



Government Size and Stock Market Performance in the G7 Countries: Some Robust Bilateral Causality Tests

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Abstract

This paper performs robust bilateral Granger causality tests between government size and stock market performance for the G7 countries. The robust test procedures involve the use of recently developed time series analysis of non-stationary data with possible structural breaks. Applying such tests, the paper finds the underlying data to be generally non-stationary and non-cointegrated, even after allowing for possible breaks in the data, thus implying that the standard bilateral Granger causality tests conducted in the first differences of the variables are robust. The empirical results indicate the presence of one-way causality from the stock market to government size for all the countries in the sample. Thus, we find no evidence that government size matters to the performance of the stock market. In addition, to the extent that stock prices discount future economic performance, our findings show that, if anything, it is economic prosperity that determines government size. Our findings thus refute some recent assertions that the current financial crisis is an expression of the market angst regarding the growing size of the public sector in recent decades.

Key words: Stock market performance; Government size; Time-series data

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INTRODUCTION

The relationship between government size and economic prosperity has been the subject of extensive, though largely inconclusive, empirical research. While Barro (1991, 2001), Engen and Skinner (1992), Plosser (1992), Hansson and Henrekson (1994), and Fölster and Henrekson (2001) find a significant growth-impeding effect for the public sector, Levine and Renelt (1992), Easterly and Rebelo (1993), Atkinson (1995), Slemrod (1995), Agell, Lindh, and Ohlsson (1997), Sala-i-Martin (1997), Canning and Pedroni (2004), and Bose et al. (2007) fail to detect any such effect. More recently, Roll (2011), relying on the same inconclusive evidence, attributes the recent global financial crisis to the market angst over the expanding economic role of the public sector in recent decades.

One reason for the lack of definitive evidence on the issue of the government role in the economy is the econometric problems plaguing much of the existing relevant empirical work. Some of these econometric issues, such as those associated with simultaneity and heteroscedasticity biases, have been adequately addressed. However, the existing literature still suffers from the shortcoming that it largely ignores the time series properties of the underlying data, a fact that may result in the inappropriate use of the conventional econometric techniques in the context of nonstationary processes, especially if such processes are subject to structural breaks. For example, the common practice of regressing the rate of economic growth (often a stationary process) on the government share of national expenditure (usually a nonstationary process) can produce spurious empirical results. Under these conditions, a better approach will be to use variables that share similar time series properties. For example, given that the stock market is often a discounting mechanism for future economic performance, it may be more appropriate to substitute real stock prices, which are often nonstationary, for the rate of economic

growth in all empirical work dealing with the relationship between government size and economic prosperity.

In light of the foregoing, this paper advances the evidence on the relationship between government size and economic prosperity in the context of the G7 countries in two ways. First, the paper uses the stock market as a proxy for future economic performance, thus focusing on the relationship between government size and the performance of the stock market. The use of the stock market instead of the rate of economic growth should provide for more robust estimation results. Second, the paper provides formal tests of bilateral causality between government size and stock prices and finds evidence of positive and unilateral causality from government size to the stock prices, indicating a favorable effect of government size on economic performance.

Our tests of bilateral causality between government size and stock prices adopt the approach set forth by Granger (1969). The Granger causality not only encompasses the traditional causality of one variable's actually driving the other but also one variable's merely carrying information about the future course of the other. This means that, to test for Granger causality, we must determine whether the introduction of the past values of a casual variable into a simple auto-regressive equation for a given variable does significantly add to the explanatory power of that equation. Needless to say, a pair of variables may also display a feedback process, in which each variable Granger causes the other. For this reason, we test for the presence of such a feedback process between our two variables, namely, government size and stock prices, using bilateral causality tests.

The results of such tests, however, can be misleading if the underlying data fail to display certain desirable time series properties. Engle and Granger (1987) and Granger, Huang, and Yang (2000), for example, have shown that the original Granger causality test may be misspecified in the presence of such data properties as non-stationarity, cointegration, or structural breaks. This means that it is necessary to screen the data for such properties before

any application of the standard Granger causality test. In recognition of these possibilities, this paper sequentially tests for non-stationarity, structural breaks, and cointegration to ensure that the data possess the requisite properties for our causality tests. Having ascertained that the data possess the requisite properties, we then test for the presence of bilateral Granger causality between government size and stock prices in the context of the G7 countries.

