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Rational Speculative Bubbles in the US Stock Market and Political Cycles

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Abstract

This paper tests the existence of rational speculative bubbles during Democratic and Republican presidential terms, which has not been systematically researched in existing studies. With monthly real returns on equally-weighted and value-weighted portfolios in the U.S. from January 1927 to December 2012, we find that there are rational speculative bubbles under Republican Presidents but not under Democratic Presidents. Our results are robust to different specifications.

Keywords

Rational speculative bubbles; Duration dependence; Abnormal returns; Presidential terms

1. Introduction

The term rational speculative bubbles is used to describe a persistent stock market overvaluation. Investors understand assets are sold at prices in excess of their fundamentals, which is the present value of all the asset's future cash flows (Lucas, 1978). However, they believe the bubble will continue to expand and yield a high return, compensating them for the probability of a crash. There are a large number of studies testing rational speculative bubbles internationally. Among them are Brooks and Katsaris (2003) on London stock exchange, Gan et al. (2012) on Hong Kong stock market, Kizys and Pierdzioch (2012) on stock markets in a cross section of countries, Watanapalachaikul and Islam (2007) on Thai stock market, and Zhang (2008) on Chinese stock market.

Research on asset prices in the U.S. stock market is also extensive. Some studies focus on rational speculative bubbles in general. For example, with monthly returns between 1929 and 1991, McQueen and Thorley (1994) find evidence supporting rational speculative bubbles in the U.S. stock market. Lunde and Timmermann (2004) argue that the longer an expansion, the lower is its probability to arrive at a termination and the longer a contraction, the higher is its probability to come to a termination. Other papers explore the relationship between stock market returns and political parties in power. Johnson et al. (1999) find that the return differential between Democratic and Republican presidencies is significant for small-cap stocks, but insignificant for large-cap stocks. In a seminal study, Santa-Clara and Valkanov (2003)demonstrate that the stock market returns in the U.S. are 9% higher based on value-weighted and 16% higher based on equally-weighted portfolios under Democratic than Republican presidencies over the period of 1927–1998, and they name this result the "presidential puzzle".

In this paper we apply the duration dependence test, proposed by McQueen and Thorley (1994), for the existence of rational speculative bubbles in the U.S. stock market under different Presidents by political affiliation, which has not been systematically researched in existing studies. With monthly returns on equally-weighted and value-weighted portfolios in the U.S. from January 1927 to December 2012, we find that rational speculative bubbles exist in the stock market in the U.S. in general, echoing previous research. In addition, our empirical results show that rational bubbles exist in the U.S. stock market under Republican Presidents but not Democratic Presidents. Various specifications are used and our results remain robust.

The remainder of the paper is organized as follows: Section 2 describes the duration dependence test and Section 3 presents our empirical results. Section 4 concludes and discusses potential extension to this paper.

2. Duration dependence test

Previous research has adopted a number of methods to test for speculative bubbles in asset prices such as tests for autocorrelation and kurtosis (Blanchard and Watson, 1982) and tests for skewness (Evans, 1986). McQueen and Thorley (1994) propose a duration dependence test for rational speculative bubbles, implying an inverse relationship between a run of positive abnormal returns and the length of the run. The authors point out that this test is more unique to bubbles than attributes including skewness, kurtosis, and autocorrelation which can result from other reasons, such as, time-varying risk premiums or asymmetric fundamental news.

Duration dependence is a characteristic of hazard function for duration times. McQueen and Thorley (1994) expect that the hazard function of a run of positive abnormal returns is an inverse function of the length of the run. A run is defined as a sequence of abnormal returns ($\in_t^r$) of the same sign.
Let $f(t)$ represent the density function for duration times, and $F(t)$ the corresponding distribution function. The hazard function $h(t)$ is the conditional density function for a run with duration of length *t*, given that it lasts at least until *t*. Specifically:

$$h(t) = \frac{f(t)}{1-F(t)} \quad (1)$$

If N_t and P_t represent the count of completed runs and partial runs, respectively, of length *t* in the sample, the density function version of the log likelihood for data consisting of a set S_T is as follows:

$$L(\theta|S_T) = \sum N_t \ln f_t + P_t \ln(1 - F_t) \quad (2)$$

where θ is a vector of parameters. Following McQueen and Thorley (1994), the hazard function is written as the log–logistic functional form:

$$h_t = \frac{1}{1+e^{-(\alpha+\beta \ln t)}} \quad (3)$$

Eq. (3) transforms the unbounded range of $\alpha + \beta \ln t$ into the 0,1 space of $h(t)$, the conditional probability of ending a run. The null hypothesis of the duration dependence test is that positive and negative returns are random so the probability of ending a run does not depend on prior returns. In this model, the null hypothesis indicates constant hazard rates $(\beta = 0)$. Alternatively, $\beta < 0$ suggests decreasing hazard rates or the probability of a positive run ending decreases as the run gets longer. The test is performed by substituting Eq. (3) into Eq. (2) and then maximizing the log-likelihood function with respect to α and β.

3. Rational bubbles during Democratic and Republican presidential terms

We begin this section by focusing on the level of stock returns during different presidencies. Our variable of interest is monthly stock portfolio real returns, calculated as the difference between nominal returns and the inflation rate (INF).[2] Nominal returns on equally-weighted (EWR) and value-weighted (VWR) portfolios between January 1927 and December 2012 in the U.S. are obtained from the Center for Research in Security Prices (CRSP). We report summary statistics for the full sample and two subsamples covering Great Depression and WWII and post-WWII in Table 1.

Table 1. Summary statistics of real returns for equally- and value-weighted portfolios.

	Whole sample period (January 1927–December 2012)		Great depression and WWII (January 1927–December 1946)		Post-war period (January 1947–December 2012)	
	EWR-INF	VWR-INF	EWR-INF	VWR-INF	EWR-INF	VWR-INF
Mean	9.002	6.135	10.372	4.493	8.586	6.633
Standard deviation	24.653	18.904	38.436	28.081	18.594	15.082
Median	14.559	12.283	21.575	12.928	13.221	12.189
Skewness	0.311	–0.458	0.558	–0.177	–0.606	–0.761
	[0.076]	[0.076]	[0.158]	[0.158]	[0.087]	[0.087]
Excess kurtosis	8.474	6.388	4.188	3.810	3.544	2.537
	[0.152]	[0.152]	[0.316]	[0.316]	[0.174]	[0.174]
No. of obs.	1032	1032	240	240	792	792

To confirm that our results based on the updated dataset are consistent with previous findings in the literature, we first follow Santa-Clara and Valkanov (2003) to test whether the real returns are significantly different under two presidential regimes. We regress real returns on presidential partisan dummy variables:

$$r_{t+1} = \alpha_1 RD_t + \alpha_2 DD_t + \theta' X_t + u_{t+1} \quad (4)$$

where $r_t \in \{EWR_t - INF_t, VWR_t - INF_t\}$ represents real returns on EWR or VWR portfolios, respectively; RD_t and DD_t are presidential dummy variables where $RD_t = 1$ ($DD_t = 1$) if a Republican (Democrat) is the president at time *t*, and zero otherwise; X_t is a vector of lagged dependent variables for the last 3 months as well as macroeconomic/business-cycle variables which are associated with the stock market including the default spread (DSP_t) between yields of BAA- and AAA-rated bonds, the spread (TSP_t) between the yield to maturity of a 10-year Treasury note and the 3-month Treasury bill, the inflation rate (INF_t), the relative interest rate (RR_t) defined as the difference between the 3-month Treasury bill rate and its 1-year moving average. All data are collected from CRSP.

We then test the difference between coefficients α_1 and α_2 and report the results in Table 2. As show in Table 2, the coefficient on the Republican dummy (α_1) is significantly smaller than that on the

Democratic dummy (α_2). It suggests that stock market returns are significantly higher under Democratic Presidents than under Republican Presidents holding other things constant, which is a similar finding as in Santa-Clara and Valkanov (2003).

Table 2. Average returns under Republican and Democratic Presidents, controlling for business-cycle and lagged dependent variables.

