Market Volatility around U.S. Presidential Election (1928 – 2016): The Role of Political Uncertainty

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Abstract

This paper investigates the changes in market volatility around the United States presidential elections and inaugurations between the period of 1928 and 2016 during selected event windows: *(-10, -1) vs. (+1, +10), (-20, -1) vs. (+1, +20), … (-90, -1) vs. (+1, +90)*, respectively. To isolate the corresponding impact of different types of political uncertainty, market volatility is examined under three partitions: magnitude of surprise in voting results, incumbency, and change in ruling party. The result indicates that the market volatility is more willing to settle down after an election with new president or a change in ruling party, mainly due to the comparatively higher volatility induced by such political events during the pre-election window. The results have implications for both individual and institutional investors who are exposed towards volatility risk.

Keywords: presidential election, inauguration, market volatility, event study.

"I must study Politicks and War that my sons may have liberty to study Mathematicks and Philosophy. My sons ought to study Mathematicks and Philosophy, Geography, natural History, Naval Architecture, navigation, Commerce, and Agriculture, in order to give their Children a right to study Painting, Poetry, Musick, Architecture, Statuary, Tapestry, and Porcelain."

--- John Adams (1735 – 1826)

The second President of the United States of America

(Letter to Abigail Adams, post 12 May 1780)

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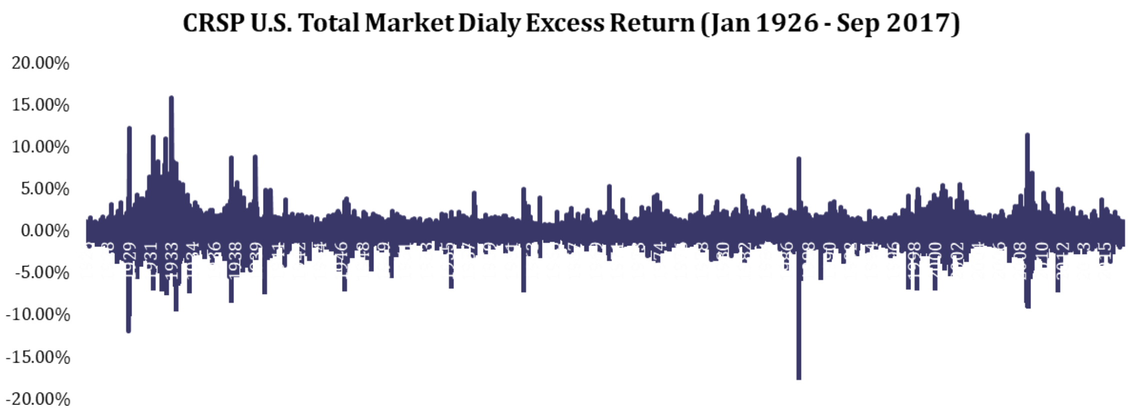

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1: Introduction

November 8th, 1960, presidential candidates --- Democrat John F. Kennedy and Republican Richard M. Nixon --- went into an incredibly narrow tie on the voting day. Kennedy eventually won the election by a narrow margin and was elected the 35th President of the United States of America, receiving merely 0.1 million more votes.

November 3rd, 1964, one year after the tragic assassination, J. F. Kennedy's formal Vice President, Democrat Lyndon B. Johnson was elected the 36th President with a promising win of 16 million more votes than his Republican opponent.

November 4th, 2008, Democrat Barack H. Obama was elected the 44th President of the United States of America. Despite being the first African-American presidential candidate in America's history, Obama won over both the presidency and people's heart with almost 10 million more votes than opponent John McCain.

November 8th, 2016, Republican Donald J. Trump was elected the 45th President, defeating his opponent --- Democrat, formal Secretary of State, and formal First Lady --- Hillary Clinton, despite Clinton receiving 2.9 million more votes.

These distinctive historical events and their contrasting results inspired us to investigate whether the change in market volatility (pre-event vs. post-event) is significantly different during these rather dynamic periods of political uncertainty.

The purpose of this study is to test whether the market volatility would decrease after political uncertainties settle down, and which types of political uncertainty would induce a more significant reduction. The hypothesis is that political uncertainty is generally high during election periods due to the pending presidency and therefore potential political changes, and intuitively, market volatility during the pre-event window shall be especially high when (i.) there is a narrow margin among the polls causing big surprise in voting results, (ii.) a new president is considered presidency, (iii.) in addition to (ii), a change in ruling party is considered in place.

Once election results are announced, the uncertainty about presidential outcome shall be resolved. Hence, our first hypothesis is: (I.) after the election, market volatility is reduced. (II.) The second hypothesis is that the reduction in volatility is especially high when there is a narrow margin among the votes (i.e., surprise of election is large). (III). The third hypothesis is the reduction in volatility is especially high when a new president is elected (hence unfamiliarity); and when there is a change in ruling party (hence change in political stands and policies). This is because the market is expected to be relatively volatile when a new president makes decision about cabinet appointments and policies. We augment the analysis with results around inauguration dates even though the predictions there can be more ambiguous. In general, we may expect an increase in volatility following the inauguration for incumbent presidents, because it is expected that policy decisions will be deferred till after the inauguration speech. For a new president, one may expect volatility to decrease given the most turbulence times is probably in the interim period between election and inauguration dates.

