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股價報酬與經濟成長的關係是否會消失？跨國橫斷面的實證分析

Is the Relationship Between Stock Returns and Economic Growth Disappearing? A Cross-Sectional Analysis

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摘要：本文利用 49 個國家 1960 年至 2003 的橫斷面資料，建構門檻迴歸(Threshold Regressive；TR)模型，重新檢驗 Binswanger (2004)的發現，即股價報酬與經濟成長之間關係可能會消失。實證結果發現，利用不同的樣本期間進行檢驗，不僅發現高所得國家股價報酬與經濟成長之間同樣具有顯著的正相關，低所得國家也會有相同的現象。因此我們認為，Binswanger (2004)利用線性模型進行估計與檢定，發現股價報酬與經濟成長之間相關性消失的現象並不完全正確，從本文的實證結果可驗證兩者之間關係的消失，僅出現在高所得國家的體制內。

關鍵詞：橫斷面資料；股價報酬；經濟成長；門檻迴歸模型

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Abstract： By employing the cross-sectional data of 49 countries from 1960 to 2003 and constructing the threshold regressive (TR) model, this study re-examines the finding of Binswanger (2004) that the relationship between the stock returns and economic growth is disappearing. Our empirical results from various sample periods indicate that the significantly positive relationship between the stock returns and economic growth exists in both high-income and low-income countries. From our findings we conclude that the empirical result from a linear estimation of Binswanger (2004) is only partially correct. Our findings show that the disappearing relationship only exists in high-income countries.

Keywords: Cross-Sectional Data; Stock Returns; Economic Growth; Threshold Regressive Model

1. Introduction

Different countries or regions have their own unique economic conditions, which in turn, creates distinct financial markets in each area. Generally speaking, most stock markets are efficient in some ways. To maintain this efficiency, the financial surrounding and the financial supervision system must collaborate with each other. [2] In an efficient market, the current price of a stock reflects not only the discounted values of the sum of the future stock dividends and capital gains, but also the investors' expectations of the company's future. From the macroeconomic view point, the performance of the stock market reveals the future of the economy, and stock returns are highly correlated with the economic performance. In general, the reason why the stock market is called "the window of the economy" is that the stock returns could be viewed as the leading indicator of the economic growth.

Most studies examining the relationship between the stock returns and economic growth use time-series data of the individual economy. For instance,

[2] Please refer to Fama (1965, 1970) for the theoretical and empirical explanations of the Efficient Market Hypothesis (EMH).

Fama (1990) and Schwert (1990) focus on the U.S., Choi, Hauser, Kopecky (1999) and Sarantis (2001) focus on the G7 countries, and Hassapis (2003) uses the Canadian data only. Some of the recent articles on this area using data of the EU, OECD countries, or the Asian emerging markets (including Singapore, Korea, the Philippines, Malaysia, Indonesia, and Taiwan). Examples of the researches include Aylward and Glen (2000), Mauro (2003), Henry, Olekalns, Thong(2004) and Huang and Yang (2004), and most of these studies find that there is significant relationship between the stock returns and economic growth.

Employing the linear VECM model, Bingswinger (2004) obtains an interesting empirical finding that the originally significant relationship between the stock returns and economic growth disappears in the beginning of the 1980s in the G7 countries, and this phenomenon is expanding to other major economic areas in the world. Domian and Louton (1997), Sarantis (2001), and Henry, Olekalns, Thong(2004) employ the time-series data and study the similar topic as Bingswinger (2004). These authors suggest that the relationship between the stock returns and economic growth should be investigated by using the nonlinear model and that the linear estimation would result in the model specification problem.

Several economic theories offer explanations to the nonlinearity of the relationship between the stock returns and economic growth. The Keynesian economists believe that the investment is the primary factor causing business cycles. As we mentioned before, the stock market is the window of the economy; therefore, the stock market will fluctuates prior to the economy does. The stock market index is composed with the trading prices and volumes of listed companies. The CEOs of the listed corporations make investment decisions based on their expectations of the economic growth. The private-sector investment is the sum of the investments of all corporations in the economy and it is the private-sector investment that triggers the so-called multiplier-accelerate effect. Therefore, the overall performance of the corporations reflects the economic growth in the future. [3] Since the economic growth is characterized by its

[3] The multiplier effect indicates the increased income caused by an increase of the investment, while the accelerate effect is associated with the increased investment derived by the increased income. These two effects could reinforce each other.

nonlinearity and the stock market is part of the economy, the two (the economic growth and the stock market) are nonlinearly correlated. [4] In addition to the Keynesian theory, a popular explanation to the nonlinearity of the relationship between the stock returns and economic growth is about the financial development and financial deepening. Researches like King and Levine (1993) find that financial indices are significantly and positively correlated with economic growth indices, which indicates that financial development or financial deepening could fuel the economic growth. Wachtel (2003) holds the same conclusion. The stock market is the milestone of the modern financial development and the crucial financing channel for most corporations. Deidda and Fattouh (2002) find that the relationship between the stock returns and economic growth has the property of asymmetry.

As to the utilization of the nonlinear estimation on this field, Domian and Louton (1997) construct the threshold autoregressive (TAR) model with the industrial production as the explained variable, the lag industrial production and lag stock returns as the explanatory variables, and the lag stock returns as the threshold variable. The authors find that there exists the nonlinear threshold effect between the stock returns and real economic activities. Sarantis (2001) employs the stock returns as the threshold variable to estimate a smooth transition autoregressive (STAR) model and finds that the stock return has the property of nonlinear. Henry, Olekalns, Thong(2004) discover that when the economy is in the expansion stage of a business cycle, the stock returns cannot be used to predict

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[4] A complete business cycle experiences four stages: trough, expansion, peak, and depression. The business-cycle-diffusion indicator or the business-cycle-composite indicator could be employed to investigate the cycle, and the growth of an economy is largely affected by the business cycle. The identification of the turning points of the business cycle of a specific economy or the world is not easy. For instance, the way the National Bureau Economic Research (NBER) identifies the business cycle turning points is through the discussions of many economists and specialists with references of the data of U.S. income, production, sales, and employments. From the published data, the U.S. has experienced 10 times of business cycles in the period of 1945 to 2001. In December 2008, NBER identified that December 2007 is the peak of the most recent business cycle. As to Taiwan, the turning points of business cycles are determined by the Council for Economic Planning and Development of the Executive Yuan of Taiwan. Since economic growth is highly affected by the business cycle, it is easily understood that the process of the economic growth is not linear.

the production growth; however, when the economy is in the depression period of a business cycle, then the stock returns could precisely predict the production growth. Lee, Chen and Wang (2008) utilize the bi-variate threshold model and obtain similar empirical results. Regarding other related articles, utilizing the data of ten Asian countries, Lee and Wang (2009) employ the financial development as the threshold variable to construct a nonlinear threshold model and re-examine the empirical findings of Rousseau and Vuthipadadorn (2005). The authors find that in the high financial development regime, the financial development could fuel economic growth in most countries, a finding consistent with the result of Rousseau and Vuthipadadorn (2005), but the direction of the impact of the financial development on the investment cannot be determined. In the low financial development regime, the financial development is negatively correlated with the investment, a finding contradictory with the result of Rousseau and Vuthipadadorn (2005), and the direction of the impact of the financial development on the economic growth cannot be determined.

The above researches all employ the time-series data to conduct empirical studies and most of the papers conclude that the stock return is nonlinearly correlated with the economic growth. The advantage of using the time-series data is that the empirical results could reveal the economic devolvement process and characteristics of the specific country; however, this research method could not be used to investigate the overall development of the whole economic region or area. Researches including Barro (1991), Mankiw, Romer, Weil (1992), and King and Levine (1993) employ annually averaged cross-sectional data to study international economic growth related issues. The advantage of the data is that one could avoid the noise from the short-run business cycles and the problem of simultaneous variables. Summarizing from the above discussion we decide to utilize the multinational cross-sectional data and construct the threshold regressive (TR) model to re-examine the finding of Binswanger (2004) that the relationship between the stock returns and economic growth is disappearing. [5]

Moreover, Aylward and Glen (2000), Mauro (2003), and Henry, Olekalns,

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[5] The difference between the TR model and TAR model is that the former does not contain lag variables in the regressors. To avoid confusion, we name the former the TR model.