	Whole sample period (January 1927–December 2012)		Great depression and WWII (January 1927–December 1946)		Post-war period (January 1947–December 2012)	
	EWR-INF	VWR-INF	EWR-INF	VWR-INF	EWR-INF	VWR-INF
Difference ($\alpha_1 - \alpha_2$)	–16.174***	–9.683**	–116.506**	–81.901**	–14.124***	–8.927**
F-statistic	9.63	5.88	5.52	4.38	8.80	5.15
R-squared	0.072	0.038	0.112	0.096	0.096	0.049
No. of obs.	1032	1032	240	240	792	792
Republicans	506	506	74	74	432	432

Control variables are: the default spread (DSP_t) between yields of BAA- and AAA-rated bonds, the spread (TSP_t) between the yield to maturity of a 10-year Treasury note and the 3-month Treasury bill, the inflation rate (INF_t), the relative interest rate (RR_t) defined as the difference between the 3-month Treasury bill rate and its 1-year moving average, as well as lagged dependent variables for last 3 months. Data are obtained from CRSP.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Next we test for rational speculative bubbles. The factor of rational speculative bubbles (b_t), or abnormal returns, is defined as the deviation of the real returns from the fundamental returns:

$$r_t = r_t^* + b_i \quad (5)$$

where r_t and r_t^* represent real and fundamental returns, respectively. The empirical model we use to estimate fundamental and abnormal returns follows McQueen and Thorley (1994):

$$r_t = \beta_0 + \beta_1 spread_{t-1} + \frac{\beta_2 D}{P_{t-1}} + \sum_{i=1}^{3} p_i r_{t-i} + \epsilon_t^r \quad (6)$$

where $r_t \in \{EWR_t - INF_t, VWR_t - INF_t\}$ represents real returns on EWR or VWR portfolios, respectively; $spread_{t-1}$ is the spread of yield-to-maturity between AAA corporate bond portfolio and the 3-month Treasury bill, and D/P_{t-1} represents the annual dividend yield, which is calculated by the sum

of the prior 12 monthly valued-weighted portfolio's dividend yields. Data used to estimate Eq. (6) are also obtained from CRSP. The residual ϵ_t^r is the deviation of real returns from predicted real returns based on the fundamental risk premium and autocorrelation, hence representing abnormal returns. Fig. 1 illustrates the abnormal returns based on real returns on EWR under different presidential terms over our sample period.

