**Authors:**
GOODNESS C. AYE, Department of Economics, University of Pretoria, Pretoria, 0002, South Africa

MEHMET BALCILAR, Department of Economics, Eastern Mediterranean University, Famagusta, Turkish Republic of Northern Cyprus, via Mersin 10, Turkey

GHASSEN EL MONTASSER, Ecole supérieure de commerce de Tunis, University of Manouba, Tunisia

RANGAN GUPTA, Corresponding author. Department of Economics, University of Pretoria, Pretoria, 0002, South Africa. Email: rangan.gupta@up.ac.za

NANGAMSO C. MANJEZI, Department of Economics, University of Pretoria, Pretoria, 0002, South Africa

# CAN DEBT CEILING AND GOVERNMENT SHUTDOWN PREDICT US REAL STOCK RETURNS? A BOOTSTRAP ROLLING WINDOW APPROACH

## ABSTRACT

This paper investigates the in-sample predictability of debt ceiling and government shutdown for real stock returns in the U.S, using rolling window Granger non-causality estimation. Causal links often evolve over time so the use of the bootstrap rolling window approach will account for potential time variations in the relationships. We use monthly time series data on measures of debt ceiling and government shutdown, and real stock returns, covering the period of 1985:M2 to 2013:M9. Since the debt ceiling and government shutdown variables under analysis are exogenous, the use of the in-sample predictability to analyse the relation-ship running from debt ceiling to real stock returns, as well as, from government shutdown to real stock returns will provide evidence of not only whether in-sample predictability exists, but also how predictability varies over time i.e. significance in episodes of high values of index. The full sample bootstrap non-Granger causality test results suggest existence of no in-sample predictability of debt ceiling or government shutdown for real stock returns in the U.S. economy. The stability tests show evidence of parameter instability in the estimated equations. Therefore, we make use of the bootstrap rolling window (24 months) approach to investigate the changes in the in-sample predictability of the relationship, and detect signifi-cant in-sample predictability of debt ceiling and government shutdown for real stock returns at different sub-periods, corresponding especially after the phases where there were sharp increases in the indexes of debt ceiling and government shutdown.

**Keywords**: Debt Ceiling, Government Shutdown, Real Stock Returns, Rolling Window, Bootstrap
**JEL Classification**: C32, G18

*Gli effetti sui rendimenti azionari reali negli USA del tetto del debito pubblico e del blocco della spesa*

Questo studio esamina la predittibilità – nel campione – degli effetti sui rendimenti azionari reali USA del tetto al debito e del blocco della spesa governativa.

Poiché le relazioni causali spesso variano nel tempo si è adottato *un bootstrap rolling window approach* cercando di valutare non soltanto se detta predittibilità sussista ma anche come essa varia nel tempo.

## 1. INTRODUCTION

This paper analyses the in-sample predictability of debt ceiling and government shutdown for real stock returns, which are mainly through the effects of uncertainty on the stock market caused by the former set of variables. For our purpose, we use time-varying (rolling) Granger non-causality tests running from the measures of debt ceiling or government shutdown indexes to real stock returns, to not only accommodate for possible structural breaks in the causal relationships, but more importantly, to identify whether episodes of increases in these two measures lead real stock returns. This approach is ideal in our setting since the spikes in the debt ceiling and government shutdown indexes are rare events.

The sensitivity of the money and stock markets to uncertainty has given politicians an oppor-tunity to force through preferred policies despite having minority vote in the United States congress. The recent "economy hostage holding" by the Republicans, by threatening to block a debt ceiling rise if the demands of an Obamacare repeal were not met, give evidence of growing sensitivity of markets to political decisions. Failure to reach an agreement on a policy by government policy makers tends to contribute to massive economic uncertainty that may cost the overall economy millions of jobs and delay economic recovery or provoke stock market collapsing (Gupta *et al.*, 2015).

The federal debt accumulates due to government issuing debt to government accounts such as Social Security and Medicare in exchange for their surpluses which, however, may realize deficits. (Austin and Levit, 2013). Additionally, the debt also increases when the government sells bonds to the public to finance budget deficits and to finance its various obligations. The Treasury's standard method of financing federal activities can be interrupted when the level of federal debt approaches its legal limit. The government is obliged to suspend funding of state programmes such as Disability Trust Fund, Civil Service and Postal Service Retiree Health Benefit (Levit *et al.*, 2013). Stevenson and Wolfers (2012) noted that if the debt ceiling is not raised by the default date, a technical debt default would result in investors turning away from the country. The credit ratings of the government would fall as happened when the United States was removed from Standard and Poor's list of risk free AAA borrowers.

In the U.S, the debt ceiling is often used by the government as an instrument of saving the soaring of financial markets. As the deadline for defaulting on debt approached in October 2012, the congress agreed to raise the debt ceiling which allowed further government borrow-ing and avoided a technical default on debt. Ozdagli and Peek (2013) noted that a default would not have only damaged the credibility of treasury securities as safe, but could have caused a financial crisis, potentially spreading beyond American borders.

The U.S government shutdown had both direct and indirect effects on economic growth. Directly, it reduced GDP since government spending is a component of GDP. The decline in consumer confidence resulted in a decrease in private spending and business investment. The indirect effect may be attributed to the debt limit impasse, which occurred at the same time as the shutdown. Since government workers could not contribute to production, there was a reduction in total supply and demand, which increased unemployment as a result of the government shutdown (Labonte, 2013).

A government shutdown results in uncertainty, which holds economic activities down. Agents postpone decision making, awaiting better information, and thus miss several business opportunities causing stock market returns to drop (Aastveit *et al.*, 2013). According to Labonte (2013), a shutdown affects countless firms because certain government purchases of private sector goods and services are frozen. In addition, exports and imports are disrupted due to delays in verifying federal imports, mortgages and small business loans are delayed because of a delay in processing of permits during the temporary shutdown period.