Thong(2004) find that the correlation between the stock returns and economic growth is higher in high-income developed countries, as well as in some emerging markets. Because of this, we will construct a bi-regime TR model to differentiate between high- and low-income countries. In this way, we could examine whether the relationship between the stock returns and economic growth would vary with income levels.

We utilize the mean of the per-capita real GDP as the threshold variable. [6] Our empirical results indicate that the stock returns and economic growth are significantly and positively correlated in most countries, and this relationship is not disappearing as Binswanger (2004) suggests. The disappearing relationship phenomenon is found only in some high-income countries in the expansion stage of the business cycles.

This paper is organized as follows. Section 1 is the introduction of our research motivation and purpose. Section 2 is the literature review. The empirical models and data are explained in section 3. Section 4 is the discussions of empirical results and economic significances. The conclusion is listed in section 5.

2. Literature review

Utilizing the U.S. data, Fama (1990) examines the relationship between the current stock returns and future output growth and finds that when this relationship is significant and positive, then one could predict output fluctuations with the change of the current stock returns. Schwert (1990) employs the annual, quarterly, and monthly U.S. data from 1889 to 1989 and constructs a variety of linear models to investigate the relationship between the real stock returns and output. The author finds that these two variables are significantly and positively correlated.

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[6] The real GDP per capita is calculated from the purchasing power parity real GDP quoted in U.S. dollars. The data come from the Penn World Data (www.bized.ac.uk/dataserv/penndata/pennhome.htm).

Using the data of G7 countries, Choi, Hauser, Kopecky (1999) examine whether the change of real stock return is ahead of the fluctuations of economic activities. The authors find that except for Italy, there are significant and long-run equilibriums between the two variables in the rest six countries, and that one could predict the outcomes of future economic activities with the stock returns.

Utilizing the time-series analysis, Domian and Louton (1997) construct the linear autoregressive model and the TAR model with the stock returns as the threshold variable to investigate the relationship between the stock returns and the economic activities in U.S. Empirical results suggest that there is the nonlinear threshold effect between these two variables. When the stock return is negative, it can be used to efficiently predict the future economic activities; when the stock return is positive, then it cannot predict well.

Aylward and Glen (2000) employ twenty three countries, including the G7 countries, to examine whether the stock return could effectively predict GDP, consumption, and investment. The empirical findings show that the prediction effectiveness of the stock return does not exit in every sample country. Among the sample countries, the prediction performance of the stock returns is better in most of the G7 countries than in the emerging countries.

Mauro (2003) constructs the panel data set with quarterly and annual data of multiple countries to investigate the relationship between the output growth and stock returns. The estimation results of the annual panel data indicate that in the uni-variate model, except for India, the positive relationship of the two variables exist in the rest countries. The significant coefficient ratio is 62.5% in the emerging countries and 58.8% in the developed countries. In the bi-variate model, the significant coefficient ratio is 50% in the emerging countries and 58.8% in the developed countries. The empirical results of the quarterly panel data show that the significant coefficient ratio is 33.3% in the emerging countries and 50% in the developed countries. In addition, the significant and positive correlation between the economic growth and stock returns exists in all countries, both emerging and developed ones.

Employing quarterly data of twenty seven countries from the second quarter of 1982 to the forth quarter of 2001, Henry, Olekalns, Thong(2004) examine whether the stock return could predict the economic growth. The estimation results of the nonlinear model include the following three points. First, the stock return is nonlinearly correlated with the output growth. If one estimates this relationship with a linear model, then there will be the model misspecification problem. Second, the significant and positive relationship between the two variables exists in the OECD countries and five southeast Asian countries. Third, the nonlinear estimation results show that only in the recession period, the stock return fluctuations are ahead of the economic growth changes.

Binswanger (2004) employs the quarterly data of the G7 countries from 1960 to 1999 and divides the sample into three sub-sample periods (the whole sample period, 1960 to 1982, and 1983 to 1999) to investigate whether the relationship between the stock returns and real economic activities still exists. The empirical findings show that in the whole sample period and in the period of 1960 to 1982, the lag stock returns could explain the current real economic growth in U.S., Canada, Japan, and the integrated European countries (data for the integrated European countries are the weighted averages of the macroeconomic data of Germany, France, Italy, and U.K.). However, in the sample periods of 1983 to 1999 and 1989 to 1999, the lag stock returns cannot explain the current real economic growth. Concluding from the empirical results the author believes that the once existed relationship of the stock returns and real economic growth disappeared in the early 1980s and this phenomenon might have expanded to the major economic areas in the world.

Employing four Asian countries (Japan, Taiwan, Korea, and Malaysia) as the sample, Lee, Chen and Wang(2008) investigate the asymmetric causality between the stock returns and output growth with the time-series data and the bi-variate threshold vector autoregressive model. The empirical findings show that in the bad-news regime, the stock return is the leading factor of the output, while in the good-news regime, there is not significant relationship between the two factors.

Many researches on this area using the cross-sectional data, for example, Barro (1991), Mankiw, Romer, Weil (1992), and King and Levine (1993). Both

Barro (1991) and Mankiw, Romer, Weil (1992) find that the predictions of the endogenous growth theory cannot be supported by the empirical data. King and Levine (1993) utilize the averaged annual data of eighty countries from 1960 to 1989 and construct a cross-sectional linear model to investigate the relationship between the financial development and economic growth. The authors use four indicators, including the ratio of the current liability to GDP, to proxy the financial development and the per capita real GDP growth rate to proxy the economic growth. The empirical results show that the financial development could significantly fuel the economic growth.

Employing the same data set as King and Levine (1993) do, Deidda and Fattouh (2002) construct a nonlinear model and use the income level as the threshold variable to discuss the relationship between the economic growth and financial deepening. The authors find that the high-income regime is associated with more advanced financial deepening, which indicates that the economic growth is highly correlated with the financial deepening in the high-income regime. In the low-income regime, the relationship between these two variables is not that significant. The findings of this study support the economic growth theories and reveal the advantages of using the nonlinear model.

3. The empirical model and the data

3.1 The methodology

Generally speaking, there are two ways to construct a nonlinear model. One is the piecewise-in-time method that uses time as the structure-change point to investigate the relationship between the dependent and explanatory variables. Another is the piecewise-in-variable method proposed by Tong (1978) and Tong and Lim (1980). This method is to construct a unit-variate TAR model using the characteristic of the variable as the structure-change point to study the correlation of the dependent and explanatory variables.

The shortcoming of the piecewise-in-time method is that the structure change point is subjectively determined by the researcher (for example, Chow, 1960), so the conclusion might be biased. The piecewise-in-variable method has the advantage of avoiding the subjective problem. The nonlinear threshold model utilizes the minimum estimated value of the sum square of error (SSE) as the criterion and the grid search method to obtain the optimum threshold value as the structure change point. The threshold value also serves as the critical value dividing the model into several regimes.

This paper uses the cross-sectional data and constructs a bi-regime TR model. Data of all the variables are the time averages of individual countries and there is no lag term in the model, which makes our model structure different from that of the TAR model using time-series data. Our TR model is specified as follows:

$$Y = \phi_1' X_1 I(q_i > \gamma) + \phi_2' X_2 I(q_i \le \gamma) + \varepsilon_i \quad ,$$

where $Y = (y_1, y_2 .., y_p)'$ is the dependent variable vector; $i = 1, 2, \ldots, p$, and p is the observation (individual countries) number; $X_j = (1, x_{1,j}, \ldots, x_{k,j})'$ is the explanatory variable vector; k is the number of the explanatory variables; $\phi_j = (\phi_{0,j}, \phi_{1,j}, \ldots, \phi_{k,j})'$ is the vector of the estimated parameters; j is the number of the regimes, and $j = 1, 2$; $I(\cdot)$ is an index function, and $I(\cdot) = 1$ when the regime holds; q is the threshold variable; γ is the threshold value.