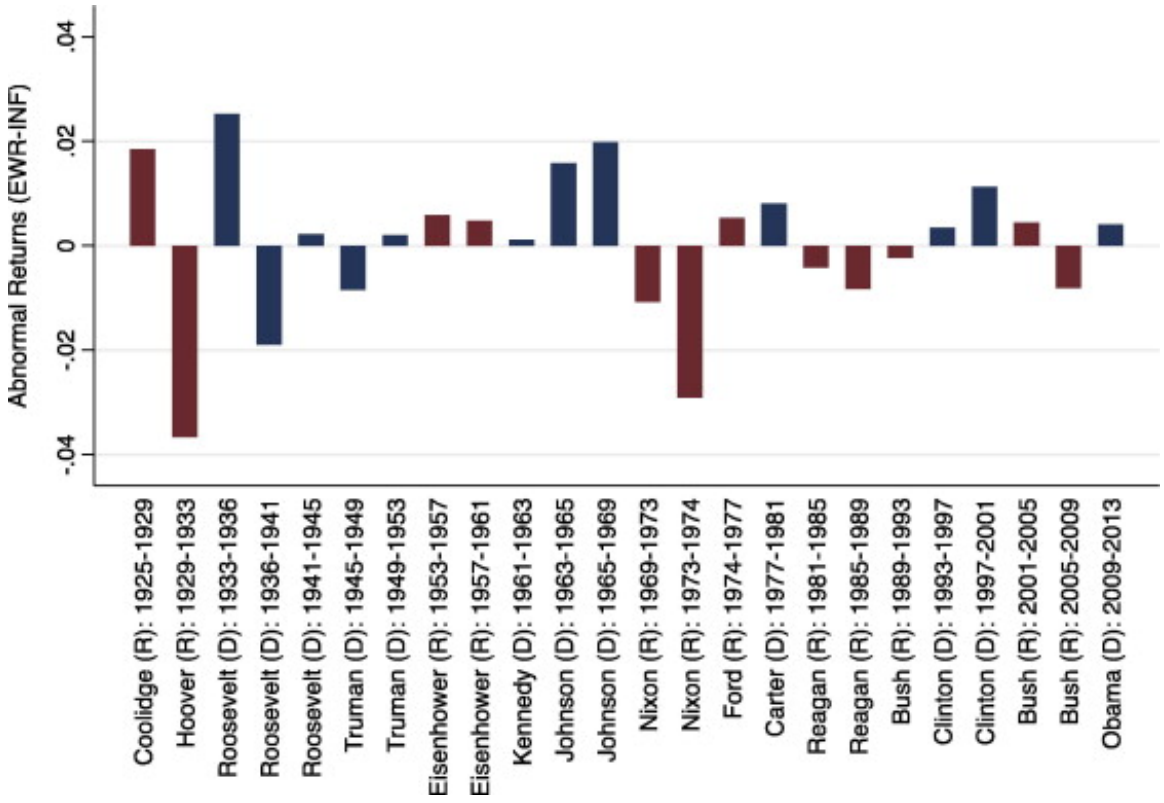

Fig. 1. Abnormal returns by presidential term, 1926–2012.

We then conduct the duration dependence test on these abnormal returns and report results in Table 3. In our full sample, there are more than 250 runs of positive abnormal returns and approximately 70% of them last for 2 months or less. Similarly, there are also about 250 runs of negative abnormal returns over our sample period with 80% of them ending at or before the second month. For runs of negative abnormal returns, the constant hazard rate $(\beta = 0)$ cannot be rejected at conventional levels. For runs of positive abnormal returns, the null hypothesis of constant hazard rate is rejected at the 10% level for the EWR portfolio and at the 5% level for the VWR portfolio. These results indicate that speculative bubbles exist in the U.S. stock market.

Table 3. Run counts, hazard rates, and duration dependence tests for runs of abnormal returns on equally-weighted and valued-weighted portfolios.

Run Length	EWR-INF				VWR-INF			
	Positive		Negative		Positive		Negative	
	Actual run counts total = 258	Sample hazard rates	Actual run counts total = 257	Sample hazard rates	Actual run counts total = 258	Sample hazard rates	Actual run counts total = 257	Sample hazard rates
(a) Run counts, hazard rates								
1	129	0.500	138	0.537	120	0.476	134	0.534
2	61	0.473	64	0.538	65	0.492	69	0.590
3	36	0.529	24	0.436	32	0.478	23	0.479
4	10	0.313	19	0.613	10	0.286	13	0.520
5	9	0.409	8	0.667	7	0.280	7	0.583
6	6	0.462	1	0.250	5	0.278	3	0.600
7	2	0.286	2	0.667	7	0.539	0	0
8	1	0.200	1	1	2	0.333	0	0
9	1	0.250			0	0	2	1
10	2	0.667			1	0.25		
11	0	0			1	0.33		
12	0	0			1	0.50		
13	0	0			0	0		
14	0	0			0	0		
15	1	1			1	1		
	Whole sample		Whole sample		Whole sample		Whole sample	
(b) Duration dependence test								
α	0.0284		0.1221		−0.0311		0.1694	
β	−0.2504*		0.0140		−0.2991**		−0.0221	
LRT of H_0: $\beta = 0$	3.6		0.01		5.79		0.02	
	Republican	Democrat	Republican	Democrat	Republican	Democrat	Republican	Democrat
α	0.2323	−0.1712	−0.1284	0.3656	0.0436	−0.1038	−0.0079	0.3448
β	−0.4656**	−0.0214	0.1928	−0.1469	−0.3234**	−0.2716	0.1829	−0.2210
LRT of H_0: $\beta = 0$	6.38	0.01	0.72	0.34	3.07	2.6	0.58	0.86

LRT = likelihood ratio test (χ^2-statistic).
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

When we divide the full sample into subsamples based on Republican and Democratic presidencies, the duration dependence tests in Panel (b), Table 3 show that the coefficient β is robustly negative and significant at the 5% level for positive runs under Republican Presidents, while not different from zero under Democratic Presidents. As also demonstrated in Fig. 2 of estimated hazard rate against the length of positive runs during Democratic and Republican presidential terms, the probability of ending a run of positive returns (hazard rate) under Republican Presidents *declines* as the bubble gets *larger* (measured by the length of the positive run), consistent with rational speculative bubbles. In contrast, the probability of a positive run ending under Democratic Presidents, does not depend on returns in the previous period. These are strong evidence showing that interestingly speculative bubbles exist in the U.S. stock market under Republic Presidents, but not under Democratic Presidents.