Furthermore, the effectiveness of monetary policy during such periods of uncertainty falls as agents become less sensitive to interest rates, which may give rise to an unstable inflation rate that negatively impacts on stock market returns. In 2011 in the U.S, the heated debate on the debt ceiling followed the congress finally agreeing on passing an increased bill in August. Brogaard and Detzel (2014) argue that the passage of a law (such as debt ceiling raising) does not mean the uncertainty is then instantly resolved. Uncertainty resulted since it was unclear whether the bill would be enacted as law successfully. Maniam (2014) suggests that the long term solution to the recurring threat of a debt crisis should involve commitment by the government to reduce future spending and increasing tax revenue so as to reduce the deficit.

The effect of uncertainty on the stock market is a popular debate in literature. Studies such as by Bachmann and Bayer (2013), Bekaert *et al.* (2013), Chugh (2013) and Popescu and Smets (2010) reported very little or no relationship while Alexopoulos and Cohen (2009), Antona-kakis *et al.* (2013) and Bloom (2012) found that returns fall mainly because of the "wait and see" approach preferred by most agents. According to Stokey (2015), uncertainty about a future tax rate creates uncertainty on the profitability of the investment and firms rationally delay committing resources to irreversible projects. However, Born and Pfeipfer (2014) acknowledged the existence of different effects of uncertainty working in opposite directions simultaneously. In contrast to the "wait and see" approach, other agents prefer to build up a buffer capital stock which may lead to an increase in investment.

Cannolly *et al.* (2005) found a negative relationship between uncertainty measures and stock and bond returns using data from 1986 to 2000 in the United States. Antonakakis *et al.* (2013) also investigated the relationship between stock market returns and uncertainty in the United States between 1997 and 2012 and found a consistently negative correlation, attributed to the increased stock market volatility and policy uncertainty.

According to Balcilar *et al.* (2010), causal relationships may suffer from inaccurate findings due to structural changes that the data series may experience. In the presence of such, the authors further argue that the dynamic links between series can exhibit instability across different sub-samples. Given this, our paper investigates whether a (Granger) causal relationship exist between a measure of debt ceiling and real stock returns, and also between a measure of government shutdown and real stock returns for the U.S economy. We make use of a rolling bootstrap causality based on data covering the monthly period of 1985:M2 to 2013:M9.

This paper contributes to existing literature by taking into account the time variation in the in-sample predictability of debt ceiling and government shutdown for the U.S. real stock returns with bootstrap Granger non-causality and rolling window sub-sample estimation. Instead of testing the full sample, which assumes permanent causal relationship, we make use of the rolling window in order to capture any structural changes that may exist in the model. The time-varying approach also helps in identifying whether the specific episodes of increases in these measures of debt ceiling and government shutdown carries leading information to provide in-sample predictability for the real stock returns. To the best of our knowledge, this study presents a first analysis on the causal relationship between debt ceiling or government shutdown and real stock returns.

The rest of the paper proceeds as follows: Section 2 explains the methodology. Section 3 presents the empirical results, while Section 4 concludes.