3.2 The empirical model

This paper utilizes the country level cross-sectional data to investigate the relationship between the stock returns and the economic growth. To avoid the omission-of-relevant-variable problem, we follow the methodologies employed in King and Levine (1993) and Huang and Yang (2004) that include the following variables in our empirical model (in addition to the growth rate of per capita real GDP and the rate of stock returns): the ratio of public consumption to GDP, the ratio of gross fixed capital formation to GDP, the inflation rate, and the ratio of international trade to GDP. These four variables are added as the explanatory variables. The functional expression of the unit-variate cross-sectional model is[7]

$$CALYG = f(CALSR, CAGOV, CAINV, CAPI, CATRD) \quad (1)$$

The functional relation of the bi-regime unit-variate TR model is

$$CALYG = \begin{cases} (\alpha_{10} + \alpha_{11}CALSR + \alpha_{12}CAGOV + \alpha_{13}CAINV + \alpha_{14}CAPI + \alpha_{15}CATRD)I(q > \gamma) \\ \alpha_{20} + \alpha_{21}CALSR + \alpha_{22}CAGOV + \alpha_{23}CAINV + \alpha_{24}CAPI + \alpha_{25}CATRD)I(q \leq \gamma) \end{cases} + \varepsilon \quad (2)$$

In equations (1) and (2), *LYG* is the growth rate of real GDP per capita; *LSR* is the stock return; *GOV* is the ratio of government consumption to GDP; *INV* is the ratio of gross fixed capital formation to GDP; *PI* is the inflation rate; *TRD* is the ratio of international trade to GDP. Variable names with the notation "*CA*" in front of them indicate that the corresponding variables are the time averaged ones. For instance, *CALYG* is the time average of the annual growth rates of real GDP per capita. $I(\cdot)$ is the index function and $I(\cdot) = 1$ when the regime holds. q is the threshold variable; γ is the threshold value; α's are the coefficients to be estimated; ε is the error term.

3.3 The data

Below we introduce the definitions of the variables and explain why we add them into the model. In the following, items (1) and (2) are the primary dependent variables (the growth rate of per capita_real GDP and the rate of stock returns) and

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[7] Since problems associated with the dynamic threshold model could not be completely solved (see Henry et al., 2004), this study employs the method combining the threshold model and the static panel data to conduct empirical studies. Researches including Barro (1991), Mankiw et al. (1992), and King and Levien (1993) employ the same estimation method as well. Deidda and Fattouh (2002) utilize the same cross-sectional data as that of King and Levine (1993) and construct a nonlinear model with income level as the threshold variable to investigate topics such as the economic growth and financial deepening. Therefore, the variables we employ here all have theoretical supports.

items (3) to (6) are the explanatory variables in the TR model. [8]

(1) Real GDP growth rate (*LYG*): This variable is proxied by the growth rate of real GDP per capita that is the log difference of the ratio of real GDP (nominal GDP divided by the GDP deflator) to total population. The primary reason why we calculate the economic growth rate like this is that the growth rate of per capital real_GDP could avoid the noise from price and population fluctuations.

(2) Rate of stock returns (*LSR*): This variable is obtained by taking log difference of the stock market indices. [9]

(3) The ratio of government consumption to GDP (*GOV*): This ratio could reveal both the impact of the government consumption on the whole economy and the strength of the demand side of the economy. This ratio is also used in De Gregorio and Guidotti (1995) and Bekaert, Harvey, Lundblad (2001).

(4) The ratio of gross fixed capital formation to GDP (*INV*): This ratio is the proxy of the capital stock and is the explanatory variable on the production side of the economy. The reason why we add this ratio to our regression is that as King and Levine (1993) point out, the financial development could fuel the economic growth through capital accumulation.

(5) Inflation rate (*PI*): The inflation rate is calculated by taking log difference of the consumer price index (CPI). Jones and Manuelli (1993) argue that the inflation rate negatively impacts the output through distorting the investment level and reducing the investment efficiency. Hung (2001) points out that the

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[8] Most of our stock return data come from the IFS data base of IMF. The rest are the stock market indices of individual countries. The stock return is a nominal variable. Except for the inflation rate, the rest explanatory variables are expressed as the ratio to nominal GDP and are nominal variables. Researches including King and Levien (1993), Deidda and Fattouh (2002), and Huang and Yang (2004) employ the same method.

[9] Except for Taiwan (the Weighted Stock Index), Germany (German DAX index), Hong Kong (Hang Seng index), and U.K. (FTSE 100 index) whose stock return data are obtained from their stock market indices because of the data availability and length , the data of the rest countries come from the IFS CD ROM of IMF (code 62, the stock index). The IFS stock indices are the percentages of individual stock market indices. For example, the U.S. stock index is the percentage of the Dow Jones Industrial Index. For the four exception countries, we take percentages of their stock market indices before using them.

high inflation hurts both the economic growth and the stock market. Because of these reasons, we add the inflation rate in our regression.

(6) The ratio of international trade to GDP (*TRD*): This ratio is the sum of imports and exports to GDP, and could be viewed as an indicator of the openness of an economy. For large open economies like U.S. and Japan or international-trade oriented economies like the four Asian tigers and the southeast Asian emerging markets, the international trade plays an important role in their economic developments; therefore, we add this ratio to our regression. Literatures including King and Levine (1993) and Bekaert et al. (2001) also employ this ratio in their empirical models.

The reason why we employ the annual data to conduct the empirical study is as follows. The GDP and national income data of most countries are quarterly or annual, so using annual data helps enlarge our sample size and length. In addition, we believe that the formation of the interaction between the stock returns and economic growth takes time; therefore, the annual data reveal this property better than other frequency data could. Researches including Fama (1990), Schwert (1990), and Mauro (2003) use annual data in their studies as well.

Our sample includes forty night countries from 1960 to 2003. Not every country has the same data length. The longest one is 44 years and the shortest one contains only 12 years. There are twenty eight countries whose data lengths are greater than or equal to 30 years, eight countries whose data lengths are between 20 and 30 years, and thirteen countries whose data lengths are less than 20 years. Please refer to Appendices 1 and 2 for the data codes and data sources. In addition, we also sort the countries according to their per capita real income. The result shows that there are twenty seven countries belonging to the high-income category, six countries belonging to the medium-to-high-income category, ten countries belonging to the medium-to-low-income category, and six countries belonging to the low-income category. [10]

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[10] According to the income categories specified by the World Bank in 2003, low-income countries indicate the ones whose per capita annul incomes are lower than US$ 765, medium-to-low-incomes countries whose per capita annual incomes are between US$ 766 and US$ 3,035, medium-to-high-income countries whose per capita annual incomes are between

4. The empirical study and analysis

Many studies employing the time-series data to examine the relationship between the stock returns and economic growth, such as Aylward and Glen (2000), Mauro (2003), and Henry, Olekalns, Thong(2004), find that this relationship is significant in most high-income as well as other income level countries. In this paper, we employ the cross-sectional data and construct the bi-regime TR model to investigate whether income levels could impact the relationship between these two variables.[11] Since our data is cross-sectional data without the time factor, there is no lag variable in the regression and we could not discuss the causality between these two variables. Moreover, our sample contains more than thirty countries so we can directly estimate the model without worrying about the small-sample problem. In addition, since the data lengths of our sample countries are not the same, we divide our sample period into three sub-sample periods, according to the available data lengths.

