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On the causal links between the stock market and the economy of Hong Kong

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ABSTRACT

A bulk of literature has identified the major economic drivers of Hong Kong's rapid and steady economic performance over the last three decades. Of the major economic drivers identified, the performance of the stock market has received less attention. This paper examines the causal links between the stock market performance and economic performance of Hong Kong in an augmented VAR setting. Using an extended quarterly dataset that covers the period of 1986Q2–2014Q4 and the Toda-Yamamoto causality test, we find that stock market performance as proxied by the market capitalization ratio and economic performance stimulate each other. In addition, stock market performance as proxied by the total value traded ratio and economic performance influence each other. However, the causal links between stock market performance and economic performance dissipate if stock market performance is proxied by the turnover ratio. This finding suggests that the causal links between stock market performance and economic performance are highly dependent on the proxy used for stock market performance in the case of Hong Kong.

KEY WORDS: Causality, Economic Performance, Stock Market Performance, Toda-Yamamoto

JEL Classification: E44, C32

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1. Introduction

The growing importance of stock markets around the world has generated diverse research in the finance and economic literature, most of which has identified a strong positive association between the performance of stock markets and the performance of economies. The theoretical contributions suggest that the stock market is an important component of financial sector development in promoting economic growth in different ways. By reducing the cost of mobilizing savings, the stock market may facilitate investment into the most productive technologies, thereby leading to economic growth (Greenwood & Smith, 1997). As the stock market develops, it may improve corporate governance by addressing the principal-agent problem, which is beneficial to economic growth (Jensen & Murphy, 1990). Well-developed stock markets also allow world portfolios to shift from safer low-return capital to riskier high-return capital, which can create substantial welfare gain through the effects on expected consumption growth (Obstfeld, 1994). In addition, the stock market provides market liquidity, which allows investors to trade financial assets in a less risky manner. Such an increase in liquidity also provides companies with easy access to capital, thereby contributing to long-term growth (Bencivenga, Smith, & Starr, 1996; Levine, 1991).

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There are equally opposing theoretical views about the association between stock market performance and the performance of an economy. In terms of stock market liquidity, Demirgüc-Kunt, and Levine (1996) identify various channels through which stock market development hurts economic performance. First, greater stock market liquidity may reduce the savings rate by increasing the returns on investment. Second, by reducing the uncertainty associated with investment, it may make investment more attractive to risk-averse agents and decrease the demand for precautionary savings. Third, a highly liquid stock market encourages dissatisfied investors to sell quickly, which can lead to a disincentive to exert corporate control and therefore compromise the quality of corporate governance (Jensen & Murphy, 1990). In addition, excessive price volatility in stock markets may lead to an inefficient allocation of resources and upward pressure on interest rates to compensate for higher uncertainty. Therefore, the quantity and productivity of investment may be compromised, which will hinder growth (Arestis, Demetriades, & Luintel, 2001; DeLong, Schleifer, Summers, & Waldmann, 1989).

Indeed, the role of stock market development in the performance of economies is an inconclusive subject. This leaves room for further research. In this paper, we attempt to answer an important country-specific question that has received less attention in the literature: Is the performance of the stock market crucial to Hong Kong's rapid and dominant economic performance over the last three decades? There are existing papers that investigate this question in panel and cross-country data settings, but the worry is that country-specific information is lost due to the "lumping" of countries. Panel data analysis usually entails a single dataset composed of several countries that may not share the same economic fundamentals. This means that the ability of panel data to isolate the effects of country-specific information or more general policies depends on making appropriate assumptions and selecting the "right models" (Hsiao, 2005). We cannot be sure that these previous studies made the appropriate assumptions and selected the right models in their empirical analysis. In addition, cross-country data are limited in that they usually have one historical context and therefore do not allow the researcher to examine economic relationships over time (Kramer, 1983). To eliminate these uncertainties, time series techniques may be very useful. Our study aims to utilize time series techniques to re-assess the above question.

To the question at hand, there are existing studies that provide different answers. For example, Atje and Jovanovic (1993), using 40 countries for the period of 1980-1988, conclude that there is a large effect of stock market development on the level and growth rate of economic activities. Levine and Zervos (1996), in a study of 41 countries, including Hong Kong, over the period of 1976-1993, find that stock market development is positively associated with economic growth. In another study, Levine and Zervos (1998) utilize cross-country regressions for 47 countries, including Hong Kong, covering the period of 1976-1993. They demonstrate that stock market liquidity is positively correlated with economic growth. Rousseau and Wachtel (2000) examine the relationship between stock markets, banks and growth for a set of 47 countries from 1980-1995. Their findings indicate that stock market development and banking sector development explain subsequent growth. A similar result is supported by Beck and Levine (2004), who studied a panel of 40 countries for the period of 1976-1998. Minier (2003), using the data of Levine and Zervos (1998), claims that there is a positive correlation between stock market development and economic growth in countries with high levels of market capitalization such as Hong Kong. A similar view is also held by Rioja and Valev (2004), who conclude that the nexus differs at various stages of economic development. Recent studies such as Masoud and Hardaker (2012), Naik and Padhi (2015), Phiri (2015), Sehrawat and Giri (2015) also indicate that stock market development and economic growth are positively related. In direct contrast, Singh (1997), studying the role of stock markets on the economic growth of developing countries during the 1980s and 1990s, concludes that stock market development does not promote faster long-term economic growth. This view is also supported by Harris (1997), who studied 49 countries from 1980-1991. In the whole sample and in the sub-sample of developing countries, the study yields no hard evidence that the level of stock market activity can explain economic growth.

We add to this burgeoning literature by arguing that the performance of the Hong Kong stock market has contributed greatly to the rapid and steady performance of its economy over the past three decades. To provide firm support for our argument, we regressed the indices of stock market performance on economic performance in an augmented VAR setting. Using the Toda-Yamamoto test for causality, we find that the performance of the Hong Kong stock market, as proxied by the market capitalization ratio, and the performance of the Hong Kong's economy influence each other. In addition, we find that, if proxied by the total value traded ratio, the stock market and the economy of Hong Kong influence each other. However, the causal links between stock market performance and economic performance vanish if stock market performance is proxied by the turnover ratio. This suggests that the causal links between stock market performance and economic performance are highly dependent on the proxy of stock market performance in the case of Hong Kong.

In the next section, we briefly discuss the stock market development in Hong Kong. Section 3 presents the methodology and the data. Section 4 reports our main empirical results. Section 5 performs a sensitivity analysis of the results, and section 6 provides the conclusion.