We test these predictions using univariate *t*-tests and the ARCH/GARCH models. While *t*-tests returned rather ambiguous results, ARCH/GARCH models generally agree with our hypotheses. The ARCH/GARCH results on election days affirm our hypotheses (I.) and (III.), however we do not see a significant impact due to narrow poll margin. Consistently, ARCH/GARCH results on inauguration days also display affirmations on hypotheses (I.) and (III.).

We acknowledge that our methodology and partition schemes are relatively preliminary, and various improvements can be implemented to further enhance the testing procedure.

2: Literature Review

Prior studies in the related fields --- such as relation between market volatility and political uncertainty (Goodell and Vähämaa 2013), and relation between equity return and political uncertainty (Li and Born 2006) --- allowed us to draw inspiration in forming our own research method.

We segmented 23 U.S. elections during the period 1928 to 2016 with 3 simplified partitions: magnitude of surprise, incumbency, and change in ruling party. Similar partition mechanism was adopted in prior studies, identifying *narrow margin of victory* and *change in political orientation in the government* as two major factors in inducing volatility fluctuation. (Białkowski, Gottschalk and Wisniewski 2008).

A prior study on the U.S. market excess return showed that the market performs better on average under Democratic rules than Republican (Santa-Clara and Valkanov 2003) (Sy and Zaman 2011). Less is known about how each of these parties is related to volatility. On the one hand, there is reason to suspect that volatility will be higher under Republican rule because both the Great Depression (1929 – 1933) and the financial crisis that crushed Wall Street (2007 – 2008) occurred during Republican rules. Hence, analysing the entire period would be problematic if one wishes to get at identification. Instead, we recognize that other things may cause fluctuations in market performance. We hypothesize that political uncertainty and 'change in ruling party' may particularly contribute to fluctuation in volatility.

Stock prices have been found to exhibit patterns of closely following the four-year election cycle according to a prior study on the period between January 1965 and December 2003 (Wong and McAleer 2009). Additionally, it is argued that since 1960, the U.S. macroeconomic policies and the election cycle have been in sync due to active management, where the U.S. economy would be 'managed to expand prior to an election and contract thereafter' (Allvine and O'Neill 1980) . In this paper we take a different route of exploration, we hypothesize that around the schedule of the major political events, once every four years, changes in market behaviour are expected to affect market volatility.

The goal of this paper is to look for the short-term impact resulted from political uncertainties during selected event windows around elections and inaugurations. Instead of evaluating the markets 2 years around, we decided to focus within the 3 months before and after event window, in the hope of narrowing down impact forged particularly by elections (and/or inaugurations).

3: Data

3.1 Market Return & Volatility

We obtained CRSP U.S. Total Market Index daily excess returns from WRDS database, which gave us the daily return data starting from January 1926 and ending at September 2017. During this period, there were 23 presidential elections (therefore 23 inaugurations) in the United States. We chose the one-month U.S. Treasury Bill rate to approximate for the daily risk-free rate. The market volatility was then calculated as the standard deviation of the CRSP U.S. Total Market Index daily returns minus the risk-free rate under selected event windows accordingly.

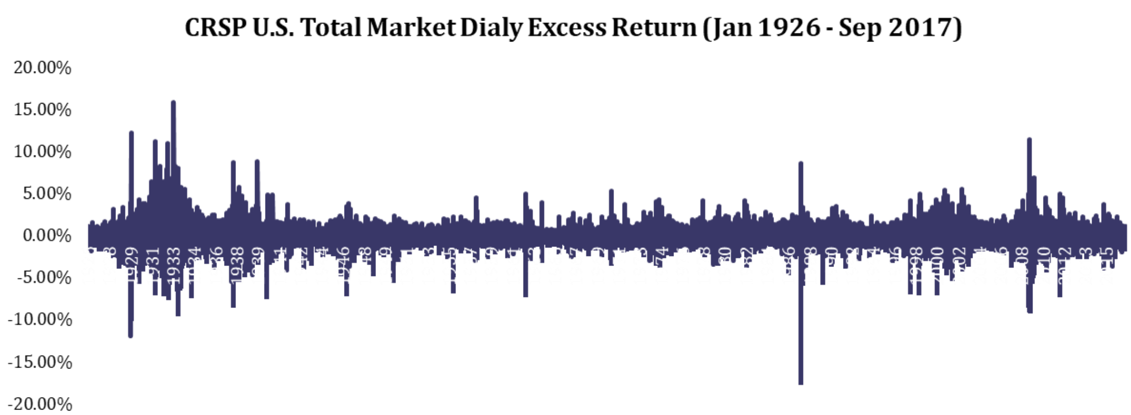

Figure 1
CRSP U.S. Total Market Index Daily Excess Return Jan 1926 – Sep 2017 (WRDS 2017)

3.2 Election Data

We extracted historical presidential election data from 270towin.com, which allowed us to view the number of electoral votes as well as popular votes for each election.