Table 1 lists the three models corresponding to the three different sample periods and the countries included or added in the three models. The sample period of Model 1 is from 1975 to 2003 and Model 1 contains thirty sample countries. The sample period of Model 2 is from 1982 to 2003 and Model 2

US$ 3,036 and US$ 9,386, and high-income countries whose per capita annual incomes are higher than US$ 9,386. The categorizing method used by the World Bank is similar to the one used by the United Nations that divides the countries into two categories: developed countries and developing countries. In our opinion, categorizing countries by income levels has the advantage of finely grouping countries into several, rather than only two, categories, which helps researchers utilize the information on studies and analyses.

[11] The reason why we employ dollar quoted per capita real GDP as the threshold variable is that we would like to differentiate sample countries between high- and low-income ones. This threshold variable cannot reflect the world business cycles. The only way the threshold variable could achieve this purpose is through the changes of the threshold values. For instance, as the sample period approaching the year 2003, we could see that the optimal threshold value is increasing with time. In Model 1 (contains 30 countries), the optimal threshold value is US$ 14,286; in Model 2 (contains 36 countries), the optimal threshold value is US$ 15,114; in Model 3 (contains 49 countries), the optimal threshold value is US$ 21,968. This implies that the real per capita GDP of both high and low income countries are increasing, which indicates that the world economy is growing.

contains thirty six sample countries. The sample period of Model 3 is from 1992 to 2003 and Model 3 contains forty nine countries.

Table 1

Model summary

Country number:			
↑ 49 ↓			**Model 3：←1992 (49 countries) →2003** Bangladesh, China, Greek, Israel,Republic of Kenya, Republic ofMauritius, Mexico, Morocco, Peru,Poland, Portugal, Saudi Arabia, Sri Lanka
	↑ 36 ↓		**Model 2 : 1982 ← (36 countries) → 2003** Chile, Singapore, Thailand, Indonesia, Jordan, Norway
		↑ 30 ↓	**Model 1 : 1975 ← (30 countries) → 2003** Australia, Austria, Belgium, Canada, Columbia, Denmark, Finland, France, Germany, Hong Kong, India, Ireland, Italy, Jamaica, Japan, Korea, Luxemburg, Malaysia, Neitherland, New Zealand, Pakastain, the Philippines, South Africa, Spain, Sweden, Switzerland, Taiwan, U.K., U.S., Venezuela
Sample period:	**1975→**	**1982→**	**1992→ 2003**

The primary purposes that we divide our sample among the three sub-sample periods are as follows. First, in this way, we could prolong our sample period to 28 years (Model 1); otherwise, we would have the whole sample period of only 12 years as in Model 3. Second, in this way we could enlarge our sample to include as many countries as possible without any missing value. [12] Third, our sample period could overlap with that of Binswanger (2004). Fourth, when dividing among sub-samples, many studies use ten years as a window. [13]

In addition, we derive six sub-models from Model 1: Model 1_82 (sub-sample period: 1982 to 2003), Model 1_92 (sub-sample period: 1992 to 2003), Model 1_7581 (sub-sample period: 1975 to 1981), Model 1_8291 (sub-sample period: 1982 to 1991), Model 1_7584 (sub-sample period: 1975 to 1984), and Model 1_8594 (sub-sample period: 1985 to 1994). From Model 2, we derive Model 2_92 with sub-sample period from 1992 to 2003. The primary purpose that we derive sub-models from Models 1 and 2 is that by doing this we could understand the impact of different sample periods on the estimation results and find the sub-sample period that would mostly affect the estimation results. In this way, we could both overlap our estimation period with that of Binswanger (2004) and find the evidence and time period of the disappearing relationship between the stock returns and economic growth.

Table 2 lists the basic statistics of all variables. Comparing the means of *CALSR* (the stock return) and *CALYG* (the economic growth) in the three models, one could see that in Models 1 and 2, the means and minimums are positive and the standard deviations do not change a lot. It seems that although there are six more countries added into the sample of Model 2 and the sample period of Model

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[12] The primary reason we divide our sample into several sub-sample periods is to avoid the possible biased estimation. If we did not do this, there are missing values for the countries with shorter data lengths. When there are missing values in the cross-sectional data, the estimation results might be biased.

[13] Although we employ the cross-sectional data, there are some "dynamic" elements in our empirical study. Through changing the sample periods, we construct several derived models, for example, Models 1_82, _92, _7584, _8594, and 2_92. We could compare different derived or sub-models to analyze a specific country's performances in different time periods, and we could, as well, utilize the estimation results of the sub-models to re-examine the findings of Binswanger (2004).

2 is 7 years shorter, the basic statistics of these two variables in the two models are not influenced much by the sample size and length. In Model 3, there are thirteen more countries added into the sample and the sample period is only 12 years. One can see that the basic statistics of the two variables have more

Table 2

Basic statistics of the variables

1975 to 2003	*CALSR*	*CALYG*	*CAGOV*	*CAINV*	*CAPI*	*CATRD*
Mean	9.25	2.15	16.51	22.06	7.00	74.61
Maximum	22.51	6.93	27.51	31.72	23.83	238.96
Minimum	3.00	-1.86	7.80	16.57	2.41	18.42
Range	19.51	8.79	19.71	15.15	21.42	220.54
Standard deviation	4.09	1.66	4.69	3.64	4.95	51.13
Skewness coefficient	1.58	0.67	0.33	1.02	2.02	1.67
Kurtosis coefficient	6.08	4.57	2.79	3.87	6.72	5.56
Observations	30	30	30	30	30	30
1982 to 2003	*CALSR*	*CALYG*	*CAGOV*	*CAINV*	*CAPI*	*CATRD*
Mean	9.88	2.20	16.38	22.67	6.45	82.87
Maximum	29.13	6.04	27.72	36.24	26.96	293.70
Minimum	2.97	-2.24	8.08	16.44	1.42	19.34
Range	26.16	8.28	19.64	19.8	25.54	274.36
Standard deviation	5.29	1.63	5.08	4.61	5.24	61.30
Skewness coefficient	1.75	0.12	0.36	1.18	2.26	1.90
Kurtosis coefficient	6.51	3.70	2.36	3.87	8.35	6.41
Observations	36	36	36	36	36	36
1992 to 2003	*CALSR*	*CALYG*	*CAGOV*	*CAINV*	*CAPI*	*CATRD*
Mean	8.13	2.09	16.27	22.30	5.59	81.42
Maximum	29.97	7.68	29.16	36.48	32.49	279.60
Minimum	-5.80	-2.82	4.67	15.54	0.26	18.95
Range	35.77	10.5	24.49	20.94	32.23	260.65
Standard deviation	7.12	1.78	5.55	4.96	5.84	58.61
Skewness coefficient	0.86	0.51	0.26	1.16	2.44	2.05

Kurtosis coefficient	4.28	5.12	2.59	3.84	10.53	6.99
Observations	49	49	49	49	49	49

significant changes. For instance, the minimums switch to negative values, the means decrease, and the standard deviations increases a lot. Summarizing from these analyses we can say that because there are more changes to the sample of Model 3, the basics statistics of *CALSR* and *CALYG* become more complicated. However, the changes of the characteristics of *CALSR* and *CALYG* head toward the same directions.

As to other exogenous explanatory variables, the largest means of *CAGOV* and *CAPI* are in Model 1, of *CAINV* and *CATRD* in Model 2. The largest standard deviations of all explanatory variables are in Model 3, except for that of *CATRD* (Model 2). The statistics of ranges also reflect the same phenomena, which indicates that as the sample period gets shorter and the sample size gets larger, all variables, including *CALSR* and *CALYG*, fluctuate more.