2. Stock Market Development in Hong Kong

Hong Kong has experienced more than a hundred years of stock market development. The first formal stock exchange, the Association of Stockbrokers in Hong Kong, was established early in 1891. In 1914, it was renamed the Hong Kong Stock Exchange. However, the activities of the Exchange were generally regarded as insignificant until the 1970s. During the 1970s, Hong Kong was regarded as the Euro-Dollar market in a different time zone, and the flows of international capital into Asia boosted its financial activities (Jao, 2003). There was an influx of foreign banking and non-bank financial institutions that contributed to the rapid growth of the stock market. As a result, three other stock exchanges were established in the late 1960s and early 1970s (Tsang, 2004).

The global market crash in 1987 revealed various flaws that led to major reforms in the stock market of Hong Kong. One of them was the unification of four stock exchanges to become the Hong Kong Stock Exchange in 1986 to avoid destructive competition among them (Hong Kong Exchanges and Clearing Limited (HKEx), 2011). In 1999, the Stock Exchange, the Futures Exchange and its associated clearing houses were merged to form the Hong Kong Stock Exchange and Clearing Limited (HKEx) to reduce operation costs through achieving economies of scale. In the same year, a second board known as the Growth Enterprise Market was launched to provide start-up companies with a capital formation platform and an alternative market to the Main Board (HKEx, 1999). In 2000, the HKEx was demutualized to become one of the first stock exchanges in the world to go public (Ghosh, 2006; HKEx, 2011). In 2012, a joint venture known as the China Exchange Service Company Limited was formed between the HKEx, the Shanghai Stock Exchange and the Shenzhen Stock Exchange to strengthen the linkage of stock market activities between Hong Kong and Mainland China. In the same year, the London Metal Exchange was acquired as the HKEx's first overseas member, with a vision of developing the HKEx into a global vertically integrated multi-asset class exchange (HKEx, 2015a).

The Hong Kong stock market responded positively to the reforms and became one of the most highly developed markets as indicated by the size and the liquidity of the market. The size of the stock market, as measured by the stock market capitalization, increased significantly from US$608 billion in 1999 to US$3101 billion in 2013. In 2013, it was ranked as the fifth largest stock market in the world and the second largest in Asia (World Federation of Exchanges, 2015). The major reason for the phenomenal growth in the market capitalization is that Hong Kong has been established as a preferred center for initial public offering (IPOs) internationally. The amount raised by IPOs increased significantly from HK$17 billion in 1999 to the highest level of HK$449 billion in 2010. In 2013, HK$169 billion was raised through IPOs, contributing 45% to the total equity fund raised in that year (HKEx, 2013). The growth of Hong Kong as an IPO fund-raising center has been driven largely by the listing of companies from Mainland China. In 2013, Hong Kong became the second largest IPO fund-raising center in the world, just behind the New York Stock Exchange (Ernst & Young, 2013).

The performance of the Hong Kong stock market becomes more impressive when the comparison is

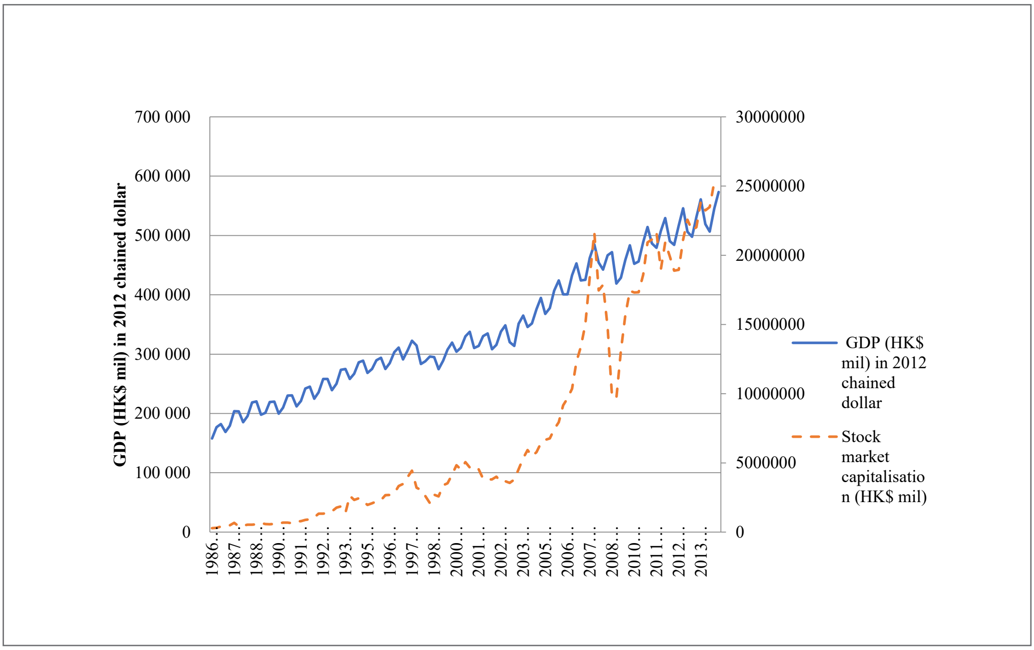

Figure 1. Economic performance and stock market development in Hong Kong during 1986Q2 to 2014Q4
Source: Adapted from "Securities Statistics Archive" by Hong Kong Exchanges and Clearing Limited (2015b). Available from http://www.hkex.com.hk/eng/stat/smstat/statarch/statarchive.htm and "Gross Domestic Product (GDP), implicit price deflator of GDP and per capita GDP" by Census and Statistics Department of Hong Kong (2017, May 11). Available from http://www.censtatd.gov.hk/hong_kong_statistics/statistical_tables/index.jsp?tableID=030

based on the market capitalization as a percentage of GDP. Figures from the World Development Indicators (WDI, 2014) indicate that Hong Kong has been the home of the largest stock market in the world during the period of 1999 to 2012, in terms of the market capitalization ratio, for the following reasons. First, there has been substantial increase in the number of listed enterprises from Mainland China on the Exchange. In 2013 alone, Mainland Chinese enterprises accounted for 41% of the total market capitalization (HKEx, 2013). Second, there has been an expansion in the activities of Hong Kong companies in overseas territories. Many listed companies in Hong Kong have substantial investment in countries overseas. Their sources of earning are outside Hong Kong and do not necessarily have a direct relationship with the GDP in Hong Kong (Lee & Poon, 2005).

The stock market in Hong Kong has also recorded impressive growth in terms of liquidity, as indicated by the total value traded ratio and the turnover ratio (Levine & Zervos, 1996; 1998). The HKEx had the most liquid stock market in the world during the period of 2007 to 2012, as measured by the total value traded ratio (WDI, 2014). It was also the seventh most liquid market globally in 2012 by the turnover ratio, according to figures from the WDI (2014). On these accounts, we could argue that Hong Kong has an extremely liquid stock market with low transaction costs.

