectional regressions conclude that stock markets have long-run impacts on economic growth and it was also found that stock markets influence growth through a number of channels: liquidity, risk diversifications, acquisition of information about firms, corporate governance and savings mobilization (Levine and Zervos 1996).

Demetriades and Hussain (1996) find very little evidence that financial market is a leading sector in the process of economic growth in a sample of 10 countries. Luintel and Khan (1999) study 10 developing economies and find bi-directional causality between financial development and economic growth in all sample countries. Levine and Zervos (1998) measure stock market development along various dimensions: aggregate stock market capitalization to GDP and the number of listed firms (size), domestic turnover and value traded (liquidity), integration with world capital markets, and the standard deviation of monthly stock returns (volatility). The results suggest a strong and statistically significant relationship between initial stock market development and subsequent economic growth.

Mauro (2000) exhibits that stock market is a stable predetermining factor of economic growth in emerging economies. Empirical works continue to show largely some degree of positive relationship between stock markets and growth. In a study using Granger causality techniques to examine the link between financial markets and growth, Rousseau and Wachtel (2000) analyze 47 economies and report that greater financial sector development leads to increased economic activity. Adjasi and Biekpe (2005) find that positive influence of stock market development on economic growth is significant for countries classified as upper middle income economies from the study of 14 African countries. Similarly, Siliverstovs and Duong (2006) reveal that even when accounting for expectations, represented by the economic sentiment indicator, the stock market has certain predictive content for the real economic activity.

2. Methodology

2.1 Data

The data analyzed in this paper consists of economic and financial time series of Nepal. These include real GDP, nominal GDP, and stock market index and market capitalization. The sources of the data include various issues of *Economic Survey* published by Government of Nepal, Ministry of Finance, and *Quarterly Economic Bulletin* published by Nepal Rastra Bank. The data set of the study consists of 18 annual observations covering 1988 to 2005. The system of computation of quarterly GDP is not yet developed in Nepal. This has impeded the analysis of the real sector on a quarterly basis. The base year of NEPSE index is 1994. It has not been used in the study as only 12 observations are available. Instead, an equally weighted single indicator of three stock market development indicators; the average of ratios of market capitalization to GDP, annual turnover to GDP and the annual turnover to market capitalization, referred to as INDEX in the study, has been used.

2.2 Econometric Analysis Methods

Testing for Causality: This study uses *Granger-causality* test proposed by Granger (1969) for testing the causality between stock market growth and economic growth. The hypotheses of interest are:

H_{01}: Stock market growth does not Granger-causes economic growth.
H_{02}: Economic growth does not Granger-causes stock market growth.

H_{03}: Economic growth does not Granger-causes stock market growth and vice versa (i.e. there is no bilateral/feedback causation).
The hypotheses are tested in the context of VAR of the following form:

$$EG_t = \sum_{i=1}^{n} \alpha_i EG_{t-i} + \sum_{j=1}^{n} \beta_j SMG_{t-j} + u_{1t} \quad \ldots \ldots \ldots (1)$$

$$SMG_t = \sum_{i=1}^{n} \lambda_i SMG_{t-i} + \sum_{j=1}^{n} \delta_j EG_{t-j} + u_{2t} \quad \ldots \ldots \ldots (2)$$

Where, EG is economic growth proxied by real and nominal GDP and SMG is stock market growth proxied by market capitalization and INDEX.
To test the hypotheses, the restricted F-test is applied, which is given by:

$$F = [(RSS_R - RSS_{UR})/m] / [RSS_{UR}/(n-k)] \quad \ldots \ldots \ldots (3)$$

Where, m is number of lagged terms and k is the number of parameters and RSS_R and RSS_{UR} are residual sum of squares of restricted and unrestricted models respectively.
The appropriate lag length is established by Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).
Testing for Stationarity: The VAR is modeled in stationary variables so that the test statistics have standard distributions. A first step is, therefore, to assess the order of integration of the variables. For the purpose, the DF (Dickey Fuller) and ADF (Augmented Dickey Fuller) tests of stationarity are used in the study. The nature of unit root process has different possibilities. To allow for them, the DF test is estimated in three different forms:

V_t is a random walk:	$\Delta V_t = \delta V_{t-1} + u_i$	… … … (4)
V_t is a random walk with drift:	$\Delta V_t = \mu + \delta V_{t-1} + u_t$	… … … (5)
Vt is a random walk with drift around a stochastic trend:	$\Delta V_t = \mu + \delta V_{t-1} + \gamma t + u_t$	… … … (6)

Where ΔV_t is the first differenced time-series variable. The τ (tau) statistic (Dickey and Fuller 1979) is used to find out the significance of the estimated coefficients. The ADF test consists of estimating the following regression:

$$\Delta V_t = \mu + \delta V_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta V_{t-i} + \gamma t + \varepsilon_t \quad \ldots \ldots \ldots (7)$$

The null hypothesis in all above equations is that $\delta = 0$; that is, there is a unit root – the time series is non-stationary.
Testing for Cointegration: The Engle-Granger (1987) approach referred to as Augmented Engle Granger (AEG) Test has been used for testing of cointegration. As in the standard ADF regression, it may be necessary to augment the regression by p lagged valued of $\Delta \hat{\varepsilon}_t$ to ensure that the estimated u_t are free from serial correlation, in which case the model becomes:

$$\Delta \hat{\varepsilon}_t = \gamma \hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \hat{\varepsilon}_{t-i} + u_t \quad \ldots \ldots \ldots (8)$$

The $\hat{\varepsilon}_t$ values are estimated residuals. The test statistic is the estimated 't' statistic on γ, denoted by $\hat{\tau}_\gamma$. The null hypothesis, H_0: $\gamma = 0$, i.e. the two time series are non-cointegrating.

3. Empirical Results

Test of Stationarity :The test statistics may often show a significant relationship between variables in the regression model even though no such relationship exists between them. This type of regression is known as 'spurious regression' (Patterson 2000). The value of R^2 close to 1 and the value of *DW* close to 2 shows that the goodness of fit of the model is high and the regression results are reliable. However, when R^2 is greater than the DW value, it is a good rule of thumb to suspect that the estimated regression is spurious (Granger 1986). The case of spurious regression is frequently encountered while dealing with the time series data. Spurious regression occurs mainly because of the non-stationarity in the time series. To solve such a problem of spurious regression, the stationarity of the time series is examined by conducting unit root test. Also, Granger-causality test assumes that the time series data are stationary. The coefficients (δ values) of the first order lagged variables of the DF and ADF models are presented in Table 1. The values in parenthesis given below the coefficients are the τ (Tau) statistics.

Table 1: Results of the Unit Root Tests

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	DF Test					
Time Series	RW	RWD	RWDT	ADF Test	Result	I(d)
rGDP	0.0387	-0.0091	-0.6027	-0.7297	NS	I(1)
	(7.8750)	(-0.4378)**	(-2.2930)**	(-2.0384)**	NS	I(1)
nGDP	0.0802	0.0192	-0.4658	-0.5937	NS	I(1)
	(7.1804)	(1.0332)	(-3.0626)**	(-2.9435)**	NS	I(1)
INDEX	0.1167	-0.0988	-0.8612	-1.5341	NS	I(1)
	(0.9269)	(-0.3779)**	(-2.2898)**	(-3.732)*	NS	I(1)
mCap	0.13515	0.0536	-0.5083	-0.8702	NS	I(1)
	(1.6904)	(0.4413)	(-1.9362)**	(-3.2750)**	NS	I(1)

Notes: *RW = Pure Random Walk, RWD = Random Walk with Drift, RWDT = Random Walk with Drift and Stochastic Trend, NS = Non-stationary, rGDP = Real GDP, nGDP = Nominal GDP, mCap = Market Capitalization.*

** and ** show that the null hypothesis is accepted at 1% and 5% level of significance respectively.*

In the case of the data set used by the study, test statistics for unit root have been reported in Table 1 with the conclusion that all the economic time series used in the study are nonstationary and integrated of order 1, i.e. all $Y_t \sim I(1)$ consistent with the findings of Shrestha (2006).