4.1 The TR model

We first construct the single regime model and then we conduct the linearity test. According to equation (2), the single regime model is as follows:

$$\begin{aligned} CALYG_i = C + \phi\, CALSR_i + \beta_1 CAGOV_i + \beta_2 CAINV_i \\ + \beta_3 CAPI_i + \beta_4 CATRD_i + \varepsilon_i \end{aligned}, \tag{3}$$

where C is the constant term; ϕ and β's are the coefficients; ε is the error term; i denotes the ith country. When estimating equation (3), to avoid the overparameterization problem, we simplify the regression by reserving only the variables with significant coefficients. In addition, to examine the existence of the nonlinearity, we use the economic growth as the dependent variable and the stock returns and other variables as the explanatory variables to construct the uni-variate model. If the linearity hypothesis is rejected, then we could construct the bi-regime-unit-variate TR model to examine the relationship between the stock returns and economic growth. [14]

Table 3

Summary of the linearity test results and the optimal threshold values

Dependent variable: economic growth Threshold variable: per capita real GDP (US$)				
Sample period	**Model specification (explanatory variables)**	**Threshold value**	**F statistic**	**P value**
Model 1	Observations: 30			
1975 to 2003	Constant term, *CALSR*, *CAINV*, *CAPI*	14286.45	5.67**	(0.03)
1982 to 2003	Constant term, *CALSR*, *CAINV*, *CAPI*	15800.69	4.59*	(0.06)
1992 to 2003	Constant term, *CALSR*, *CAGOV*, *CAPI*	21968.20	9.31**	(0.00)
1975 to 1981	**Constant term, *CALSR*, *CAINV*, *CAPI***	**14784.50**	**2.54**	**(0.44)**
1982 to 1991	Constant term, *CALSR*, *CAINV*, *CAPI*	**18382.79**	**1.65**	**(0.74)**
1975 to 1984	Constant term, *CALSR*, *CAGOV*, *CAINV*	5828.28	10.13**	(0.00)
1985 to 1994	Constant term, *CALSR*, *CAGOV*	8020.56	6.04**	(0.04)
Model 2	Observations: 36			
1982 to 2003	Constant term, *CALSR*, *CAGOV*, *CAPI*, *CATRD*	15114.03	5.31**	(0.02)
1992 to 2003	Constant term, *CALSR*, *CAGOV*, *CAINV*, *CAPI*	2.1968.20	8.01**	(0.00)
Model 3	Observations: 49			
1992 to 2003	Constant term, *CALSR*, *CAGOV*, *CAINV*, *CAPI*	21968.20	3.76*	(0.07)

Note: Numbers in the parentheses are the p values of the linearity test statistics of the TR model. ** and * indicate the 5% and 10% significances, respectively.

In this paper, we utilize the U.S. dollar quoted averaged per capita real GDP as the threshold variable to differentiate between high- and low-income regimes and to construct the TR model. The Tsay (1989, 1998) linearity test associated

[14] For detailed explanations of the estimation processes of the nonlinear models with cross-sectional data, please refer to Deidda and Fattouh (2002).

with lag period setting cannot be applied here; therefore, we employ the *Sup LM* linearity test proposed by Hansen (1996).[15] In addition, to compare the estimation robustness among models, we specify ten different models according to the sub-sample periods for the following uses.

Table 3 reports the linearity test results. Under the 10% significant value, the null hypothesis is rejected in eight models: Model 1, Model 1_82, Model 1_92, Model 1_7584, Model 1_8594, Model 2, Model 2_92, and Model 3. This result suggests that we could employ the bi-regime TR model in those eight models. As to Model 1_7581 and Model 1_8291, since the linearity hypothesis cannot be rejected in these two models, we discard them in the following discussions.

4.2 The empirical results and analyses

Table 4 lists the estimation results of the TR model. In the following, we explain and discuss our findings of each model.[16]

Model 1:

The threshold value is US$ 14,286. In regime 1, the high-income regime, the stock return is positively and significantly correlated with the economic growth. In regime 2, the low-income regime, the two variables are positively correlated but the correlation is not significant. These findings indicate that in the 29 years, the relationship between the two variables is significant and positive only in high-income countries. This result is consistent with the conclusions of Aylward and Glen (2000), Mauro (2003), and Henry, Olekalns, Thong(2004) that

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[15] The critical values of the large-sample linearity test are highly sensitive to the nuisance parameter. Hansen (1996) suggests that one could transform the test statistic with the large-sample distribution, and the transformed statistic follows the large sample uniform distribution (U(0, 1)) under the null hypothesis. In this way, the critical values will not be influenced by the nuisance parameter.

[16] Norman (2008) finds that the estimation result of the small-sample threshold model could be biased. To reconfirm the robustness of the estimation result in Table 4, we utilize the suggestion of Norman (2008) and the bootstraps method to obtain eight critical values of the estimated coefficients of the threshold model. Please refer to Appendix 3 for detailed information. The results show that except for the significant levels of some coefficients, the whole estimation results are not affected by the small-sample problem, which indicates that our estimation results are robust.

use time-series data to investigate the same question. As to the outcome of regime 2, we believe that the reason for the insignificance of this relationship is as follows. Although there are some high-income countries like the Asian emerging industrial economies, there are other low- and medium-low income ones. Since our data are averaged ones, this might weaken the significance of the relationship between the two variables in high-income countries of regime 2 and lead to the insignificance in regime 2.

As we can see in Table 3, the threshold effect is significant in four of the derived models of Model 1, including Model 1_82, Model 1_92, Model 1_7584, and Model 1_8594. In the following, we discuss the "sample period" impact through the derived models.

Model 1_82:

The sub-sample period of Model 1_82 is from 1982 to 2003 and there are 30 observations in the model. The threshold value reported in Table 4 is US$ 15,800. In regime 1, the relationship between the stock returns and economic growth is positive and significant; in regime 2, the positive relationship between the two variables is not significant. Comparing the estimation results of Model 1 and Model 1_82, we can see that in regime 1 of Model 1_82, the significance level of the relationship between the two variables is reduced, while the significance level in regime 2 is raised. The major reason of the significance-level fluctuation between the two models might be that the data length is 7 years shorter in Model 1_82.

Model 1_92:

The sample period of Model 1_92 is shortened, from 1992 to 2003. There are 30 observations and the threshold value is US$ 21,968. The positive and significant relationship between the stock returns and economic growth is disappeared in regime 1 but shown up in regime 2. It is very obvious that because the sample period of Model 1_92 is 17 years shorter than that of Model 1, the relationship between the two variables is no longer the same. It seems that when the sample period changes, the originally positive and significant relationship between the two variables would switch from regime 1 to regime 2. To obtain the more specific impact of the sample period on the estimation result, we compare the following two derived models.

Table 4
Estimation results of the TR model

Model 1: sample period: 1975 to 2003 (30 observations) threshold value: US$ 14,286.45								
	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value		
Constant term	18	-1.67	(0.29)	12	1.95	(0.56)	Adjusted R^2	0.56
CALSR		**0.24**	**(0.03)**		**0.11**	**(0.29)**	Residual sum	1.10
CAINV		0.09	(0.08)		0.13	(0.37)	Residual sum of squares	26.40
CAPI		-0.11	(0.56)		-0.33	(0.00)	Log likelihood	-40.65
Countries included in the regime	Luxemburg, U.S., Switzerland, Denmark, Canada, Australia, Japan, Sweden, Netherland, Belgium, France, Hong Kong, Germany, Austria, U.K., Italy, Finland, New Zealand			Spain, Ireland, Taiwan, Korea, Venezuela, South Africa, Malaysia, Columbia, the Philippines, Jamaica, India, Pakistan				

Model 1_82: sample period: 1982 to 2003 (30 observations) threshold value: US$ 15,800.69								
	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value		
Constant term	18	-0.93	(0.53)	12	2.91	(0.22)	Adjusted R^2	0.52
CALSR		**0.10***	**(0.08)**		**0.07**	**(0.22)**	Residual sum	1.08
CAINV		0.09	(0.13)		0.07	(0.53)	Residual sum of squares	25.51
CAPI		-0.03	(0.87)		-0.28	(0.00)	Log likelihood	-40.14

Model 2: sample period: 1982 to 2003 (36 observations) threshold value US$ 15,114.03								
	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value		
Constant term	21	0.54	(0.45)	15	8.77	(0.00)	Adjusted R^2	0.61
CALSR		**-0.13**	**(0.35)**		**0.12****	**(0.02)**	Residual sum	1.02
CAPI		0.30	(0.24)		-0.35	0.00)	Residual sum of squares	27.19

CAGOY		0.02	(0.65)	-0.29	(0.00)	Log likelihood	-46.03
CATRD		0.01	(0.00)	0.00	(0.50)		
Countries included in the regime	Luxemburg, U.S., Switzerland, Norway, Denmark, Canada, Australia, Japan, Sweden, Netherland, Belgium, France, Hong Kong, Germany, Austria, U.K., Singapore, Italy, Finland, New Zealand, Ireland			Spain, Taiwan, Korea, Venezuela, Chile, South Africa, Malaysia, Columbia, Thailand, Jordan, the Philippines, Jamaica, Indonesia, India, Pakistan		The six squared countries are the ones not included in the sample of Model 1.	