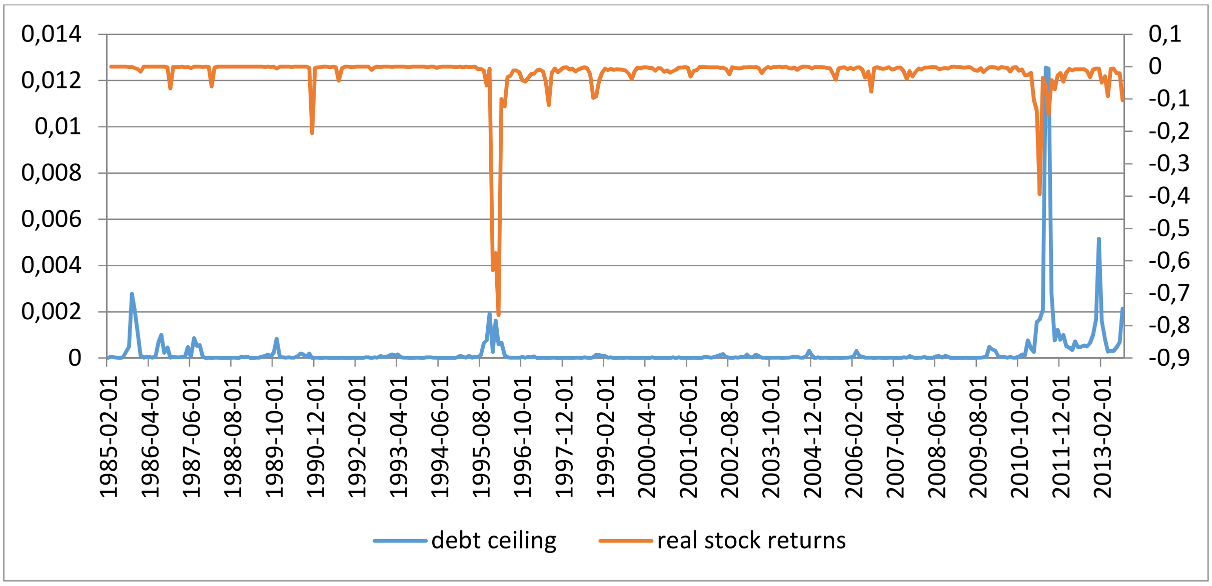
## 2. DATA AND EMPIRICAL MODEL

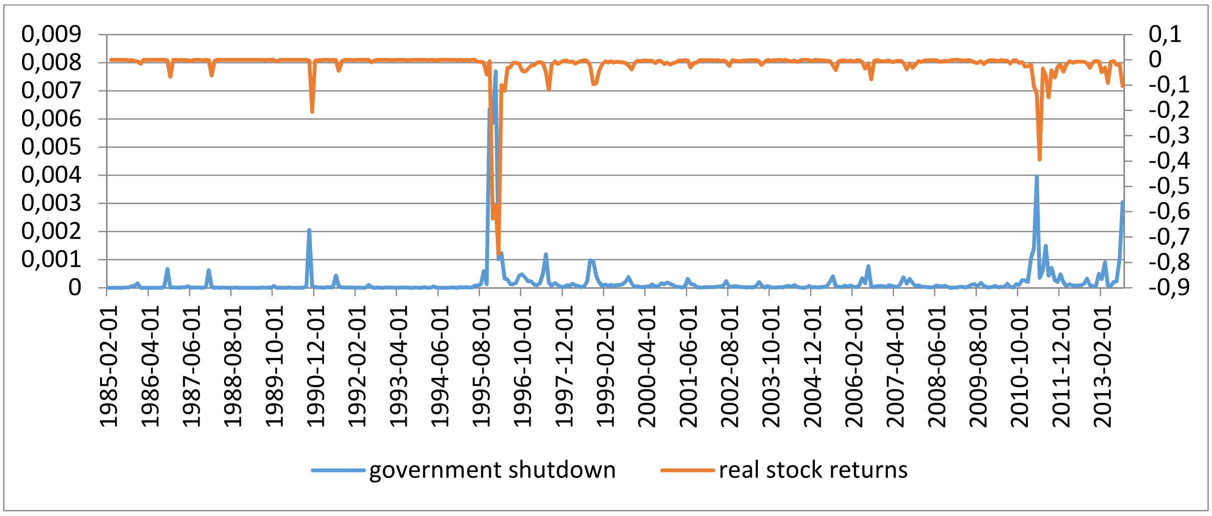
This study uses monthly data on debt ceiling, government shut down and real stock returns for the United States covering the monthly period of 1985:M1 to 2013:M9, with the start and end date being driven by the availability of data on the debt ceiling and government shut-down indexes. The data used to analyse the relationship between debt ceiling and real stock returns as well as government shutdown and real stock returns included four variables; the S&P500 stock price index, seasonally adjusted Consumer Price Index (CPI), and indexes of debt ceiling and government shutdown. The data on debt ceiling and government shutdown is based on the number of mentions of "debt ceiling" or "government shutdown" as a percent-age of total news articles from Access World News' Newsbank Service which contains relevant archives of over 1000 U.S. newspapers differing in size. Both series were taken from the www.policyuncertainty.com database. The seasonally adjusted CPI and the S&P500 data was obtained from the FRED database of the Federal Reserve Bank of St. Louis. We process the stock price data by dividing SP500 index with the CPI to obtain a measure for the real stock price, and then the series is logged, first-differenced and multiplied with 100 to obtain the real stock returns in percentages. Note that the computation of the real stock returns, results in us loosing the observation corresponding to 1985:M1.

The upper and lower panels of Figure 1 shows the relationship between debt ceiling and real stock returns as well as between government shutdown and real stock returns for the US over the period 1985:M2-2013:M9. The pattern shown tends to provide a picture of negative correlation between debt ceiling and government shutdown with real stock returns, especially after or on periods where the debt ceiling and government shutdown indexes spikes. This in general, tends to suggest that these two indexes are likely to carry leading information for predicting real stock returns. predicting real stock returns.

FIGURE 1 – *Debt Ceiling (Left Axis), Government Shutdown (Left Axis) and Real Stock Returns (Right Axis)*




The null hypothesis is Granger non-causality from debt ceiling and real stock returns and between government shutdown and real stock returns. We assume that there is no causality (or predictive power) from stock returns to either of the debt ceiling or government shutdown, because the later are indeed exogenous. Granger non-causality occurs when the information set on the first variable (e.g., debt ceiling or government shut down) does not improve the prediction of the second variable (e.g., real stock returns) over and above the predictive capacity of the information in the real stock returns time series. From a statistical perspective the Granger non-causality test is performed by examining the joint significance of lagged values for the first variable in a predictive model for the second variable that is usually embedded in a two-equation VAR model. In such a VAR framework the joint parameter restriction associated with the Granger non-causality test can be conducted with the Wald, Likelihood ratio (LR) and Lagrange multiplier (LM) statistics. But, it is important to emphasize that, these test statistics are based on the assumption that the underlying data is stationary, which happens to be in our case (as we show below).

This paper builds on standard Granger non-causality test by using a residual based bootstrap (RB) test rather than standard asymptotic tests and also accounting for the fact that real stock returns has no in-sample predictability for debt ceiling or government shutdown, which understandably is a valid assumption. It is the outstanding performance (in terms of power and size) of the residual RB method, irrespective of cointegration, that justifies this step[1]. In light of this encouraging result we follow Balcilar and Ozdemir (2013) and Balcilar *et al.* (2010, 2013) and use the RB based modified-LR statistics to examine the causality between debt ceiling or government shutdown and real stock returns in the U.S.

To illustrate the bootstrap modified-LR Granger causality, consider the following bivariate VAR(p) process:

$$y_t = \Phi_0 + \Phi_1 y_{t-1} + \ldots + \Phi_p y_{t-p} + \varepsilon_t,\ t = 1,2\ldots,T \qquad (1)$$

where $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})'$ is a white noise process with zero mean and covariance matrix Σ and p is the lag order of the process. In the empirical section, the Schwarz Information Criterion (SIC) is used to select the optimal lag order p. To simplify the representation, $y$ is partitioned into two sub-vectors, debt ceiling or government shutdown ($y_1$) and real stock returns ($y_2$). Hence, rewrite equation (1) as follows:

[1]This result has been demonstrated by numerous Monte Carlo studies, including: Horowitz (1994), Shukur and Mantalos (2004), Mantalos and Shukur (1998), Shukur and Mantalos (2000), Mantalos (2000) and Hacker and Hatemi-J(2006).