The paper is organized as follows. Section II discusses the empirical methodology. Section III presents the empirical findings. Section IV concludes.

1. EMPIRICAL METHODOLOGY

In testing for causality between government size and stock prices, we draw on the standard Granger (1969) causality test, in which the first difference of the dependent variable is regressed on the lagged first differences of both the dependent and the independent variables, as shown below. First differencing of the variables is required in the presence of unit roots in the variables as is shown to be the case for the time series of this paper:

$$\Delta Y_{1t} = \gamma_0 + \sum_{i=1}^k \gamma_{1i} \Delta Y_{1(t-i)} + \sum_{i=1}^k \gamma_{2i} \Delta Y_{2(t-i)} + \omega_{1t} \tag{1}$$

$$\Delta Y_{2t} = \delta_0 + \sum_{i=1}^k \delta_{1i} \Delta Y_{1(t-i)} + \sum_{i=1}^k \delta_{2i} \Delta Y_{2(t-i)} + \omega_{2t} \tag{2}$$

A finding that the coefficients γ_2 (δ_1) are jointly significant indicates unidirectional Granger causality from Y_2 to Y_1 (from Y_1 to Y_2). If both coefficients γ_2 and δ_1 are found to be jointly significant, then we have bilateral causality or feedback between Y_1 and Y_2 . However, as shown by Engle and Granger (1987), the above equation is misspecified if the underlying variables are cointegrated. Under such conditions, the Granger causality equations should be modified to incorporate the so-called error corrections terms associated with the cointegration equations, as follows:

$$\Delta Y_{1t} = \gamma_0 + \sum_{i=1}^k \gamma_{1i} \Delta Y_{1(t-i)} + \sum_{i=1}^k \gamma_{2i} \Delta Y_{2(t-i)} + \gamma_3 (Y_{1(t-1)} - \tau_1 Y_{2(t-1)}) + \omega_{3t} \tag{3}$$

$$\Delta Y_{2t} = \delta_0 + \sum_{i=1}^k \delta_{1i} \Delta Y_{1(t-i)} + \sum_{i=1}^k \delta_{2i} \Delta Y_{2(t-i)} + \delta_3 (Y_{2(t-1)} - \tau_2 Y_{1(t-1)}) + \omega_{4t} \tag{4}$$

In the light of the foregoing, it is thus necessary to test the underlying data for the presence of both unit roots and cointegration to determine the appropriate form of the equation to employ in the causality tests. Such tests can be performed using the standard Dickey-Fuller (1979) unit

root test and the Engle-Granger (1987) cointegration test.

However, as recent works by Perron (1989), Perron and Vogelsang (1992), Zivot and Andrews (1992), and Granger et. al. (2000), among others, show, both the Dickey-Fuller and Engle-Granger tests can yield misleading results

in the presence of breaks in the data. In the presence of such breaks, for example, the Dickey-Fuller test may indicate the presence of a unit root in the data, while in reality the data are stationary around a shifting or broken trend. Likewise, such breaks in the data may lead to the Engle-Granger test to reject incorrectly the existence of cointegration between the underlying variables. Given that the possibility of breaks in the data is very strong in the present study, as the sample period has been characterized by major events such as oil price shocks and huge drops

$$\Delta Y_t = \alpha_0 + \alpha_1 D_t + \alpha_2 T + \alpha_3 Y_{t-1} + \sum_{i=1}^k \alpha_{4+i} \Delta Y_{t-i} + \varepsilon_{2t} \quad (5)$$

$$\Delta Y_t = \alpha_0 + \alpha_1 D_t + \alpha_2 T + \alpha_3 DTB_t + \alpha_4 Y_{t-1} + \sum_{i=1}^k \alpha_{5+i} \Delta Y_{t-i} + \varepsilon_{3t} \quad (6)$$

Where D is a dummy variable with a value of 0 for the periods before the break and 1 thereafter, DTB = T-TB if T>TB and DTB = 0 otherwise, and TB represents the breakpoint. In both equations, the breakpoint is endogenously determined by running recursive regressions and selecting the values of TB for which the coefficient of Y_{t-1} is most highly significant, using the critical values provided by Zivot and Andrews (1992). Note that if the dummy variables are dropped from the above equations, i.e., if we exclude the possibility of a break of either kind in the data, the above equations simply reduce to the standard Dickey-Fuller unit root test against the alternative of stationarity around a linear trend.