The magnificent growth in the stock market is also accompanied by the rapid growth of economic activities in Hong Kong. Hong Kong has achieved an "economic miracle" over the past few decades. The real GDP has increased more than threefold from HK$ 157,823 million in 1986Q2 to HK$ 573,280 million in 2014Q4, comparable to the advanced market economies. Figure 1 shows the economic performance and stock market development in Hong Kong during 1986Q2 to 2014Q4.

3. Methodology and Data

In this section, we present the preliminary tests employed, the models and the data used to examine the relationship between the stock market performance and the performance of the Hong Kong economy. To examine the stationary properties of the stock market and the economic performance series, we use two sets of stationarity tests: (i) stationarity tests without structural breaks, i.e., the Augmented Dickey-Fuller (ADF) and the Dickey-Fuller generalized least squares (DF-GLS) tests, and (ii) stationarity tests with structural breaks, i.e., the Perron and the Zivot-Andrews tests. We then examine whether the series are causally linked using the Toda-Yamamoto test developed by Toda and Yamamoto (1995).

3.1 Stationarity Tests without Structural Breaks

As a preliminary analysis, prior to examining the nature of the relationship between stock market performance and the performance of the economy, we examine their stationary properties. We utilize the ADF and DF-GLS tests. The DF-GLS test is proposed by Elliot, Rothenberg, and Stock, (1996). We use this test to compensate for the drawback of the ADF test. The ADF test has been found to over-reject the null hypothesis of unit root when the time series under consideration has a large and negative moving average (MA) component, even when there is a unit root (Caner & Killian, 2001; Schwert, 1986). Elliot et al. (1996) demonstrate that the DF-GLS test has substantially higher power, even when the root of the time series is closer to unity. To estimate results that are based on parsimonious regressions, we determine the optimal lags for both tests using the Modified Akaike Information Criterion (MAIC). The regressions and test statistics underlying DF-GLS tests have been discussed thoroughly in various studies. Thus, we preserve space by not discussing it here.

3.2 Stationarity Tests with Structural Breaks

Macroeconomic time series, such as the ones we use in this paper, are found to be characterized by structural breaks. The presence of structural breaks has been found to distort the statistical power of the stationarity tests we have discussed so far. Perron (1989), for example, found that these tests accept the null hypothesis of unit roots in time series, even when there are clear indications of no unit roots. Since this discovery, various stationarity tests have been developed to take into account structural breaks in time series. In this paper, we utilize the Perron (1997) test and the Zivot and Andrews (1992) test as robust alternatives for examining the stationary properties of the series considered in this paper.

The Perron test, which was originally derived by Perron (1989) and later modified by Perron (1997), proceeds by fitting the following Augmented Dickey-Fuller (ADF) regression with shifts in mean and trend,

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{i=1}^{k} \rho_i \Delta y_{t-i} + \mu_t + \epsilon_t, \qquad (1)$$

where $\mu_t = \mu_0 + \mu_0^s d_{tT_B} + \mu_1 t + \mu_1^s (t - T_B) d_{tT_B}$ are potential deterministic terms and T_B is the break date. The test has three null hypotheses: (i) y_t is non-stationary with a structural break in the intercept, (ii) y_t is non-stationary with a structural break in the trend, and (iii) y_t is non-stationary with a structural break in the intercept and trend.

Zivot and Andrews (1992) argue that the Perron test suffers because the break date is determined exogenously. They argue that the identification of a break date may be unassociated with the data. Thus, if the critical values computed under the null hypothesis are computed on the basis that the break date is determined *ex ante*, then there could be substantial size distortions. Under this kind of situation, the Perron test will frequently reject the null hypothesis of unit root. The Zivot-Andrews test differs from the Perron test by explicitly modeling the break date endogenously. The Zivot-Andrews test also uses the ADF regression in *Eq.* (1). The test applies the Perron (1989) procedure for each break date in the dataset and selects the break date for which the support for the null hypothesis is the strongest (Zivot & Andrews, 1992). The null hypotheses under the Zivot-Andrews test are the same as those under the Perron test.

3.3 Specification for Testing Granger Causality

The traditional test for causality proposed by Granger (1969) in the vector autoregressive (VAR) setting requires the researcher to first establish the integration properties of the time series. In cases where the series are I(1), the researcher will need to test whether there are any co-integrating relationships before carrying out the test for causality. However, most of the diagnostic tests for unit roots and co-integration are known to have low power against the alternative hypotheses of stationarity and cointegration. Toda and Yamamoto (1995), in particular, stress that the traditional way of testing for causality by first testing for unit root and cointegration exposes this approach to pretesting bias. This view is supported by He and Maekawa (2001), who argue that testing for causality using *F*-statistics when one or both time series are non-stationary can lead to spurious causality.

Thus, according to Toda and Yamamoto (1995), the problems inherent in the traditional testing for Granger causality can be avoided by fitting an augmented VAR model that adds the highest order of integration to the optimal lag of the VAR model. This technique ensures that the test statistic for the causality test has a standard asymptotic distribution. We specify a modified vector autoregressive model, $VAR(m+d_{max})$, following Yamada (1998), of the form

$$y_t = \gamma_0 + \sum_{i=1}^{m}\gamma_{1i}y_{t-i} + \sum_{i=m+1}^{m+d_{max}}\gamma_{2i}y_{t-i} + \sum_{i=1}^{m}\varphi_{1i}x_{t-i} + \sum_{i=m+1}^{m+d_{max}}\varphi_{2i}x_{t-i} + u_{1t} \quad (2)$$

$$x_t = \Theta_0 + \sum_{i=1}^{m}\Theta_{1i}x_{t-i} + \sum_{i=m+1}^{m+d_{max}}\Theta_{2i}x_{t-i} + \sum_{i=1}^{m}\delta_{1i}y_{t-i} + \sum_{i=m+1}^{m+d_{max}}\delta_{2i}y_{t-i} + u_{2t}, \quad (3)$$

where y_t and x_t are the series under consideration; δ, γ, Θ and φ are the parameters of the model; and u_1 and u_2 are the white-noise innovations.