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \varphi_{10} \\ \varphi_{20} \end{bmatrix} + \begin{bmatrix} \varphi_{11}(L) & 0 \\ \varphi_{21}(L) & \varphi_{22}(L) \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}, \qquad (2)$$

where $\phi_{ij}(L) = \sum_{k=1}^{p+1} \phi_{ij,k} L^k$, $i, j = 1,2$ and $L$ is the lag operator such that $L^k y_{it} = y_{it-k}$, $i = 1,2$.
The restriction $\varphi_{12}(L) = 0$ in Eq. (2) is due to exogeneity of the debt ceiling and government shutdown variables. In this setting, the null hypothesis that debt ceiling or government shutdown does not Granger cause real stock returns can be tested by imposing zero restrictions $\varphi_{21,i} = 0$ for $i = 1,2,\ldots,p$. In other words, debt ceiling or government shutdown does not contain predictive content, or is not causal, for real stock returns if the joint zero restrictions under the null hypothesis:

$$H_0 : \varphi_{21,1} = \varphi_{21,2} = \ldots = \varphi_{21,p} = 0 . \qquad (3)$$

are not rejected. If the hypothesis in Eq. (3) is rejected, then debt ceiling or government shutdown Granger causes real stock returns. The causality hypothesis in Eq. (3) can be tested using a number of testing techniques. However, this study uses the bootstrap approach pioneered by Efron (1979) which uses critical or p values generated from the empirical distribution derived for the particular test using the sample data. In this case, the bootstrap approach is employed to test for Granger non-causality.

Granger non-causality tests assume that parameters of the VAR model used in testing are constant over time. This assumption is often violated because of structural changes and as Granger (1996) pointed out, parameter non-constancy is one of the most challenging issues confronting empirical studies today. Although the presence of structural changes can be detected beforehand and the estimations can be modified to address this issue using several approaches, such as including dummy variables and sample splitting, such an approach introduces pre-test bias. Therefore, this study adopts rolling bootstrap estimation in order to overcome the parameter non-constancy and avoid pre-test bias. For more details on the methodology refer to Balcilar and Ozdemir (2013). To examine the effect of structural changes, the rolling window Granger causality tests, which are also based on the modified bootstrap test, are used. Structural changes shift the parameters and the pattern of the causal relationship may change over time. To deal with structural changes and parameter non-constancy, this paper in addition to full sample estimation, applies the bootstrap causality test to rolling window subsamples for $t = \tau-l+1, \tau-l, ..., \tau$, $\tau = l, l+1, ..., T$, where l is the size of the rolling window. Note that, this also allows us to detect whether debt ceiling or government shutdown has lead real stock returns especially after periods where these two indexes increasesd sharply.

Prior to investigating Granger causality, we test for the stationarity of the data using the $Z_\alpha$ unit root test of Phillips (1987) and Philips and Perron (1988) (PP), Augmented Dickey Fuller (ADF) test, $MZ_\alpha$ test of Ng and Perron (2001) and Dickey-Fuller GLS (ERS) test[2]. Further, the parameter values and the pattern of (no) causal relationship may change over time due to structural changes. The results of the Granger causality tests will be sensitive to sample period used and order of the VAR model, if the parameters are temporally instable (Balcilar and Ozdemir, 2013). Hence, conflicting results for the causal links between debt ceiling or government shutdown and real stock returns can be found if one uses different sample periods and different VAR specifications. The results of Granger causality tests based on the full sample also become invalid with structural breaks because they assume parameter stability. Therefore, this study tests for parameter stability in the estimated VAR models following Balcilar *et al.* (2010), Balcilar and Ozdemir (2013), and Aye *et al.* (2014).

In practice, a number of tests exist for examining the temporal stability of VAR models (e.g. Hansen, 1992; Andrews, 1993; Andrews and Ploberger, 1994). These tests can be applied in a straightforward manner to stationary models. The preliminary analysis shows that the three series are stationary, thus precluding cointegration analysis and long run stability test. To investigate the stability of the short-run parameters, the Sup-F, Ave-F and Exp-F tests developed by Andrews (1993) and Andrews and Ploberger (1994) are used. These tests are computed from the sequence of LR statistics that tests constant parameters against the alternative of a one-time structural change at each possible point of time in the full sample. Andrews (1993) and Andrews and Ploberger (1994) report the critical values for the non-standard asymptotic distributions of these tests. To avoid the use of asymptotic distributions, the critical values and p-values are obtained using the parametric bootstrap procedure. Specifically, the p-values are obtained from a bootstrap approximation to the null distribution of

[2]The $Z_\alpha$ and $MZ_\alpha$ tests statistics have nonstandard distributions, and critical values are available from a number of sources. We used the response surface critical values computed by Mackinnon (1996).

the test statistics, constructed by means of Monte Carlo simulation using 2000 samples generated from a VAR model with constant parameters. The Sup-F, Ave-F and Exp-F tests needs to be trimmed at the ends of the sample. Following Andrews (1993) we trim 15 percent from both ends and calculate these tests for the fraction of the sample in [0.15, 0.85].

## 3. EMPIRICAL RESULTS

Tests for stationarity are based on the ADF, PP, DF-GLS, and NP tests. Table 1 reports the four unit root tests that were performed to determine whether debt ceiling, government shutdown and real stock return series for the U.S economy are stationary. We test the null hypothesis of non-stationarity (unit root) against the alternative of stationatiry (no unit root) for debt ceiling, government shutdown and real stock returns, under two alternative specifications of constant, and constant and trend. According to the tests conducted, we cannot reject the null hypothesis of a unit root at 1 percent level of significance, with the lag-length of the test being determined by the SIC, where applicable. Therefore the results indicate that debt ceiling, government shutdown and real stock return series of the U.S conform to I(0) processes.