The RW DF model is ruled out because the δ values are positive. In this case, the time series would be explosive. In both RWD and RWDT models, the estimated δ coefficients are negative (except for mCap and nGDP in RWD). As the estimated τ values (with asterisk sign) are less than critical τ values, it is concluded that the time series are not stationary. The augmented Dickey-Fuller (ADF) test with ADF(1) also revealed that after taking care of possible autocorrelations, the time series are nonstationary.

Test for Cointegration: Cointegration analysis is used to investigate long term relationship between stock market development and economic growth. The analysis recognizes the non-stationarity of the time series. Any equilibrium relationship among a set of nonstationary variables implies that their stochastic trends must be linked (Enders 2004). In the case, they are said to be cointegrated. Granger (1986) states that a test for cointegration can be thought of as a pre-test to avoid 'spurious regression' situations. The estimates of γ values (coefficients of lagged error terms) are presented in Table 2. The values in the parentheses are the $\hat{\tau}_\gamma$ values. The unaugmented column shows results from Engle-Granger (EG) tests and augmented column depicts results of Augmented Engle-Granger (AEG) tests without trend and intercept.

Table 2: Results of EG and AEG Tests

Variables	Unaugmented	Augmented	Result
ln(rGDP) and INDEX	-0.8867 (-2.5640)**	-1.4736 (-3.8549)**	Cointegrated
ln(nGDP) and INDEX	-0.8707 (-2.4615)**	-1.4863 (-3.8399)**	Cointegrated
ln(mCap) and ln(rGDP)	-0.5696 (-2.5240)**	-0.951 (-4.2930)*	Cointegrated
ln(mCap) and ln(nGDP)	-0.7253 (-3.0186)*	-1.2002 (-4.9024)*	Cointegrated

Note: *ln stands for natural logarithm.*
** and ** show that the null hypothesis is rejected at 1% and 5% level of significance respectively.*

Table 1 shows that the time series variables used in the study are all I(1). It is possible that, although they are individually I(1), a linear combination of them is I(0). When this happens, the variables are said to be cointegrated. Economically speaking, two variables will be cointegrated if they have long-term, or equilibrium relationship between them (Engle and Granger 1987). The results shown in Table 2 depict that there is long term relationship between the stock market variables and the macroeconomic variables, which, corroborate with the findings of Demetriades and Hussain (1996), Rousseau and Wachtel (2000), and Adjasi and Biekpe (2005).

Test for Causality: The procedure used in the study for testing statistical causality between the stock market and the economy is the "Granger-causality" test developed by C.W.J. Granger in 1969. The Granger causality tests determine the predictive content of one variable beyond that inherent in the explanatory variable itself. The variables to be used in the Granger Causality test are assumed to be stationary. In the case of the study's data set, test statistics for unit root have already been reported in Table 1, with the conclusion that the time series are I(1). The time series were made I(0) or stationary by taking their first differences. The study used two most common choices of information criteria AIC and SIC and found that outcome of the test was sensitive to number of lags introduced in the model.

The results given in Table 3 suggest that the direction of causality is from Real GDP to INDEX. However, there is no reverse causation from INDEX to Real GDP. There is bilateral or feedback causality between market capitalization and real GDP. The present value of a stock today is the discounted sum of the expected future cash flows (dividends and capital gain). To the extent that today's stock values reflect expected future dividends, stock market indexes might be used to forecast future economic activity. An increase in stock market indexes today potentially signals the market's expectation of higher corporate dividends and profits and in turn, higher economic growth. Similarly, growth in economic activities, according to existing theories, should positively affect the stock market. In contrast to the theories, however, the results suggest that INDEX and Market Capitalization consecutively do not granger cause Nominal GDP and vice versa.