From *Eq.* (2), x_t causes y_t if $\varphi_{1i} \neq 0, \forall i = 1,2,\ldots,m$. Similarly, in *Eq.* (3), y_t causes x_t if $\delta_{1i} \neq 0, \forall i = 1,2,\ldots,m$. The test statistic for these hypotheses follows a *chi-squared* distribution. Take the hypothesis $\delta_{1i} = 0, \forall i = 1,2,\ldots,m$, for example, and let $\delta = vec(\delta_1, \delta_2, \ldots, \delta_m)$ be a vector of m VAR parameters. Toda and Yamamoto (1995) demonstrate that for a suitably selected Z, the modified *Wald*-statistic for testing this hypothesis is of the form

$$W = T(\hat{\delta}'Z'(Z\hat{\Sigma}_u'Z')^{-1}Z\hat{\delta}) \quad (4)$$

where $\hat{\delta}$ is the OLS estimate of δ; $\hat{\Sigma}_u$ is a consistent estimate of the variance-covariance matrix of $\sqrt{T}(\hat{\delta}-\delta)$; and T is the sample size. W, the test statistic, is *chi-squared* distributed with m degrees of freedom.

3.4 Data

3.4.1 Data Sources

The period covered in this paper is from the second quarter of 1986 to the fourth quarter of 2014. The data are obtained from the World Federation of Exchanges (2015), the HKEx (2015b), and the Census and Statistics Department of Hong Kong (2017). These data sources are preferred to other sources because they provide the original data on each of the variables employed in this paper.

3.4.2 Definitions of Variables

(i) Economic Performance (GDP)

There are various proxies for economic performance in the literature. In this paper, economic performance is proxied by real GDP, which is an indicator of output based on GDP after controlling for the inflationary effect. It captures the size of the output of the economy in a given year. This proxy has also been used by Cheng (2012), Hondroyiannis, Lolos, and Papapetrou (2005), Malik and Amjad (2013), and Marques, Fuinhas, and Marques (2013), among others.

(ii) Stock Market Performance (MCR, TVR and TOR)

Stock market performance is a multifaceted concept that captures the size, liquidity, degree of international integration, and volatility (Levine & Zervos 1998). In this paper, we choose three proxies that are frequently used in the empirical literature to measure stock market performance. These are the stock market capitalization ratio (MCR), the total value traded ratio (TVR), and the turnover ratio (TOR). MCR shows the size of a stock market, whereas TVR and TOR show the liquidity of a stock market. MCR is the value of equities traded on the domestic stock market as a percentage of GDP. The variable has also been used by studies such as Arestis and Demetriades (1997), Boyd, Levine, and Smith (2001), Deb and Mukherjee (2008), Enisan and Olufisayo (2009), Levine and Zervos (1996; 1998), Malik and Amjad (2013), Masoud and Hardaker (2012), and Marques et al. (2013). TVR shows the value of trades of domestic shares on the domestic stock market as a percentage of GDP. It measures trading volume as a share of economic output, thereby positively reflecting the liquidity of the stock market on an economy-wide basis. The variable has been used by studies such as Atje and Jovanovic (1993), Boyd et al. (2001), Deb and Mukherjee (2008), Enisan and Olufisayo (2009), Levine and Zervos (1996; 1998), and Masoud and Hardaker (2012). TOR shows the value of trades of domestic shares on the stock market as a percentage of the size of the stock market. A high turnover ratio may indicate low transaction costs in the stock market. The variable has also been used by studies such as Boyd et al. (2001), Jeffus (2004), Levine and Zervos (1996; 1998), Masoud and Hardaker (2012), and Minier (2003).

4. Empirical Results

4.1 Results of the Tests for Stationarity

To examine the effect of stock market performance on the performance of the Hong Kong economy, we first test whether the proxies for stock market performance and economic performance are stationary. We employ the ADF and DF-GLS tests and perform our stationarity analysis by considering the drift and trend options. The tests for the stationarity of the series in their levels are presented in Tables 1 and 2. The evidence in favor of stationarity or no unit roots in the series using the ADF and DF-GLS is weak at the conventional levels of significance. The drawback here is that the ADF and the DF-GLS have substantial size distortion when these series contain structural breaks. In practice, there are various reasons that we should expect breaks in the stock market and the economic performance variables we utilize in this paper. The oil price shocks of 1973 and 1979, the Gulf war in 1990, the Asian financial crisis of the 1997, and the recent global financial and economic crisis could have caused substantial shocks to the path of these variables. The ADF and the DF-GLS tests are unable to detect these breaks. To present robust stationarity evidence, we employ two alternative stationarity tests that cater to structural breaks in our series. These are the Perron and the Zivot-Andrews tests. The results of these tests presented in Table 1 also indicate that all the variables, except *LNTOR,* contain unit roots. Therefore, we difference the non-stationary variables once and again examine their stationary status. The results, presented in Table 2, show that the variables are first-difference stationary at conventional levels of significance.

4.2 Lag Selection and Model Diagnostics

To perform the Toda-Yamamoto test, the appropriate lag length needs to be selected. In this paper, we select the lag length using the Akaike Information Criterion (AIC), the Hannan-Quinn Criterion (HQC), the Schwartz Information Criterion (SIC), and the Final Prediction Error (FPE). For all three VAR models, the optimal lag selected is 5. Thus, we fit the three *VAR* models by including 5 lags. In addition to selecting the lags, our models must be structurally stable and free of serial correlation. The inverses of the roots of the characteristic equations are greater than unity (i.e., for *LNGDP* and *LNMCR* equations, the inverse of the root is 1.0077; for *LNGDP* and *LNTVR*, it is 1.0099; and for *LNGDP* and *LNTOR*, it is 1.0113) indicating that the models are structurally stable. Figures A.1, A.2 and A.3 in the appendix show the cumulative sum of recursive residual plots, which also support this evidence. The models are also free of serial correlation. For example, the *chi-squared statistic* is 35.635 with a *p-value* of 0.8114 for the *LNGDP* and *LNMCR* model; 44.496 and 0.4507 for the *LNGDP* and *LNTVR* model; and 57.027 and 0.143 for the *LNGDP* and *LNTOR* model.

4.3 Results of the Tests for Causality

Having satisfied the necessary requirements for the Toda-Yamamoto test, we fitted a $VAR(6)$ for each of the three models (i.e., $m=5$ and $d_{max}=1$). The results of the tests for Granger causality between *LNGDP* and *LNMCR* are reported in Table 3. The results show that there is a bidirectional causal relationship between *LNMCR* and *LNGDP* at a 1% level of significance. This is indicated by the *chi-squared statistics* of 35.60 and 24.10, with corresponding *p-values* of 0.00 and 0.00 for the *LNGDP* and *LNMCR* equations, respectively. The implication is that the performance of the stock market, as proxied by the market capitalization ratio, can stimulate the performance of the Hong Kong economy. In a similar fashion, economic performance can also influence the performance of the stock market. This finding is consistent with the existing findings (Atje & Jovanovic, 1993; Beck & Levine, 2004; Levine & Zervos, 1996; 1998).