TABLE 1 - *Unit Root Tests*

| | Real stock returns | | Debt ceiling | | Government shutdown | |
|---|---|---|---|---|---|---|
| | Intercept | Trend and intercept | Intercept | Trend and intercept | Intercept | Trend and intercept |
| ADF | -14.069*** | -14.086*** | -6.775*** | -7.007*** | -8.423*** | -8.480*** |
| PP | -14.038*** | -14.042*** | -8.000*** | -8.128*** | -8.628*** | -8675*** |
| DF-GLS | -3.2197*** | 12.212*** | -6.638*** | -6.877*** | -8.184*** | -5.999*** |
| NP | -16.648*** | -145.091*** | -80.306*** | -84.925*** | -187.175*** | -80.978*** |

*Note*: *** denotes significance 1% level.

TABLE 2 - *Full Sample Bootstrap Granger Causality Tests between Debt Ceiling, Goverment Shutdown and Real Stock Prices*

| $H_0$: Debt Ceiling does not Granger cause Real Stock Returns | | $H_0$: Government Shutdown does not Granger cause Real Stock Returns | |
|---|---|---|---|
| *LR*-Statistic | Bootstrap *p*-value | *LR*-Statistic | Bootstrap *p*-value |
| 2.097 | 0.512 | 2.097 | 0.52 |

Having proven stationarity, the study proceeds by estimating the full sample bootstrap *LR* statistic to test the null hypothesis that debt ceiling and government shutdown do not Granger cause real stock returns with the residual based bootstrap modified-*LR* tests, as suggested by Shukur and Mantalos (2000, 2004), Mantalos and Shukur (1998), Mantalos (2000), and Hacker and Hatemi-J (2006). As before the optimal lag length is determined with the SIC criteria which determined a lag length of 1. The two null hypotheses at stake are (a) that debt ceiling does not Granger cause real stock returns and (b) that government shut down does not Granger cause real stock returns and these will be tested with a full sample bootstrap *LR* statistic. The results are presented in Table 2. The bootstrap *LR*-test uses the *p*-values obtained from 2000 replications. According to the bootstrap *p*-values; both null hypotheses fail to be rejected, indicating absence of any full-sample causal links between debt ceiling, government shutdown and real stock returns in the U.S. The null hypothesis would be rejected at 10% level when *p*-value falls below 0.10. However, the bootstrap *p*-values are even above 50%.

As indicated earlier, we note that in the presence of structural changes, parameters values may shift the pattern of the relationship in VAR models estimated using full-sample data from U.S. This will cause instability in the relationship between debt ceiling, government shutdown and real stock returns in the U.S. Therefore, the full-sample causality tests with assumptions of parameter constancy and a single causal relationship across the whole sample period are no longer reliable, and the ensuing results turn to be meaningless (Zeileis *et al.*, 2005). For this reason, this paper proceeds to test for parameter stability and to determine whether structural changes exist. As mentioned before, we use the *Sup-F, Ave-F* and *Exp-F* tests developed by Andrews (1993) and Andrews and Ploberger (1994) to investigate the stability of parameters in the above VAR models formed by debt ceiling, government shutdown and real stock returns.

The stability tests relating to debt ceiling and real stock returns are reported in Table 3, while those with respect to government shutdown and real stock returns are reported in Table 4. The *Sup-F* tests under the null hypothesis of parameters constancy against a one-time sharp shift in parameters are reported in the first row. The *Ave-F* and *Exp-F* tests under the null hypothesis that parameters follow a martingale process against the possibility that the parameters might evolve gradually are reported in the second and third rows respectively. As can be seen, there is strong evidence of instability, not only in the individual equations, but also the system in general, based on all the three tests. Since our concern is the one-way causality from debt ceiling and government shutdown to real stock returns, the instability in the real stock returns equation warrants our need to look at time-varying causality.

TABLE 3 - *Parameter Stability Test: Real Stock Returns and Debt Ceiling*

| | Real stock returns Equation | | Debt ceiling Equation | | VAR (1) System | |
|---|---|---|---|---|---|---|
| | Statistics | Bootstrap *p*-value[a] | Statistics | Bootstrap *p*-value[a] | Statistics | Bootstrap *p*-value[a] |
| *Sup-F* | 96.99 | <0.01 | 25.18 | 0.02 | 67.97 | <0.01 |
| *Exp-F* | 28.04 | <0.01 | 15.48 | 0.01 | 28.83 | <0.01 |
| *Ave- F* | 43.01 | <0.01 | 8.611 | 0.03 | 30.69 | <0.01 |

Note: [a]*p*-values are calculated using 2000 bootstrap repetitions.

TABLE 4 - *Parameter Stability Test: Real Stock Returns and Government Shutdown*

| | Real stock returns Equation | | Government shutdown Equation | | VAR (1) System | |
|---|---|---|---|---|---|---|
| | Statistics | Bootstrap *p*-value[a] | Statistics | Bootstrap *p*-value[a] | Statistics | Bootstrap *p*-value[a] |
| *Sup-F* | 32.92 | <0.01 | 214.05 | <0.01 | 108.20*** | <0.01 |
| *Exp-F* | 11.77 | 0.05 | 26.00 | <0.01 | 21.50** | 0.03 |
| *Ave -F* | 11.16 | <0.01 | 101.55 | <0.01 | 48.62*** | <0.01 |

*Note*: [a]*p*-values are calculated using 2000 bootstrap repetitions.

Given the existence of parameter instability, one would expect that Granger causality between debt ceiling or government shutdown and real stock returns to be sensitive to sample period changes. Therefore, bootstrap rolling estimations are performed since results from traditional Granger causality test may be misleading.[3] Besides, recall that our objective is to analyze whether these two indexes have in-sample predictive power, i.e., leads the real stock returns after a spike in the measures of debt ceiling or government shutdown, which in turn, are generally rare events. The plots of the bootstrap *p*-values of the rolling tests statistics are shown in figures 2 to 3 corresponding respectively to debt ceiling and government shutdown respectively, with the horizontal axis showing the final observations in each of the 24 months rolling window, with SIC determining the optimal lag-length for each window.[4] The bootstrap *p*-values as shown in figures 2 and 3 suggest that there are significant changes in the causal links

[3] Given, the evidence of instability, we also conducted Rossi's (2005) instability-robust causality test. Not surprisingly, we could detect strong (with *p*-values of 0.00) evidence of causality running from debt ceiling or government shutdown to real stock returns, thus highlighting the importance of using causality tests that account for parameter instability. However, since this test is a full-sample analysis and does not allow us to pick up specific periods for which causality is observed, and determine whether debt ceiling or government shutdown peaked before or during these periods, we do not report these results to save space. We just concentrate on the rolling causality tests. The causality results from Rossi's (2005) instability-robust test are, however, available upon request from the authors.