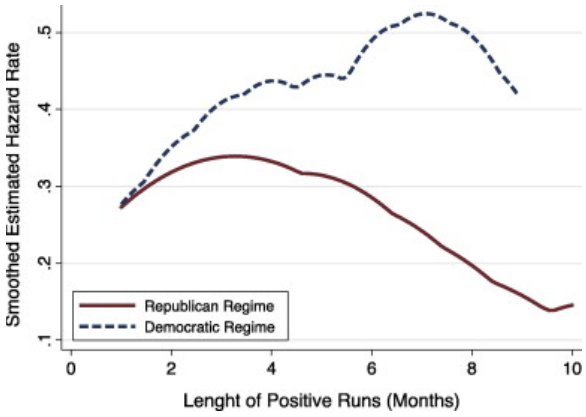

Fig. 2. Kaplan–Meier diagram of estimated hazard rates.

In Table 4 we provide robustness checks for the basic duration dependence test by measuring abnormal returns in different specifications. The results are in general qualitatively similar to those in Table 3.

Table 4. Sensitivity analysis for duration dependence test on positive runs of abnormal returns.

Specification		EWR-INF			VWR-INF		
		Full sample	Republican	Democrat	Full sample	Republican	Democrat
1. Base case	β	−0.250*	−0.465**	−0.021	−0.299**	−0.323*	−0.271
	LRT	3.6	6.38	0.01	5.79	3.07	2.6
2. Nominal returns	β	−0.276**	−0.527**	−0.022	−0.228*	−0.32*	−0.149
	LRT	4.60	8.28	0.02	3.12	2.65	0.75
3. Fin. crisis dummy	β	−0.280**	−0.474***	−0.080	−0.312**	−0.290	−0.322*
	LRT	4.60	6.67	0.18	6.28	2.42	3.68
4. Monthly dummies	β	−0.224*	−0.291	−0.164	−0.222*	−0.312*	−0.139
	LRT	2.77	2.19	0.78	2.88	2.72	0.59
5. ARCH-in-mean	β	−0.437***	−0.741***	−0.142	−0.361**	−0.526**	−0.212
	LRT	10.89	14.81	0.53	6.35	6.38	1.15
6. Linear-logistic	β	−0.090**	−0.147***	0.000	−0.099**	−0.104*	−0.092*
	LRT	4.14	6.71	0.00	6.03	3.09	2.80

LRT = likelihood ratio test (χ^2-statistic).
Case 1: Abnormal returns are estimated based on the baseline specification presented in Eq. (6). We estimate abnormal returns by revising Eq. (6) under the following alternative specifications.
Case 2: rt is defined as nominal returns, not real returns.
Case 3: Financial crisis dummy variable (2008:1–2009:6) is included.
Case 4: Monthly dummy variables are included.
Case 5: ARCH-in-mean model is specified.
Case 6: The linear-logistic function, $ht=1/(1+\exp[-(\alpha+\beta t)]$, is estimated.
$*p < 0.1$.

$^{**}p < 0.05$.
$^{***}p < 0.01$.

Although the duration dependent test is sufficient to detect the existence of speculative bubbles, it does not necessarily show the rationality of the stock market. In a rational market, a speculative bubble will not last forever. The longer a positive run of abnormal returns, the more severe a potential crash will be. In other words, a market is rational when the conditional mean of abnormal returns is constant even if the probability of negative abnormal returns decreases (McQueen and Thorley, 1994). This can happen when the conditional skewness of a crash is more negative as the run of prior positive abnormal returns lasts longer. As a result, we further test whether the condition of rationality is satisfied in the stock market under Republican and Democratic Presidents by examining the mean and skewness of returns conditional on the number of prior consecutive positive abnormal returns.