Table 3: Results of Granger Causality Test

Direction of Causality	F-Value	Causality	No. of Lags
INDEX → Real GDP	0.28	No	2
Real GDP → INDEX	13.44*	Yes	3
	7.8**	Yes	4
M Cap → Real GDP	10.45**	Yes	4
Real GDP → M Cap	7.00**	Yes	3
	9.72**	Yes	4
INDEX → Nominal GDP	1.11	No	2
Nominal GDP → Index	0.75	No	2
M Cap → Nominal GDP	0.32	No	2
Nominal GDP → M Cap	1.77	No	2

** and ** shows that the null hypothesis is rejected at 1% and 5% level of significance respectively.*

The results indicate that real economic growth does “Granger cause” stock market growth and stock prices do “Granger cause” economic activity. The results corroborate with existing empirical works (Mauro 2000, Rousseeu and Wachtel 2000, Adjasi and Biekpe 2005). Furthermore, it is found that significant lag lengths between fluctuations in the stock market and changes in the real economy are observed to be 3 to 4 years. However, it is pointed out that given the controversy surrounding Granger causality method, the empirical results and conclusions drawn from them should be considered as suggestive rather than absolute (Comincioli 1996). For completeness, the test statistics for Granger-causation with lags 1 to 4 are reported in Appendix I.

4. Conclusions

The paper sheds light on the role of stock market development on economic growth. The results of the study disclose that the stock market growth and economic growth have long-run, or equilibrium, relationship. It reveals that the stock market fluctuations do help to predict the future economy. The findings are consistent with existing theoretical underpinnings as illustrated by rational expectations hypothesis and wealth effect. However, the stock market liquidity effect is not found significant for causation of economic growth. The causality has been observed only in real variables but not in nominal variables. More precisely, the causality runs from market capitalization to economic growth with significant feedback. Thus, the finding that changes in real GDP is "Granger-caused" by changes in market capitalization is important in the sense that it supports to justify the leading role of the stock market in determining economic activities even in developing country like Nepal, which has a relatively small capital market. In addition, it is found that the effects of changes in economy are reflected in stock market with a lag of three to four years and vice versa.

Having recognized the importance of financial system for economic growth, Nepal government has initiated financial sector reform program and has increased the efforts towards improving the financial systems of the country to stimulate economic growth. However, the main focus is on banking system. Policy makers should equally encourage stock market development. They should remove impediments to stock markets, such as tax, legal, and regulatory barriers. One of the reasons Nepal has a small stock market is low saving rate. To promote stock market development, government should encourage savings and investment by appropriate policies. Therefore, equal importance must be given to both, bank-based financial sector and market-based stock market of the economy, for fostering capital formulation and investment to increase living standard of the people via economic growth.

The findings of this study have been constrained by the limited number of observations of time series due to unavailability of quarterly data on Nepalese GDP. In addition, the causality used in the study is "Granger causality". Thus, the need of further research is obvious in order to get more evidence about the impact of stock markets on economic growth and vice versa.