[4] For the rolling estimations, the window size is an important choice parameter. Indeed, the window size controls the number of observations covered in each subsample and determines the number of rolling estimates, since a larger window size reduces the number of observations available for estimation. More importantly, the window size controls the precision and representativeness of the subsample estimates. A large window size increases the precision of estimates, but may reduce the representativeness, particularly in the presence of heterogeneity. On the contrary, a small window size will reduce heterogeneity and increase representativeness of parameters, but it may increase the standard error of estimates, which reduces accuracy. Therefore, the choice of the window size should balance the trade-off between accuracy and representativeness. We follow Liu *et al.*, (forthcoming) in using a window size of 24, observing from Figure 1 the fact that stock market movements are sharp and short-lived following a spike in these two indexes. We, however, tested with a bigger window size of 60, but the qualitative results did not change, as was the case when nominal stock returns were used instead of real ones. These findings are available from the authors.

between debt ceiling, government shut down and real stock returns over the sample period under investigation.

The left vertical axis of Figure 2 presents the bootstrap *p*-value of the *LR* statistics estimated using sub-sample data on debt ceiling and real stock returns from the U.S. The null hypothesis that debt ceiling does not Granger cause real stock returns can be rejected at 10 per cent level of significance. Therefore *p*-values greater than 0.10 are ignored to protect against low power results. Figure 2, shows the null hypothesis that debt ceiling Granger causes stock returns in the U.S is rejected at 10 per cent level of significance in the following sub-periods: 1998:M4-1998:M8, 1998:M11-1999:M3, 1999:M5-1999:M6, 2000:M1-2000:M11, 2001:M12-2002:M3, 2005:M2-2005:M3 and 2013:M5-2013:M7. In Figure 2, we also superimpose the debt ceiling index and is measured on the right vertical axis. As can be seen, in all cases where we observe causality running from debt ceiling to real stock returns, the debt ceiling index shows a spike before and during the same month(s) for which the null is rejected, making the causal relationship persistent.

The left vertical axis of Figure 3, reports the rolling bootstrap *p*-value of *LR* –statistics with respect to the null hypothesis that government shutdown does not Granger cause real stock returns in the U.S. According to Figure 3, the null hypothesis is rejected at 10 per cent level of significance in the following sub-periods: 1995:M6, 1998:M4-1998:M8, 1998:M11-1999:M6, 1999:M12-2000:M11, 2001:M12-2002:M1, 2002:M3, 2005:M2 and 2013:M5-2013:M7. As in Figure 2, we also superimpose the government shutdown index and is measured on the right vertical axis of Figure 3. Again, as with debt ceiling, in all cases where we observe causality running from government shutdown to real stock returns, the government shutdown index shows a spike before and during the same month(s) for which the null is rejected. Overall Figures 2 and 3 point towards the failure to reject the null hypothesis of non (Granger) causality between debt ceiling or government shutdown and real stock returns in the U.S. when accounting for time-variation. More importantly, with the causality being observed for periods after which these two indexes spiked, highlights the fact that the detected causality is not spurious and a statistical artifact, but that it really runs from the measures of debt ceiling and government shutdown to real stock returns for certain sub-samples.

FIGURE 2 - *Bootstrap P-Values (Left-Axis) of LR Statistic Testing the Null Hypothesis that Debt Ceiling does not Granger Cause Real Stock Returns, with Debt Ceiling Index Superimposed and Measured on Right-Axis*