Next, we analyze the causal relationship between *LNGDP* and *LNTVR*. The results for this are reported in Table 3. Similar to the first model, we find bidirectional causality between *LNGDP* and *LNTVR* at a 5% level of

Table 1. Tests for Unit Roots for Variables in Levels

Test	Level Variables			
	LNGDP	LNMCR	LNTOR	LNTVR
ADF[Drift]	-1.156	-0.702	-2.061	-1.225
ADF[Trend]	-2.399	-3.220*	-3.032	-3.908**
DF-GLS[Drift]	1.893	0.229	-1.116	-0.044
DF-GLS[Trend]	-1.0588	-3.152**	-3.051**	-3.866***
Perron[Drift]	-3.668	-4.778	-5.501**	-4.672
	[1997Q2]	[2005Q4]	[2005Q2]	[2005Q4]
Perron[Trend]	-2.187	-4.199	-5.281**	-4.196
	[2001Q4]	[1990Q3]	[2010Q2]	[1990Q3]
Zivot-Andrews[Drift]	-3.721	-4.778	-5.544***	-4.729*
	[1997Q4]	[2006Q1]	[2006Q1]	[2006Q1]
Zivot-Andrews[Trend]	-2.474	-3.286	-5.223	NA
	[2002Q2]	[2006Q1]	[2009Q3]	NA

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. NA denotes non-applicable. Items in block parentheses are break dates.

Table 2. Tests for Unit Roots for Variables in First-Difference

	First-difference Variables			
	ΔLNGDP	ΔLNMCR	ΔLNTOR	ΔLNTVR
ADF[Drift]	-10.808***	-12.049***	-13.177***	-12.180***
ADF[Trend]	-10.753***	-11.997***	-13.122***	NA
DF-GLS[Drift]	-0.140	-4.333***	-4.287***	-5.545***
DF-GLS[Trend]	-1.282	-11.85675***	NA	NA
Perron[Drift]	-5.323**	-12.889***	NA	-12.429***
	[2003Q2]	[2008Q4]	NA	[1990Q4]
Perron[Trend]	-4.928**	-12.176***	NA	-9.277***
	[1997Q1]	[2006Q4]	NA	[2007Q1]
Zivot-Andrews[Drift]	-5.412***	-9.499***	NA	-6.610***
	[2003Q3]	[2008Q1]	NA	[2008Q2]
Zivot-Andrews[Trend]	-4.653**	-9.278***	NA	-6.301***
	[2007Q1]	[2007Q1]	NA	[2007Q1]

Note: ** and *** denote significance at the 5% and 1% levels, respectively. NA denotes non-applicable. Items in block parentheses are break dates. Δ denotes the first-difference operator.

Table 3. Tests for Granger Causality using the Full Sample

	Wald-statistic [p-value]			Inverse Roots
Variable	LNGDP	LNMCR		
LNGDP	NA	35.60[0.00] ***		1.008
LMCR	24.10[0.00]***	NA		1.008
Variable	LNGDP	LNTVR		
LNGDP	NA	12.80[0.025]**		1.010
LNTVR	13.40[0.02]**	NA		1.010
Variable	LNGDP	LNTOR		
LNGDP	NA	3.00[0.70]		1.011
LNTOR	6.00[0.31]	NA		1.011
Lag Selection	AIC = 5	BIC = 5	HQC = 5	FPE = 5
Serial Correlation	χ^2-statistic	p-value		
	35.635	0.811		
	44.496	0.451		
	57.027	0.143		

Note: ** and *** denote significance at the 5% and 1% levels, respectively. NA denotes non-applicable.

significance. This is indicated by the *chi-squared statistics* of 12.80 and 13.40, with corresponding *p-values* of 0.025 and 0.02 for the *LNGDP* and *LNTVR* equations, respectively. Thus, stock market performance defined in terms of total value traded ratio and economic performance influence each other. This finding is also documented in the literature (Beck & Levine, 2004; Minier, 2003; Rousseau & Wachtel, 2000).

Finally, we analyze the causal relationship between *LNGDP* and *LNTOR*. This is reported in Table 3 as well. The causality test reveals no causal flow between *LNGDP* and *LNTOR*. This is indicated by the *chi-squared statistics* of 3.00 and 6.00, with corresponding *p-values* of 0.70 and 0.31 for the *LNGDP* and *LNTOR* equations, respectively. Thus, the performance of the stock market, as proxied by the turnover ratio, does not influence the performance of the Hong Kong economy at the conventional level of significance. This conclusion holds, conversely, and is consistent with some previous findings (Harris, 1997; Singh, 1997).

It is important to note that the results reported so far rest on the assumption that the variables have maintained constant slopes over time. In reality, these variables experienced sharp changes in their slopes during the Asian financial crisis, which started in July 1997. To make our results reliable, we divided our sample into two periods: 1986Q2–1997Q2, marking the period before the crisis, and 1997Q3–2014Q4, marking the period during and after the crisis. Then, we perform a causality test for these subsamples. These results are reported in Tables 4 and 5. The results are basically the same as those reported in Table 3 for the full sample. We find evidence of bidirectional causality between stock market development and economic performance when stock market performance is proxied by either the market capitalization ratio (MCR) or total value

Table 4. Tests for Granger Causality (1986Q2–1997Q2)

	Wald-statistic [p-value]		Inverse Roots	
Variable	LNGDP	LNMCR		
LNGDP	NA	22.39[0.00] ***	1.240	
LMCR	18.46[0.00]***	NA	1.240	
Variable	LNGDP	LNTVR		
LNGDP	NA	10.84[0.03]**	1.142	
LNTVR	16.55[0.00]***	NA	1.142	
Variable	LNGDP	LNTOR		
LNGDP	NA	6.83[0.28]	1.102	
LNTOR	4.69[0.62]	NA	1.102	
Lag Selection	AIC = 3	BIC = 3	HQC = 3	FPE = 3
Serial Correlation	χ^2 -statistic	p-value		
	38.201	0.741		
	41.526	0.497		
	53.441	0.180		

Note: ** and *** denote significance at the 5% and 1%, respectively. NA denotes non-applicable.

traded ratio (TVR). However, the evidence dissipates once we proxy stock market performance by the turnover ratio (TOR). Therefore, regime shifts are not driving the results reported for the full sample.