Note: Regime 1 corresponds to the case that the income is greater than the threshold value, while regime 2 corresponds to the case that the income is smaller than the threshold value. Numbers in the parentheses are the p values. ** and * indicate the 5% and 10% significances, respectively.

Table 4 (continued)

Model 1_7584: sample period: 1975 to 1984 (30 observations) threshold value: US$ 5,828.27

	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value	Adjusted R^2	0.69
Constant term	22	4.41	(0.17)	8	-2.65	(0.26)	Residual sum	1.22
CALSR		**0.14***	**(0.05)**		**0.37****	**(0.00)**	Residual sum of squares	33.01
CAGOY		-0.16	(0.19)		-0.85**	(0.00)	Log likelihood	-44.00
CAINY		-0.05	(0.44)		0.61**	(0.00)	AIC	3.47
	Luxemburg, U.S., Switzerland, Canada, Denmark, Japan, Hong Kong, Australia, Sweden, France, Germany, Belgium, Austria, Netherland, Italy, U.K., Finland, New Zealand, Spain, Ireland, Venezuela, South Africa			India, Pakistan, the Philippines, Jamaica, Columbia, Malaysia, Taiwan, Korea				

Model 1_8594: sample period: 1985 to 1994 (30 observations) threshold

value: US$ 8,020.56								
	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value	Adjusted R^2	-0.01
Constant term	23	3.51	(0.19)	7	-10.95	(0.15)	Residual sum	2.28
CALSR		**0.08**	**(0.58)**		**0.11**	**(0.11)**	Residual sum of squares	124.89
CAGOY		-0.12	(0.27)		0.91	(0.07)	Log likelihood	-63.96
							AIC	4.66
	Luxemburg, U.S., Switzerland, Canada, Denmark, Japan, Hong Kong, Australia, Sweden, France, Germany, Belgium, Austria, Netherland, Italy, U.K., Finland, New Zealand, Spain, Ireland, Taiwan, Korea, South Africa			India, Pakistan, the Philippines, Jamaica, Columbia, Malaysia, Venezuela				

Model 1_7584:

The sample period of Model 1_7584 is from 1975 to 1984 and there are 30 observations. This sample period is in the first one third of the 29-year period and through the estimation results of this model, we could understand the impact of this 10-year period on the relationship between the stock returns and economic growth. The empirical findings show that the threshold value is US$ 5,828 and the relationship between the two variables is positive and significant in both regimes. The only difference between the estimation results of the two regimes is that the significance level (p value) in regime 1 is lower than that of regime 2.

Table 4 (continued)

Model 1_92: sample period: 1992 to 2003 (30 observations) threshold value: US$ 21,968.2

	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value		
Constant term	15	-0.73	(0.44)	34	9.17	(0.00)	Adjusted R^2	0.68
CALSR		**0.09**	**(0.30)**		**0.12***	**(0.09)**	Residual sum	0.97
CAGOY		0.06	(0.03)		-0.34	(0.00)	Residual sum of squares	20.86
CAPI		0.34	(0.42)		-0.38	(0.00)	Log likelihood	-37.12
							AIC	3.01

Model 2_92: sample period: 1992 to 2003 (36 observations) threshold value: US$ 21,968.2

	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value		
Constant term	15	-7.49	(0.01)	34	8.91	(0.00)	Adjusted R^2	0.62
CALSR		**0.13**	**(0.12)**		**0.13****	**(0.03)**	Residual sum	1.04
CAGOY		0.16	(0.01)		-0.35	(0.00)	Residual sum of squares	28.03
CAINY		0.21	(0.01)		0.01	(0.81)	Log likelihood	-46.58
CAPI		0.52	(0.14)		-0.37	(0.00)	AIC	3.14

Model 3: sample period: 1992 to 2003 (49 observations) threshold value: US$ 21,968.2

	Regime 1			Regime 2				
	Obs.	Coef.	P value	Obs.	Coef.	P value		
Constant term	15	-7.49	(0.00)	34	2.03	(0.41)	Adjusted R^2	0.42
CALSR		**0.13***	**(0.10)**		**0.10****	**(0.05)**	Residual sum	1.36
CAGOY		0.16	(0.00)		-0.13	(0.06)	Residual sum of squares	71.65

CAINY	0.21	(0.00)	0.14	(0.03)	Log likelihood	-78.84
CAPI	0.52	(0.12)	-0.25	(0.00)	AIC	3.63
Countries included in the regime	Luxemburg, U.S., Norway, Switzerland, Hong Kong, Denmark, Canada, Japan, Singapore, Australia, Netherland, Austria, Belgium, Germany, Sweden		U.K., France, Italy, Finland, Ireland, New Zealand, Israel, Spain, Taiwan, Portugal, Greece, Korea, Mauritius, Chile, Saudi Arabia, Mexico, Malaysia, Poland, South Africa, Venezuela, Thailand, Columbia, Peru, Morocco, Jordan, Indonesia, the Philippines, Jamaica, Sri Lanka, China, India, Pakistan, Bangladesh, Kenya		The thirteen squared countries are the ones not included in the sample of Model 2.	

Model 1_8594:

The sample period of Model 1_8594 is from 1985 to 1994 and there are 30 observations. This sample period is in the middle of the 29-year period. The threshold value is US$ 8,020.56. The estimation result shows that the relationship between the stock returns and economic growth is positive but insignificant in both regimes, which is contrary to the estimation result of Model 1_7584. This empirical finding seems to indicate that in this period, there may exist some factors that would reduce the significance of the relationship between these two variables. Our findings also reflect both the phenomenon pointed out by Binswanger (2004) that the relationship between the stock return and economic growth was disappearing and the timing of this very phenomenon.

We summarize our estimation results of Models 1_82 and 1_92 as follows. Because of the change of the sample periods, the originally positive and significant relationship between the stock returns and economic growth in regime 1 of Model 1_82 starts to fade after 1982. Till 1992, this relationship becomes insignificant. This significance-fading pattern is confirmed by the estimation results of Models 1_7584 and 1_8594. During the 10 years of 1975 to 1984, the relationship is significant in both regimes. In the 10 years of 1985 to 1994, however, the significant relationship disappears in both regimes, which indicates that the economic environments in these two 10 years are very different.

Using 1980 as the switching point, we discover the disappearing relationship phenomenon first observed by Binswanger (2004). The estimation results of regime 1 in all the sub-models of Model 1 confirm the finding of Binswanger (2004). We believe that this phenomenon could not be completely examined by the linear model and the reason is as follows. From our above findings, the positive and significant relationship between the stock returns and economic growth does exist. However, during some period, this positive and significant relationship would switch from regime 1 to regime 2 in the whole sample period.