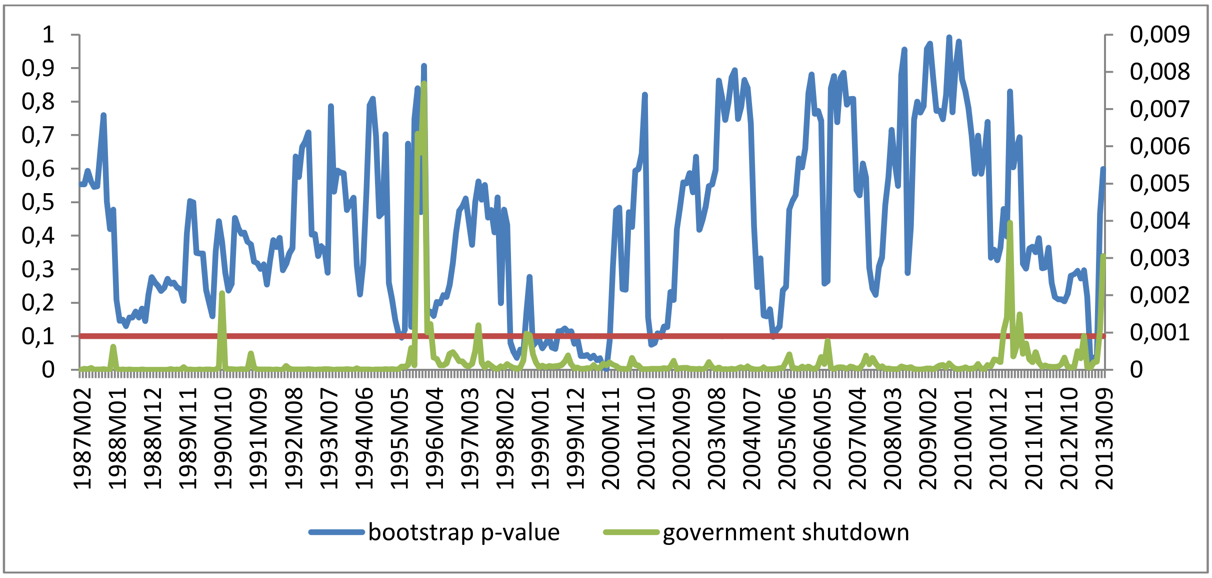
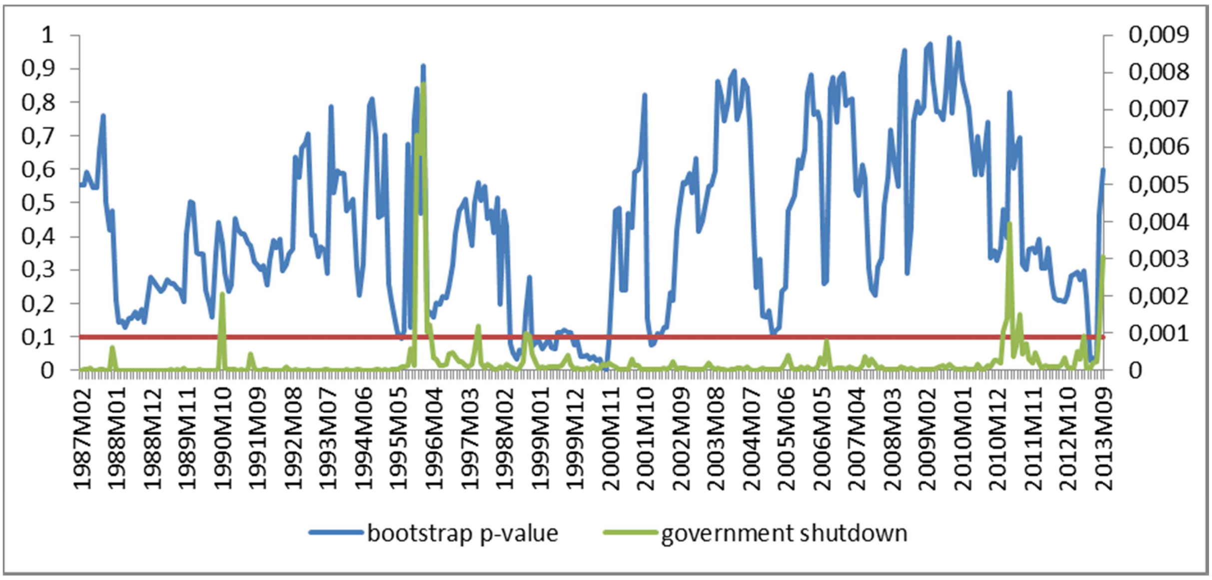



FIGURE 3 - *Bootstrap p-Values (Left-Axis) of LR Statistic Testing the Null Hypothesis that Government Shut Down does not Granger Cause Real Stock Returns, with Government Shutdown Index Superimposed and Measured on Right-Axis*



## 4. CONCLUSION

This study investigates the in-sample predictability ability of debt ceiling and government shutdown for real stock returns using bootstrapped full-sample and sub-sample rolling window Granger causality tests for the U.S. The data used in this study are monthly time series data covering the period 1985:M2 to 2013:M9. The bootstrap full-sample causality test provides no evidence of any causal relationship between debt ceiling and real stock returns, as well as, between government shutdown and real stock returns. The stability tests, however, exhibit short run parameter instability. Therefore, we make use of the bootstrap rolling window (24 months) approach to investigate the changes in the causal relationship between debt ceiling (government shutdown) and real stock returns. Besides, given that our objective is to analyze whether debt ceiling or government shutdown have in-sample predictive power, i.e., leads the real stock returns after a spike in these two indexes, which in turn, are generally rare events, the time-varying approach is ideally suited for our purpose. We find evidence of significant in-sample predictive ability of debt ceiling or government shutdown for real stock returns for several sub-samples, corresponding especially after episodes of sharp increases in the indexes of debt ceiling and government shutdown, pointing to the fact that the causality is not spurious or a statistical artifact, but that it really exists for certain sub-samples. Our results highlight the importance of the time-varying approach in detecting in-sample predictability in the face of instability. Thus, news about government shutdown and debt ceiling may assist investors and managers to predict the movement in stock returns more accurately and hence, make better portfolio allocation decisions. As part of future research, it would be interesting to investigate whether these two indexes also carry out-of-sample predictive content for real stock returns, both in statistical and economic sense, since it is well-known that in-sample predictability does not necessarily translate into out-of-sample forecasting gains.

## REFERENCES

Aastveit, K.A., J.N. Gisle and S. Serglo (2013), "Economic Uncertainty and the Effectiveness of Monetary Policy", Norges Bank Working Paper No. 17.

Alexopoulos, M. and J. Cohen (2009), "Uncertain Times, Uncertain Measures", Department of Economics, University of Working Paper No. 352.

Antonakakis,N., I. Chatziantoniou and G. Filis (2013), "Dynamic Co-movements of Stock Market Returns, Implied Volatility and Policy Uncertainty", *Economics Letters,* 120(1), 87-92.

Andrews, D.W.K. (1993), "Tests for Parameter Instability and Structural Change with Unknown Change Point", *Econometrica,* 61(4), 821-856.

Andrews, D.W.K. and W. Ploberger (1994), "Optimal Tests when a Nuisance Parameter is Present only Under the Alternative", *Econometrica,* 62(6), 1383-1414.

Austin, D.A. and M.R. Levit (2013), "The Debt Limit: History and Recent Increases", Congressional Research Service Report RL31967.

Aye, G.C., M. Balcilar, A. Bosch and R. Gupta (2014), "Housing and the Business Cycle in South Africa", *Journal of Policy Modeling,* 36(3), 471-491.