In summary, the causal links between stock market performance and economic performance are highly dependent on the proxy of stock market performance in the case of Hong Kong. One plausible explanation of this finding may stem from the way the proxies of stock market performance are calculated. The first two proxies of stock market performance, namely, MCR and TVR, are calculated as percentages of GDP, whereas the third proxy, TOR, is calculated as the total value of shares traded as a percentage of stock market capitalization. Hence, by their construction, it is obvious that MCR and TVR are correlated with GDP so that factors that may drive GDP may also be driving MCR and TVR. This implies that any model containing GDP and any of these stock market variables should exhibit reverse causality. This may not necessarily be the case if such a model contains TOR instead. Second, unlike TOR, MCR and TVR are dependent on stock prices. Therefore, if stock prices increase – with the number of transactions in the stock market unchanged – MCR and TVR will increase. In this sense, MCR and TVR are susceptible to the "price effect", whereas this price effect is factored away when calculating TOR. The price effect may play an important role when examining the causal linkages between the stock market and the economy (Levine & Zervos 1998). Our results appear to confirm this assertion.

5. Sensitivity Analysis

The results obtained thus far rest on the assumption that the tests for causality that entail testing for unit roots and cointegration are exposed to pre-testing bias

Table 5. Tests for Granger Causality (1997Q3–2014Q4)

	Wald-statistic [p-value]			Inverse Roots
Variable	LNGDP	LNMCR		
LNGDP	NA	25.83[0.00] ***		1.153
LMCR	14.22[0.01]**	NA		1.153
Variable	LNGDP	LNTVR		
LNGDP	NA	11.90[0.03]**		1.137
LNTVR	19.78[0.00]***	NA		1.137
Variable	LNGDP	LNTOR		
LNGDP	NA	5.42[0.34]		1.046
LNTOR	5.65[0.32]	NA		1.046
Lag Selection	AIC = 3	BIC = 4	HQC = 3	FPE = 3
Serial Correlation	χ^2-statistic	p-value		
	29.516	0.879		
	32.307	0.583		
	35.894	0.468		

Note: ** and *** denote significance at the 5% and 1%, respectively. NA denotes non-applicable.

and therefore not appropriate. It is important to note that by not accounting for cointegration, additional information, i.e., the short-run dynamics of the model, is lost. Hence, this section provides a sensitivity analysis of our results when cointegration properties of the model are accounted for. We first perform three cointegration tests on our specifications and then explore the causal dynamics of the variables. Here, we employ the Johansen, the Engel-Granger, and the Phillips-Ouliaris tests (Engle & Granger, 1987; Johansen & Juselius, 1990; Johansen, 1991; Phillips & Ouliaris, 1990) to perform the cointegration analysis. The results are presented in Tables 6 and 7. Using the Johansen trace and maximum eigen value test, we can conclusively state that *LNGDP* and *LMCR* are cointegrated at 5% (see Table 6). This is also confirmed by the Engel-Granger and the Phillips-Ouliaris tests (see Table 6). The results reported by the Johansen test, however, do not show any cointegrating relationship between *LNGDP* and *LNTVR*. This contrasts the evidence reported by the Engel-Granger and the Phillips-Ouliaris tests. Since the Johansen test provides better results than these single-equation–based tests, we conclude that *LNGDP* and *LNTVR* are not cointegrated (see Table 7).

The presence of a cointegrating relationship between *LNGDP* and *LNMCR* provides a hint of causality between these variables in the short and long runs. The absence of any cointegrating relationship between *LNGDP* and *LNTOR* and between *LNGDP* and *LNTVR* implies that if there is any causal flow, then it occurs in the long run. To test for causality between *LNGDP* and *LNMCR*, we fit a VECM in the spirit of the Engel-Granger representation theorem. Additionally, to test for causality between *LNGDP* and *LNTOR* and between *LNGDP* and *LNTVR*, we fit two small-scale unrestricted VAR models. We then use these esti-

Table 6. Tests for Cointegration between LNGDP and LNMCR

Item	**Johansen Test**			
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value (5%)	P-value♦
None	0.135	18.181	15.494	0.019
At most 1	0.019	2.175	3.841	0.140
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	Critical Value (5%)	P-value♦
None	0.135	16.006	14.264	0.026
At most 1	0.019	2.175	3.841	0.140
	Engle-Granger			
Dependent	tau-statistic	P-value♠	z-statistic	P-value♠
LNGDP	-3.566	0.033	-16.716	0.093
LNMCR	-2.017	0.522	-11.259	0.276
	Phillips-Ouliaris			
Dependent	tau-statistic	P-value♠	z-statistic	P-value♠
LNGDP	-6.813	0.000	-61.401	0.000
LNMCR	-6.716	0.000	-62.167	0.000

Note: ♠MacKinnon (1996) p-values. ♦MacKinnon-Haug-Michelis (1999) p-values.

mates to perform the causality analysis. The results for the tests of Granger causality between the variables are reported in Table 8. The results show that there is a distinct causal flow from *LNMCR* to *LNGDP* in the long run. The results also indicate bidirectional causality between *LNGDP* and *LNMCR* and between *LNGDP* and *LNTVR* in the short run at a 1% significance level. Finally, we find no causal flow between *LNGDP* and *LNTOR*. In light of this, the results are not sensitive to the approach used for testing the causal links between the variables in this study.

6. Conclusion

The arguments surrounding the role of stock markets in the performance of economies have remained inconclusive. Today, there are a number of studies that find a strong positive association between the stock market and economic performance (Bencivenga et al., 1996; Greenwood & Smith, 1997; Jensen & Murphy, 1990; Levine, 1991; Obstfeld, 1994). However, other studies have found that strong stock market performance hurts the performance of the economy in some ways (Arestis et al., 2001; DeLong et al., 1989;

Table 7. Tests for Cointegration between LNGDP and LNTVR

Item	**Johansen Test**			
		Trace		
No. of CE(s)	Eigen value	Statistic	Critical Value (5%)	P-value♦
None	0.097	12.426	15.495	0.138
At most 1	0.011	1.185	3.841	0.277
		Max-Eigen		
No. of CE(s)	Eigen value	Statistic	Critical Value (5%)	P-value♦
None	0.097	11.242	14.265	0.143
At most 1	0.011	1.185	3.841	0.276
	Engle-Granger			
Dependent	tau-statistic	P-value♠	z-statistic	P-value♠
LNGDP	-2.981	0.123	-16.648	0.094
LNTVR	-3.057	0.106	-20.241	0.043
	Phillips-Ouliaris			
Dependent	tau-statistic	P-value♠	z-statistic	P-value♠
LNGDP	-4.797	0.001	-37.341	0.001
LNTVR	-5.062	0.000	-41.702	0.000