Appendix 1
Results of the Granger-causality Test

No of Lags	RSSr	RSSur	F value	Decision
$H0_1$: INDEX does not granger cause Real GDP				
1	3.649811	3.637038	0.049167	accept
2	1.796639	1.709125	0.281622	accept
3	0.793140	0.553723	1.153005	accept
4	0.668482	0.308207	1.461173	accept
$H0_2$:Real GDP does not granger cause INDEX				
1	0.002425	0.002022	2.790307	accept
2	0.002385	0.001725	2.104348	accept
3	0.001819	0.000301	13.448505*	***reject***
4	0.001761	0.000243	7.808642**	***reject***
$H0_3$:Market Capitalization does not granger cause Real GDP				
1	3.649811	3.452578	0.799768	accept
2	1.796639	1.698230	0.318714	accept
3	0.793140	0.481544	1.725538	accept
4	0.668482	0.071377	10.456887**	***reject***
$H0_4$:Real GDP does not granger cause Market Capitalization				
1	2.330515	2.148835	1.183674	accept
2	2.286817	1.600917	2.356431	accept
3	1.855266	0.511794	7.000066**	***reject***
4	1.698868	0.193487	9.725337**	***reject***
$H0_5$:INDEX does not granger cause Nominal GDP				
1	3.550286	2.97339	2.716275	accept
2	2.987707	2.48506	1.112472	accept
3	2.607094	1.381638	2.365224	accept
4	1.541788	0.4393	3.137059	accept
$H0_6$:Nominal GDP does not granger cause Index				
1	0.002425	0.002314	0.671564	accept
2	0.002385	0.002098	0.752383	accept
3	0.001819	0.000972	2.323731	accept
4	0.001761	0.000542	2.811347	accept
$H0_7$:Market Capitalization does not granger cause Nominal GDP				
1	3.550286	3.539724	0.041774	accept
2	2.987707	2.8225	0.321927	accept
3	2.607094	2.063369	0.702702	accept
4	1.541788	0.745761	1.334253	accept
$H0_8$:Nominal GDP does not granger cause Market Capitalization				
1	2.330505	1.840727	3.725100	accept
2	2.286817	1.727682	1.779982	accept
3	1.855266	1.258922	1.263184	accept
4	1.698868	0.644843	2.043181	accept

Notes: RSS_r and RSS_{ur} are residual sum of squares of restricted and unrestricted models respectively.
*Significant at *(1%) and **(5%) level of significance.*

Appendix 2
Macroeconomic and Stock Market Indicators: 1988-2005
(Rs. in Millions)

Mid July	Market Cap.	Real GDP	Nominal GDP	MCR	Annual Turnover	INDEX	Listed Cos	NEPSE Index
1988	1089	148405	76906	0.014	7.7	0.007	27	NA
1989	1509	156478	89270	0.017	30	0.012	36	NA
1990	1775	163893	103416	0.017	25.3	0.011	41	NA
1991	2516	174908	120370	0.021	27.3	0.011	46	NA
1992	2120	183371	149487	0.014	36.9	0.011	55	NA
1993	3806	188780	171474	0.022	79.8	0.015	62	NA
1994	13872	204397	199272	0.07	441.6	0.035	66	226.03
1995	12963	209976	219175	0.059	1054.3	0.048	79	195.48
1996	12295	221930	248913	0.049	215.6	0.023	89	185.61
1997	12698	233040	280513	0.045	416.2	0.027	95	176.31
1998	14289	240816	300845	0.047	202.6	0.021	101	163.35
1999	23508	251758	342036	0.069	1500	0.046	107	216.92
2000	43123.3	267096	379488	0.114	1157	0.048	110	360.7
2001	46349.4	279749	410789	0.113	2335.9	0.056	115	348.4
2002	34703.8	278848	422301	0.082	1540.6	0.043	96	227.54
2003	35240.4	286480	454935	0.077	576	0.032	108	204.86
2004	41424.8	296459	494883	0.084	2144.3	0.047	114	222.04
2005	61365.9	303298	504101	0.202	4507.7	0.097	125	286
Mean	**20258.2**	**227205**	**139947**	**0.062**	**905.489**	**0.032**		
St. Dev.	**18273.3**	**49519**	**139947**	**0.046**	**1142.29**	**0.021**		
Skewness	**0.704**	**-0.024**	**0.16**	**1.39**	**1.757**	**1.17**		
Kurtosis	**2.27**	**1.662**	**1.684**	**5.086**	**5.849**	**4.47**		
JB Statistic	**1.886**	**1.344**	**1.375**	**9.068**	**15.357**	**5.732**		

Source: Annual Publications of Nepal Rastra Bank and Securities Board of Nepal

Note: *MCR = Market Capitalization Ratio, NA = Not Available, INDEX = average of the ratios of market capitalization to GDP, annual turnover to GDP & annual turnover to market capitalization.*

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