With the time series properties of the data established, we then test for cointegration to determine the appropriate form of the equations of the causality tests. Again recognizing the possibility of breaks in the data, we employ three different cointegrating equations. This first is the basic Engle-Granger test, which is appropriate in a simple bivariate framework, assuming no breaks in the data:

$$Y_{1t} = \beta_0 + \beta_1 Y_{2t} + \mu_{1t} \quad (7)$$

Under this test, cointegration is accepted if the hypothesis of a unit root in the estimated residuals is rejected.

The second model modifies the Engle-Granger equation to test for a level shift in the data:

$$Y_{1t} = \beta_0 + \beta_1 D_t + \beta_2 Y_{2t} + \mu_{2t} \quad (8)$$

Finally, the third model tests for both a level and a directional shift:

$$Y_{1t} = \beta_0 + \beta_1 D_t + \beta_2 Y_{2t} + \beta_3 D_1 Y_{2t} + \mu_{3t} \quad (9)$$

where the dummy variable D is defined as in equations 5 and 6. Note that here again if the dummy variables are dropped from the above equations, i.e., if we exclude the possibility of a break of either kind in the data, the above equations simply reduce to the standard Engle-Granger cointegration test.

in stock prices throughout the world, we also employ the recently developed tests which are robust with respect to the presence of breaks in the data.

One such test, developed by Zivot and Andrews (1992), provides evidence as to whether the data are characterized by unit roots in the context of endogenously determined breaks in the level and direction of the trends in the data. Specifically, we use the following equations to perform tests for unit roots with the respective alternatives being a level shift and a joint level and slope shift:

Whether the variables of the model are found to be cointegrated determines the form of the equation to be employed in the causality tests. If the variables are cointegrated, it is necessary to include the estimated residuals from the above cointegrating equations in the causality tests. Otherwise, a simple VAR in first differences will suffice. Our equations test first whether stock prices cause consumer confidence and then whether consumer confidence causes stock prices. Finding that stock prices drive consumer sentiment, we then perform parallel tests for bilateral causality between consumer sentiment and the economy.

2. EMPIRICAL FINDINGS

We perform the tests described above for government size, defined as the share of government consumption in national income, and real stock prices for each of the G7 countries (Canada, France, Germany, Italy, Japan, UK, and US). The underlying data, which cover the period 1980 to 2010, are taken from the RATS OECD data file and are quarterly and logarithmic. Since all the unit root and cointegration tests incorporate lags, we used a lag of 7 quarters, as suggested by the Akaike (1974) information criterion.

The Phillips-Perron (1988) unit root test results are reported in Table 1. For each country, assuming no breaks in the data, the results indicate that all variables are I (1). However, considering the possibility that breaks in the data may account for our findings of non-stationarity, we perform additional unit root tests considering first the possibility of a level shift and then the possibility of both level and directional shifts. The test results reveal that, even after allowing for possible breaks in the data, both government size and stock prices are still characterized by unit roots.

Table 1
Phillips-Perron Unit Root Test Results

Country	Government Size				Stock Prices			
	Levels	First Differences	Intercept Shift	Intercept and Slope Shift	Levels	First Differences	Intercept Shift	Intercept and Slope Shift
Canada	-1.30	-8.11*	-3.00	-2.83	-3.19	-8.33*	-3.80	-3.75
France	-2.55	-5.85*	-4.31	-3.55	-2.28	-7.08*	-3.74	-3.71
Germany	-2.04	-12.48*	-4.81*	-5.31*	-2.42	-8.13*	-4.11	-4.00
Italy	-1.32	-7.41*	-3.19	-4.30	-2.61	-6.99*	-2.77	-3.05
Japan	-3.21	-12.37*	-3.15	-3.88	-1.93	-7.58*	-3.96	-4.28
UK	-0.75	-10.87*	-3.60	-4.10	-1.65	-9.07*	-3.34	-4.02
USA	-2.05	-9.50*	-3.46	-3.62	-1.82	-7.83*	-3.03	-3.98

*Indicates significant at the 5 percent level.