Note: ♠MacKinnon (1996) p-values. ♦MacKinnon-Haug-Michelis (1999) p-values

Demirgüc-Kunt & Levine, 1996). The inconclusive nature of these studies makes the links between stock market performance and economic performance worthy of empirical re-investigation. Additionally, Hong Kong is among the countries whose stock market and economy have experienced tremendous advancements in the last three decades, making it a worthy candidate for this empirical investigation. In this paper, we ask the following question: Is the strong performance of the stock market in Hong Kong essential to the performance of its economy? This question has received less attention in the literature, perhaps due to the inconclusive nature of the links between stock markets and real economic activities. We explore this question in this paper in an augmented VAR setting by making use of the Toda-Yamamoto test for causality. Using an extended quarterly dataset that covers the period 1986Q2-2014Q4, we find bidirectional causal linkages between stock market performance, as proxied by the market capitalization ratio, and the performance of the Hong Kong economy. In addition, we find bidirectional causal flow between stock mar-

Table 8. Tests for Granger Causality – Alternative Approach

	F-statistic		[t-statistic]
Variable	LNGDP	LNMCR	ECT
LNGDP	---	11.518***	-0.172[-4.988]***
LMCR	8.174***	---	0.858[4.005]***
Variable	LNGDP	LNTVR	ECT
LNGDP	---	4.414***	---
LNTVR	3.366***	---	---
Variable	LNGDP	LNTOR	ECT
LNGDP	---	1.191	---
LNTOR	0.722	---	---

Note: * and *** denote significance at the 10% and 1% levels, respectively.

ket performance, as proxied by the total value traded ratio, and the performance of the Hong Kong economy. However, the causal links between stock market performance and economic performance vanish if stock market performance is proxied by the turnover ratio. This suggests that the causal links between stock market performance and economic performance are highly dependent on the proxy used for stock market performance in the case of Hong Kong. This paper clearly shows that the choice of the proxies for stock market performance matters. Proxies of stock market performance based on the total value traded and market capitalization ratio may exhibit strong correlation with measures of economic performance, thereby generating reverse causality *a priori*, whereas proxies of stock market performance based on the turnover ratio may not. Moreover, the inherent price effects in proxies of stock market performance based on the total value traded and market capitalization ratio imply that the results based on these proxies may differ from those based on the turnover ratio. Hence, for an empirical researcher, care must be taken when selecting the proxies of stock market performance. Perhaps a robust way to proxy stock market performance is pulling the information contents of these three proxies to construct a single multifaceted proxy for stock market performance. The results based on this new proxy may then be compared with those based on the three proxies to make a proper judgment. Future studies may shift toward this direction.