Model 2:

The sample period of Model 2 is from 1982 to 2003 and there are 36 observations. Since there are six more countries (Norway, Singapore, Chile, Thailand, Jordan, and Indonesia) in the sample, compared to that of Model 1_82, we could view Model 2 as the derived model of Model 1_82 and the comparison of the estimation results of the two models could give us an idea about the impact of the sample size. [17]

The estimation results of Model 2 are reported in Table 4. The threshold value is US$ 15,114, higher than that of Model 1. Different from the estimation result of Model 1_82, in Model 2, the stock return is positively and significantly correlated with the economic growth in regime 2 and the correlation is negative in regime 1, which indicates that after adding six more countries into the sample, the significance level in regime 1 is reduced while that in regime 2 is raised. The two countries added in regime 1 are Singapore and Norway and the four countries

[17] Since 1984, the averaged economic growth rate of Chile was about 6.5%. The rate was 6.7% in 1996, while in 1997, the rate dropped to negative. Chile started to recover in 2000. The averaged growth rate in the recent 10 years is 6%. The averaged economic growth rate of Jordan between 1981 and 1985 was 11%. Starting from August 1990, the First Gulf War period, Jordan's economy declined. Jordan participated the World Trade Organization in 1999. The averaged economic growth rate between 1999 and 2002 was around 3% and 4%. As to Indonesia, its primary export is oil. The averaged economic growth rate between 1985 and 1994 was over 5%. In 1997, the rate dropped from 7% to -13%.

added in regime 2 are Chile, Thailand, Jordan, and Indonesia. In addition to these four countries, part of the original countries in regime 2 are Asian emerging industrial countries, including Korea, Taiwan, the Philippines, Thailand, Indonesia, and Malaysia. [18] Same as the findings of Model 1_82, the relationship disappearing phenomenon discovered by Binswanger (2004) also appears in regime 1 of Model 2. To examine the impact of the sample periods, we derived Model 2_92 whose sample period is 10 years shorter than that of Model 2.[19]

Model 2_92:

The sample period of Model 2_92 is from 1992 to 2003 and there are 36 observations. The threshold value is US$ 21,968. The relationship between the stock returns and economic growth is positive and significant in regime 2, positive and insignificant in regime 1. Comparing the estimation result of Model 2_92 with that of Model 2, we find that the significance level of the relationship between the two variables is higher in regime 1 of Model 2_92 (the p value is changed from 0.35 in Model 2 to 0.12 in Model 2_92) and the direction of the relationship is switched from negative in Model 2 to positive in Model 2_92. We believe the primary reason of the estimation result difference in regime 1 of the two models is that the sample period of Model 2 is 10 years shorter. As to the disappearing relationship phenomenon found in Binswanger (2004), the phenomenon does not show in our estimation. The relationship between the stock returns and economic growth is positive and significant in regime 2.

[18] In the 1980s, the European and American high-income countries grew at low but stable rates, and the stock markets of those countries performed well. In that period, only eastern Asian and Pacific region economies had high economic growth rates. In the period of 1985 to 1994, the growth rates of Hong Kong, Singapore, Thailand, Korea, Malaysia, and Indonesia were over 5%. China and India both had surprising economic performances. The financial, stock, and exchange rate markets of Asian emerging industrial economies grew at high speed. For detailed information about economic growth data of these countries.

[19] The way we divide between the two regimes is based on the endogenously produced threshold value by the model, not by our subjective decisions. Because of the limit number of the observations, we have only two regimes: the high-income regime (regime 1) and the low-income regime (regime 2). This classification method creates slightly different results from the classification of the World Bank. For instance, in our classification, Taiwan and Korea belong to regime 2, the low-income regime. Even though there is this kind of classification difference, our empirical results are consistent with most of the researches on this field.

Model 3:

The sample period of Model 3 is from 1992 to 2003 and there are 49 observations, the largest number of observations and the shortest sample period in all models.[20] Model 3 could be viewed as the derived model of Models 1_92 and 2_92 by adding more observations. The estimation results show that the threshold value is US$ 21,968 and the relationship between the stock returns and economic growth is positive and significant in both regimes 1 and 2. The significantly positive correlation finding is consistent with the conclusions of many time-series studies, including Aylward and Glen (2000), Mauro (2003), and Henry, Olekalns, Thong(2004), that the relationship between the stock returns and economic growth is positive and significant in high-income as well as other income level countries. For comparison convenience, we summarize our empirical findings in Table 5.

From above estimation results we could see that when the sample period is from 1960 to 2003, the relationship between the stock returns and economic growth is positive and significant in high-income countries. Why is that? We believe the major reason is that the financial markets in high-income countries are more complete and regulated, and therefore, the markets could maintain their efficiency and the stock prices could reveal the fundamental values of the economic growth of the corresponding countries. In other words, the financial markets of these countries are less susceptible to the impacts of other economic, financial, or political factors so that stock return of these financial markets would not lose their ability of predicting the economic growth. King and Levine (1993) find that the financial development could fuel the economic growth and the two variables are positively and significantly correlated. The major factor contributes to the positive and significant correlation is the complete, efficient, and regulated financial environment. Moreover, in our empirical study, when we use a shorter

[20] There are thirteen newly added countries in Model 3, including Israel, Portugal, Greece, Mauritius, Saudi Arabia, Mexico, Poland, Peru, Morocco, Sri Lanka, China, Bangladesh, and Kenya. Among them, Mexico experienced the so-called Peso crisis in 1994 and 1995, and the economy started to grow in 1996. China's economic growth speeds up after the economic reform.

sample period (for example, 1992 to 2003), no matter how many countries are included in the sample, the relationship between the stock returns and economic growth is positive and significant in regime 2, the low-income regime.

Table 5

Empirical result summary

Model and sample period	**Regime 1 (high income)**		**Regime 2 (low income)**	
	coefficient	**correlation**	**coefficient**	**correlation**
Sample period: 1975 to 2003				
Model 1 (30 observations)	**0.24****	**Yes**	0.11	No
Sample period: 1982 to 2003				
Model 1_82 (30 observations)	**0.10***	**Yes**	0.07	No
Sample period: 1992 to 2003				
Model 1_92 (30 observations)	0.09	No	**0.12***	**Yes**
Sample period: 1975 to 1984				
Model 1_7584 (30 observations)	**0.14***	**Yes**	**0.37****	**Yes**
Sample period: 1985 to 1994				
Model 1_8594 (30 observations)	0.08	No	0.11	No
Sample period: 1982 to 2003				
Model 2 (36 observations)	-0.13	No	**0.12****	**Yes**
Sample period: 1992 to 2003				
Model 2_92 (36 observations)	0.13	No	**0.13****	**Yes**
Sample period: 1992 to 2003				
Model 3 (49 observations)	**0.13***	**Yes**	**0.10****	**Yes**

Note: 1. This table is summarized from Table 4.
2. Numbers in the parentheses are the p values of the corresponding statistics. ** & * indicate the 5% and 10% significances, respectively.

In addition, when the sample periods are shortened to 1982 to 2003 and 1992 to 2003, the estimation results of the derived models of Model 1 and Model 2 show that the positive correlation between the stock returns and economic growth is switched from regime 1 to regime 2. Our findings seem to reflect the worldwide economic environment change in the 1980s and 1990s. The data published by the National Bureau of Economic Research indicate that the U.S. entered the 92-month expansion period of the business cycle in November 1982. This cycle reached the peak in July 1990 and then entered the recession period. U.S. is the leader of the world economy and its economic expansion would cause the world economy to enter the expansion of the business cycle simultaneously. Therefore, in our empirical findings, for countries belonging to regime 1, due to the impact of the long-run sustained expansion of the world economy, the originally positive and significant relationship between the stock returns and economic growth is weakened or become insignificant. This relationship change may also offers an explanation to the finding of Binswanger (2004).