Given the finding that all of our underlying variables display unit root characteristics, even after allowing for the possibility of breaks in the data, we test for cointegration before performing causality tests, using the estimation methods described in the preceding section. The Engle-Granger cointegration test results appear in Table 2. Since the cointegration results may be impacted by the choice of the dependent variable, we ran regressions with each of the underlying variables serving as the dependent variable. With the exception of UK, in no case do we find cointegration using the standard Engle-Granger test. The absence of cointegration however, could be due to struc-

tural changes, so we perform a test for an intercept shift and another for intercept and slope shift. Allowing for such shifts, we nevertheless find no evidence for cointegration. This indicates that, with the exception of UK, our causality tests should be performed as simple VARS in first differences, without the estimated residuals from the cointegrating equations. For UK, however, given the presence of cointegration, the appropriate causality test should be conducted with the estimated residuals included, that is, it should be implemented within an error correction equation.

Table 2
Engle-Granger Cointegration Test Results

Country	Government Size/Stock Prices			Stock Prices/Government Size		
	Standard	Intercept Shift	Intercept and Slope Shift	Standard	Intercept Shift	Intercept and Slope Shift
Canada	-1.46	-3.14	-3.13	-2.07	-4.22	-4.35
France	-2.50	-3.55	-3.45	-2.02	-3.72	-3.45
Germany	-2.79	-3.83	-3.85	-2.91	-4.10	-4.00
Italy	-2.42	-2.41	-2.56	-3.13	-3.00	-2.99
Japan	-3.28	-3.54	-3.59	-3.09	-3.10	-3.18
UK	-3.88*	-3.59	-3.83	-3.85*	-3.34	-4.02
USA	-3.35	-4.00	-4.92	-3.32	-4.51	-4.22

*Indicates significant at the 5 percent level.

The causality test results appear in Table 3. To ensure a lag length which is both uniform across all causality tests and sufficiently long to capture all the relevant causal effects, we used a lag length of 7 quarters, as previously suggested by the Akaike method, for all our causality tests. As noted, we test whether government size and

real stock prices for the G7 countries are characterized by the presence of bilateral causality. Our results indicate that, for all the sample countries, there is only a unilateral Granger causality from real stock prices to government size, with no feedback from government size to stock prices.

Table 3
Granger Causality Test Results

Country	F-test	F-test
	Government Size/Stock Prices	Stock Prices/Government Size
Canada	1.07	2.19*
France	1.59	3.92*
Germany	0.89	3.30*
Italy	1.13	19.67*
Japan	0.67	16.71*
UK	0.94	4.10*
USA	0.77	19.72*

The F tests have the same degrees of freedom as the number of lags.

*Indicates significant at the 5 percent level.

Having presented our causality test results, we can now offer some interpretation of these findings. As to the causal effect of stock prices on government size, it can simply be stipulated that any increase in stock prices would directly boost government revenues from taxation of financial transactions and, hence, increase government spending in the economy. There is, however, also an indirect effect of stock price increases on government size. This indirect effect arises from the fact that the stock market is a predictor of future economic conditions, so that increased stock prices should foretell increased future economic growth and, therefore, enhanced demand for public services, resulting in the expansion of government expenditures in the economy. As to the lack of a reverse causal effect from government size to stock prices, it is possible to argue similarly that the stock market, as a proxy for future economic growth, would consider any short-run benefits of fiscal expansions to be offset by the adverse long-run effects of such expansions on interest rates and business confidence. This finding thus lends support to similar findings in the literature which fail to detect any long-run effect of government size on economic prosperity.

CONCLUSION

This paper performs robust bilateral tests of Granger causality between government size, as measured by the share of government consumption in national income, and stock prices for the G7 countries. Since the standard Granger causality test, even after incorporating the possibility of non-stationarity and cointegration of the underlying data, can produce misleading results in the presence of structural breaks, we make use of the recently developed unit root and cointegration techniques with breaks to determine the appropriate Granger causal relations between government size and stock prices.

The statistical results indicate only the presence of one-way causality from the stock market to government

size for all the countries in the sample. The results are interesting in that they find the size of the public sector largely irrelevant to the performance of the stock market, at least in the context of the G7 countries. In addition, to the extent that stock prices discount future economic performance, our findings also show that, if anything, it is economic growth that determines government size. Our results thus throw considerable doubt on other findings in the literature which seem to attribute a significant growth-impeding effect to the government expenditures in the economy. In particular, we find no evidence to support some recent assertions that the recent poor performance of the financial markets has been a direct result of market anxieties about the growing role of the public sector in the G7 economies.

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