Bachmann, R. and C. Bayer (2013), "Wait-and-See Business Cycles?", *Journal of Monetary Economics,* 60(6), 704-719.

Balcilar, M. and Z.A. Ozdemir (2013), "The Export-Output Growth Nexus in Japan: A Bootstrap Rolling Window Approach", *Empirical Economics,* 44(2), 639-660.

Balcilar, M., Z.A Ozdemir and Y. Arslanturk (2010), "Economic Growth and Energy Consumption Causal Nexus Viewed through A Bootstrap Rolling Window". *Energy Economics,* 32(6), 1398-1410.

Born, B. and J. Pfeifer (2014), "Policy Risk and the Business Cycle", *Journal of Monetary Economics,* 68 (9), 68-85.

Bloom, N., F. Max, J. Nir, S. Itay and T. Stephen (2012), "Really Uncertain Business Cycles", NBER Working Paper No. 18245.

Brogaard, J. and A. Detzel (2014), "The Asset Pricing Implications of Government Economic Policy Uncertainty", *Management Science,* 61(1), 3-18.

Bekaert, G., M. Hoerova and M. Lo Duca (2013), "Risk, Uncertainty and Monetary Policy", *Journal of Monetary Economics*, 60(7), 771-788.

Chugh, S. (2013), "Firm Risk and Leverage-Based Business Cycles", FMRC Boston College Working Paper No. 844. annolly, R., C. Stivers and L. Sun (2005), "Stock Market Uncertainty and the Stock-Bond Return Relation", *Journal of Financial and Quantitative Analysis,* 40(1), 161-193.

Efron, B. (1979), "Bootstrap Methods: Another Look at the Jackknife", *Annals of Statistics*, 7(1), 1-26.

Gupta, R., X. Li, M. Balcilar and T. Chang (2015), "The Causal Relationship between Economic Policy Uncertainty and Stock Returns in China and India: Evidence from a Bootstrap Rolling Window", *Emerging Markets Finance and Trade,* DOI: 10.1080/1540496X.2014.998564.

Granger, C.W.J. (1996), "Can we Improve the Perceived Quality of Economic Forecasts?", *Journal of Applied Econometrics,* 11(5), 455-73.

Hacker, R.S. and A. Hatemi-J (2006), "Tests for Causality between Integrated Variables based on Asymptotic and Bootstrap Distributions: Theory and Application", *Applied Economics*, 38(13), 1489-1500.

Hansen, B.E. (1992), "Tests for Parameter Instability in Regressions with I(1) Processes", *Journal of Business and Economic Statistics*, 10(3), 321-336.

Horowitz, J. L. (1994), "Bootstrap-based Critical Values for the Information Matrix Test", *Journal of Econometrics*, 61(2), 395-411.

Labonte, M. (2013), "The FY2014 Government Shutdown: Economic Effects", Congressional Research Service, 7-5700, R43292.

Levit, M.R., C.T. Brass, J.J. Nicola and D. Nuschler (2013), "Reaching the Debt Limit: Background and Potential Effects on Government Operations", Congressional Research Service Report R41633.

MacKinnon, J. G. (1996), “Numerical Distribution Functions for Unit Root and Cointegration Tests”, *Journal of Applied Econometrics,* 11(6), 601-618.

Mantalos, P. (2000), “A Graphical Investigation of the Size and Power of the Granger-Causality Tests in Integrated-Cointegrated VAR Systems”, *Studies in Non-linear Dynamics and Econometrics,* 4(1), 17-33.

Mantalos, P. and G. Shukur (1998), “Size and Power of the Error Correction Model Cointegration Test. A Bootstrap Approach”, *Oxford Bulletin of Economics and Statistics,* 60(2), 249-255.

Maniam, B. (2014), “American Politics and its Debt Issue”, *Journal of Emerging Economies and Islamic Research,* 2(1), 1-7.

Ng, S. and P. Perron (2001), “Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power”, *Econometrica,* 69(6), 1519-1554.

Ozdagli, A. and J. Peek (2013), “Cliff Notes: The Effects of the 2013 Debt-Ceiling Crisis” Federal Reserve Bank of Boston Public Policy Brief No. 13-9.

Phillips, P.C. (1987), “Time Series Regression with a Unit Root”, *Econometrica,* 55(2), 277-302.

Phillips, P.C. and P. Perron (1988), “Testing for a Unit Root in Time Series Regression”, *Biometrika,* 75(2), 335-346.

Popescu, A. and F.R. Smets (2010), “Uncertainty, Risk-taking, and the Business Cycle in Germany”, *CESifo Economic Studies,* 56 (4), 596-626.

Rossi, B. (2005), “Optimal Tests for Nested Model Selection with Underlying Parameter Instability”, *Econometric Theory,* 21(5), 962-990.

Shukur, G. and P. Mantalos (2000), “A Simple Investigation of the Granger-Causality Test in Integrated-Cointegrated VAR systems”, *Journal of Applied Statistics,* 27(8), 1021-1031.

Shukur, G. and P. Mantalos (2004), “Size and Power of the RESET Test as Applied to Systems of Equations: A Bootstrap Approach”, *Journal of Modern Applied Statistical Methods,* 3(2), 370-385.

Stokey, N.L. (2015), “Wait-and-See: Investment Options under Policy Uncertainty”, *Review of Economic Dynamics,* doi:10.1016/j.red.2015.06.001.

Stevenson, B. and J. Wolfers (2012), " Debt Ceiling Déjà vu Could Sink the Economy", Bloomberg Online May 28, <http://www.bloombergview.com/articles/2012-05-28/debt-ceiling-deja-vu-could-sink-economy>.

Zeileis, A., F. Leisch, K. Hornik and C. Kleiber (2005), "Monitoring Structural Change in Dynamic Econometric Models", *Journal of Applied Econometrics,* 20(1), 99-121.