Table 5 presents the estimated results of conditional mean and skewness of abnormal real returns of equally-weighted and valued-weighted portfolios. For the full sample, we find that the means of abnormal returns conditional on prior runs lasting for one to five periods (ϵ_{1-5}^{-r}) and for six periods and longer (ϵ_{6+}^{-r}) are not significantly different from zero. Further, the null hypothesis of H_0: $\epsilon_{1-5}^{-r} = \epsilon_{6+}^{-r}$ cannot be rejected at conventional levels suggesting that the means are not significantly different from each other. These results provide strong evidence supporting that the bubbles are rational as investors are not able to make any positive abnormal returns when a bubble bursts. More importantly, in the full sample the negative skewness coefficient on the abnormal returns on the equally-weighted portfolio conditional on prior runs with six and more positive returns ($skew_{6+}^{r}$) is significantly different from the skewness coefficient conditional on prior runs with one to five positive returns ($skew_{1-5}^{r}$), which is consistent with the results of our duration dependence test on rational speculative bubbles. For the valued-weighted portfolio, we also observe negative skewness coefficients conditional on prior runs with six or more positive returns. However, due to the small positive value of skewness coefficients conditional on prior runs with one to five positive returns, the null hypothesis of constant conditional skewness cannot be rejected at conventional levels.

Table 5. Tests of rationality.

	N	Conditional mean ($\bar{\epsilon}$)	Conditional skewness *(skew)*	*N*	Conditional mean ($\bar{\epsilon}$)	Conditional skewness *(skew)*	*N*	Conditional mean ($\bar{\epsilon}$)	Conditional skewness *(skew)*
	Full sample			Republican			Democrat		
(a) Equally-weighted portfolio									
Length of positive run									
1–5	510	2.225	0.863	232	−2.301	1.785	278	6.002	0.301
		[3.389]	[0.734]		[4.674]	[1.022]		[4.834]	[0.927]
6 +	37	9.580	−0.640	22	17.112	−0.754	15	−1.466	−0.237
		[6.958]	[0.304]		[7.309]	[0.681]		[13.224]	[0.389]
$H_0 : \bar{\epsilon}_{1-5}^{r} = \bar{\epsilon}_{6+}^{r}$		−0.578			−1.263			0.355	
$H_0 : skew_{1-5}^{r} = skew_{6+}^{r}$			1.775**			1.651**			0.446
(b) Value-weighted portfolio									
Length of positive run									
1–5	512	0.286	0.128	249	−2.683	0.390	263	3.097	−0.088
		[2.408]	[0.772]		[3.300]	[0.714]		[3.493]	[1.190]
6 +	53	5.714	−0.587	19	5.076	−0.665	34	6.070	−0.556
		[6.153]	[0.264]		[9.735]	[0.424]		[8.006]	[0.344]
$H_0 : \bar{\epsilon}_{1-5}^{r} = \bar{\epsilon}_{6+}^{r}$		−0.701			−0.633			−0.293	
$H_0 : skew_{1-5}^{r} = skew_{6+}^{r}$			0.809			0.946			0.340

Standard errors are in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Across presidential parties, we find that the means of abnormal returns conditional on prior positive runs lasting for one to five periods and six and more periods are not significantly different from each

other under either Democratic or Republican Presidents. However, the skewness equality tests show that the negative skewness is greater conditioning on prior positive runs lasting for six periods and longer during Republican presidency *only*. These results again indicate rational bubbles exist under Republican Presidents, but not under Democratic Presidents, which confirms our findings based on the duration dependence test.

4. Conclusions

This study applies the duration dependence test to monthly real U.S. stock market returns. Using data of both equally-weighted and value-weighted portfolios between January 1929 and December 2012, we find that there are rational speculative bubbles in the stock market. In addition, the coefficient β in the hazard function is significantly negative during Republican presidencies while not significant during Democratic presidencies, indicating that rational bubbles exist under Republican Presidents, but not under Democratic Presidents. Our results are robust to different specifications. While this is a first step to examine speculative bubbles during various presidential terms, it would be interesting for a future project to study the reasons for the heterogeneous results in this paper. For example, Allen and Gale (2000) note that bank credit to private sectors might be a major cause of speculative bubbles based on data from a selection of countries. In addition, demand for assets, which may be proxied by savings rate, could also play a role in causing the different results concerning speculative bubbles we find in this paper.

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