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Appendix

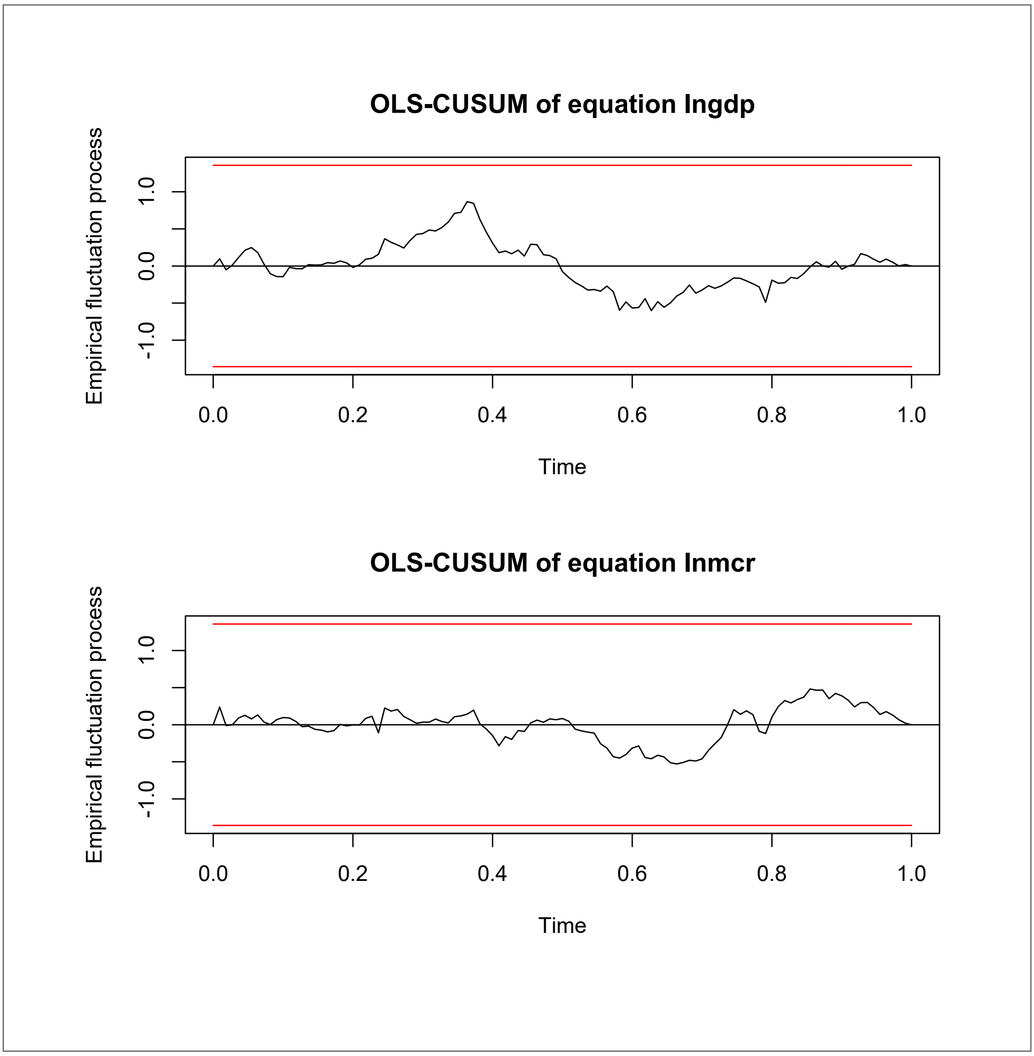

Figure A.1. Model Diagnostic Test for Structural Stability

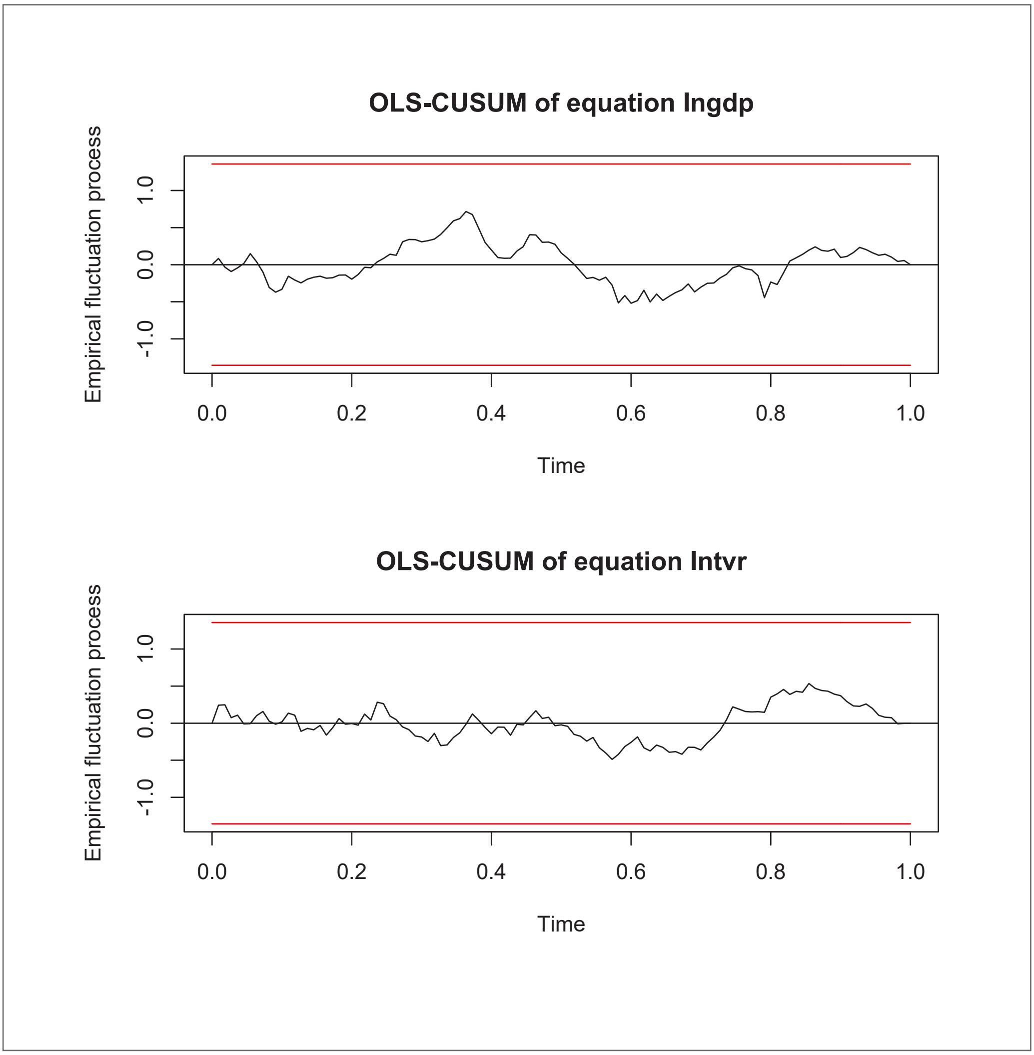

Figure A.2. Model Diagnostic Test for Structural Stability

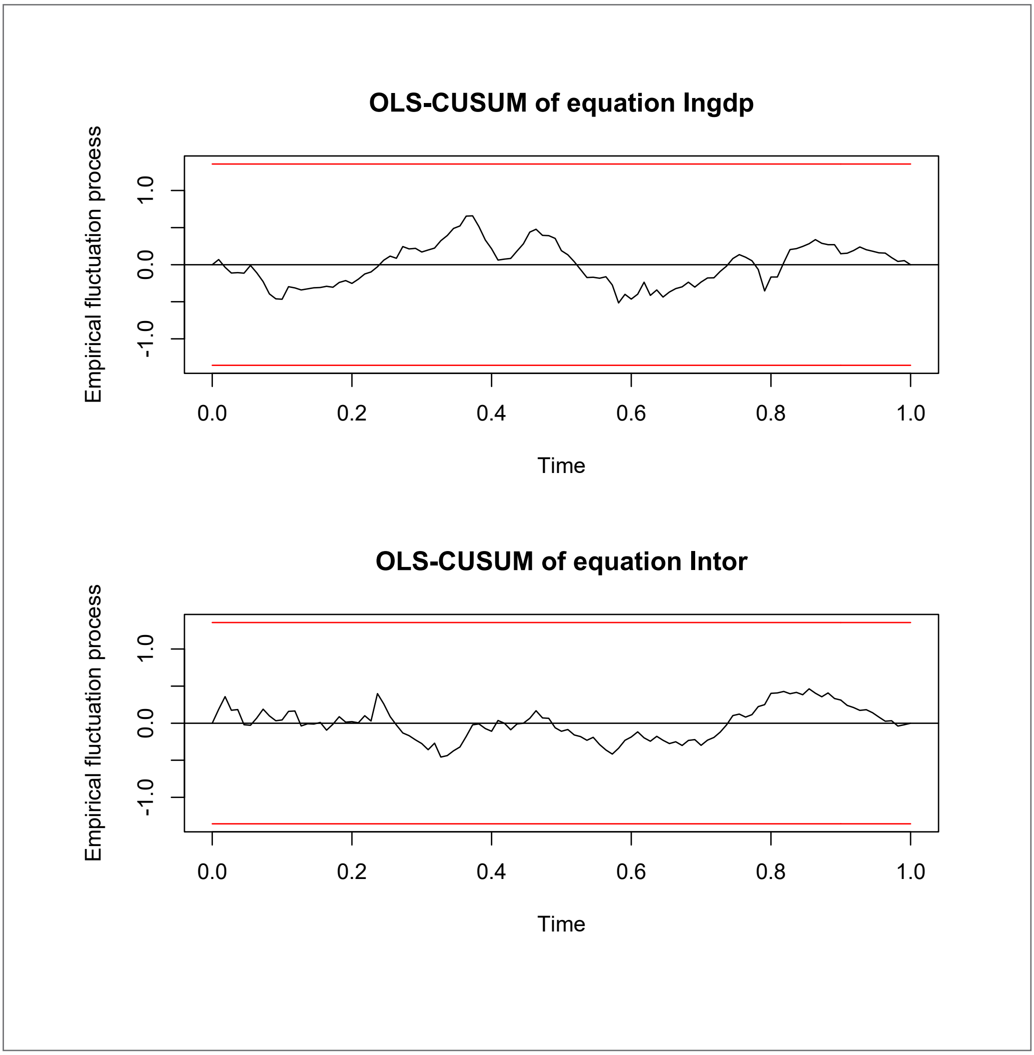

Figure A.3. Model Diagnostic Test for Structural Stability