5. Conclusions

This paper employs the cross-sectional data and constructs a bi-regime TR model to re-examine the phenomenon of the disappearing relationship between the stock returns and economic growth. The empirical results show that in different sample periods, this positive and significant relationship exists in both the high-income and low-income countries. Therefore, we believe that the disappearing relationship phenomenon found by Binswanger (2004) with a linear model is not completely correct. We utilize a nonlinear TR model to conduct the empirical analysis and find that the disappearing phenomenon only exists in high-income regime and we think the possible cause of this phenomenon is the continuous expansion of the worldwide business cycle.

In addition, we construct several derived models by vary sample periods to obtain the impact of sample periods. We find that in the periods of 1975 to 1984 and 1985 to 1994, the relationships between the stock return and economic growth are completely different. This finding helps us clarity the argument of Binswanger (2004) and could serve as a future research direction.

This paper employs the cross-sectional data and constructs a bi-regime TR model to investigate the relationship between the stock returns and economic growth. Comparing to the linear model that could obtain only single empirical finding and the time-series data that could not offer sufficient empirical conclusions, our empirical method provide multiple and more complete empirical results and conclusions, and this is the major contribution of this study.

Appendix 1

Years and income levels of sample countries

Country	Number of years	Income level	Country	Number of years	Income level
Australia	44	HI	Malaysia	29	MH
Austria	35	HI	Mauritius	14	MH
Bangladesh	15	LO	Mexico	16	MH
Belgium	30	HI	Morocco	15	ML
Canada	44	HI	Netherlands	44	HI
China	12	ML	New Zealand	43	HI
Chile	28	MH	Norway	23	HI
Colombia	34	ML	Pakistan	30	LO
Denmark	43	HI	Peru	13	ML
Finland	44	HI	Philippines	44	ML
France	43	HI	Poland	12	MH
Germany	38	HI	Portugal	14	HI
Greece	18	HI	Saudi Arabia	16	MH
Hong Kong	29	HI	Singapore	28	HI
India	44	LO	South Africa	43	ML
Indonesia	25	ML	Spain	44	HI
Ireland	44	HI	Sri Lanka	18	LO
Israel	18	HI	Sweden	43	HI
Italy	44	HI	Switzerland	43	HI
Jamaica	33	ML	Taiwan	36	HI
Japan	37	HI	Thailand	28	ML
Jordan	23	ML	United Kingdom	43	HI
Kenya	13	LO	United States of	44	HI

Korea	31	HI	American		
Luxembourg	32	HI	Venezuela, Rep. Bol.	34	ML

Appendix 2
Data source and code

1. The IFS CD ROM of IMF

Data	Variable name	Code	
Stock share price index	CALSR	62	
Consumer price index (CPI)	CAPI	64	*L64
Government Consumption	CAGOV	91	*L91F
Gross fixed capital formation	CAINV	93E	*L93E
Exports of goods and services	CATRD	90C	*L90C
Imports of goods and services		98C	*L98C
Gross domestic product (GDP)	CALYG	99B	*L99B
Population, CPI		99Z	*L99Z
GDP deflator index		99BIR	

Note: * indicates that Taiwan's data are obtained from the Taiwan's IMF IFS Format Financial Statistical Databank of the Taiwan Economic Data Center.

2. The INTLINE International Economic Statistical Databank of the Taiwan Economic Data Center

Data	Code	
Stock share price index	*M xxxpiset(1)	Dxxxpiset(1)
CPI	Qxxxpsttr	Mxxxpsttr
Gross domestic product (GDP)	Axxxvngdp	Qxxxvngdp

Note: * xxx is the country code. All the monthly and quarterly data are averaged into annual data.

Appendix 3
TR model estimation results (after bootstrap method adj.)

	Model 1			**Model 1_82**			**Model 2**			
Regime 1	calsy	cainv	capi	calsy	cainv	capi	calsy	capi	cagov	catrd
97.50%	0.390	0.194	0.118	0.328	0.245	0.374	0.018	0.590	0.094	0.017
95.00%	0.370	0.178	0.085	0.285	0.212	0.304	0.000	0.551	0.084	0.016
	0.243*	**0.092***	-0.108	0.096	0.092	-0.027	-0.127	**0.301***	0.018	**0.012***
5.00%	0.115	0.007	-0.302	-0.049	-0.009	-0.364	-0.255	0.070	-0.045	0.008
2.50%	0.095	-0.002	-0.341	-0.072	-0.029	-0.432	-0.282	0.021	-0.059	0.007
Regime 2	calsy	cainv	capi	calsy	cainv	capi	calsy	capi	cagov	catrd
97.50%	0.271	0.295	-0.171	0.199	0.200	-0.148	0.229	-0.230	-0.131	0.014
95.00%	0.246	0.271	-0.190	0.179	0.181	-0.161	0.217	-0.247	-0.154	0.011
	0.106	0.131	**-0.329***	0.074	0.069	**-0.283***	**0.123***	**-0.354***	**-0.290***	-0.005
5.00%	-0.045	-0.012	-0.455	-0.026	-0.046	-0.387	0.037	-0.456	-0.417	-0.019
2.50%	-0.074	-0.035	-0.479	-0.047	-0.063	-0.405	0.019	-0.474	-0.442	-0.023

	Model 1_7584			**Model 1_8594**	
Regime 1	calsy	cagov	cainv	calsy	cagov
97.50%	0.220	-0.042	0.117	0.282	0.084
95.00%	0.209	-0.060	0.090	0.249	0.047
	0.141*	**-0.162***	-0.051	0.080	-0.117
5.00%	0.075	-0.266	-0.195	-0.088	-0.271
2.50%	0.060	-0.288	-0.222	-0.124	-0.310
Regime 2	calsy	cagov	cainv	calsy	cagov
97.50%	0.503	-0.542	0.773	0.247	1.651
95.00%	0.484	-0.599	0.750	0.228	1.591
	0.374*	**-0.849***	**0.606***	0.112	**0.907****
5.00%	0.252	-1.066	0.482	-0.001	0.245
2.50%	0.228	-1.103	0.461	-0.017	0.196

	Model 1_92			**Model 2_92**				**Model 3**			
Regime 1	Calsy	cagov	capi	calsy	cagov	cainv	capi	calsy	cagov	cainv	capi
97.50%	0.222	0.143	1.259	0.294	0.289	0.385	1.395	0.294	0.289	0.385	1.395
95.00%	0.196	0.130	1.090	0.266	0.265	0.357	1.276	0.266	0.265	0.357	1.276
	0.088	0.059	0.340	0.133	**0.158***	**0.207***	0.520	**0.133***	**0.158***	**0.207***	0.520

5.00%	-0.023	-0.006	-0.415	-0.001	0.047	0.065	-0.262	0.001	0.047	0.065	-0.262
2.50%	-0.050	-0.024	-0.592	-0.021	0.027	0.039	-0.410	-0.021	0.027	0.039	-0.410
Regime 2	Calsy	cagov	capi	calsy	cagov	cainv	capi	calsy	cagov	cainv	capi
97.50%	0.213	-0.188	-0.261	0.230	-0.210	0.098	-0.254	0.177	-0.028	0.237	-0.131
95.00%	0.199	-0.211	-0.280	0.215	-0.233	0.086	-0.275	0.163	-0.045	0.224	-0.151
	0.117*	**-0.341***	**-0.375***	**0.133***	**-0.347***	0.012	-0.375	**0.096***	**-0.134***	**0.144***	**-0.247***
5.00%	0.028	-0.470	-0.471	0.050	-0.455	-0.058	-0.466	0.028	-0.220	0.066	-0.340
2.50%	0.013	-0.495	-0.490	0.034	-0.475	-0.076	-0.487	0.012	-0.237	0.049	-0.357

Note: All symbols in the table have the same meanings as the symbols in Table 4. ** & * stand for the 5% and 10% significances, respectively. The regime 1 (2) represented the high (low) income regime, respectively.

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