The U.S. presidential election takes place on the first Tuesday following the first Monday in November, once every four years. It is an indirect election where the U.S. citizens vote for the 538 electors to be the U.S. Electoral College, and electors will then directly vote for the president. The candidate that receives more than half of the 538 electoral votes with at least 270 electoral votes, will be elected the next president. It is worth mentioning that since the first on-record presidential election in 1824, there have been five presidential elections where the winner received more than half of the electoral votes but lost the popular votes. These five presidential elections took place in the year of 1824, 1876, 1888, 2000 and 2016, where 2000 and 2016 are in the sample of our study.

Inaugurations are held on the 20th of January following the election (1937 – now; before 1937, inaugurations were held on March 4^{th}). It is a ceremony celebrating the inception of the new four-year term of presidency. On the inauguration day, the new president will swear into the office and give a speech to the public. We choose inauguration days to be another set of event days due to the consideration that there is a delay between the day the president is elected and the day the president officially starts to execute his / her presidential power into decision makings. We consider the test results on inauguration as rather supplement, for we deem the market data imbedded in the period immediately after election to be more revealing.

Considering the background of the presidential election, we perceive the 'popular votes' to be a suitable proxy to mirror the market expectation and reaction to the political uncertainty, and any future mention of 'vote' in this paper will be referring to 'popular votes' unless otherwise specified; therefore, to put things into perspective, we partitioned three perceivable and quantifiable variables:

i. **Big surprises vs. small surprise on the voting result (quantified by popular votes):** We recognize the ratio between the two main candidates as a vital element in determining the intensity of the electoral competition. We expect a bigger surprise due to more uncertainty when there is a more intense competition; and a smaller surprise due to less uncertainty when there is a less intense competition. We consider the magnitude of the surprise to be positively related to the change in volatility after the election, where surprise is calculated as:

$$Surprise = -\left|0.5 - \frac{Winner's\ Votes}{Total\ Votes}\right|$$

'Surprise' is a negative indicator, and the larger the number (the closer it is to 0), the bigger the surprise. We therefore segment the first 11 biggest surprises from the remaining 12 smaller surprises.

ii. **A new president elected vs. an incumbent:** Among the 23 elections in the sample, there are nine elections with incumbents, where the market is more acquainted with the president elected and his / her political views and strategies. With more familiarity and agreement (being elected for the second time), we expect the market to be less volatile following elections with incumbents. This is testable both by looking at the reduction in volatility compared to cases with new presidents (a difference in difference analysis). Thus, identification is achieved by comparing the reduction in volatility that is observed for incumbent presidents compared to a new president elected. We define 'incumbency' as the second partition.

iii. **A change in ruling party vs. the same ruling party as the previous year:** With Republican and Democratic Parties having sometimes disparate policies and philosophies towards crucial economic, political and social issues such as taxes, gun control, healthcare, immigration, gay marriage and environmental regulation, we expect the market to react differently when there is a change in ruling party (inducing an increased possibility for political changes) vs. no change in ruling party. We thereupon determine change-in-party to be the third partition.

Furthermore, we subdivided three partitions into two types of events to further explore the actual event window(s) around which the market volatility is significantly impacted by political uncertainty:

i. election day, which occurs once every four years in November;

ii. inauguration day, which occurs once every four years in January.

Hence, we assign the following indicators to our 23 Presidential Election sample:

Table 1

Elections 1928 – 2016 & Inaugurations 1929 – 2017 with Partition Indicators

Elections 1928 - 2016 & Inauguration 1929 - 2017 with Partition Indicators						
Election Year	**Inauguration Year**	***President Elected***	**Election / Inauguration Indicator**	**Surprise Indicator**	**Incumbency Indicator**	**Ruling Party Indicator**
1928	1929	*H. C. Hoover*	1	small	new	same
1932	1933	*F. D. Roosevelt*	2	small	new	change
1936	1937	*F. D. Roosevelt*	3	small	incumbent	same
1940	1941	*F. D. Roosevelt*	4	small	incumbent	same
1944	1945	*F. D. Roosevelt*	5	big	incumbent	same
1948	1949	*H. S. Truman*	6	big	new	same
1952	1953	*D. D. Eisenhower*	7	small	new	change
1956	1957	*D. D. Eisenhower*	8	small	incumbent	same
1960	1961	*J. F. Kennedy*	9	big	new	change
1964	1965	*L. B. Johnson*	10	small	new	same
1968	1969	*R. M. Nixon*	11	small	new	change
1972	1973	*R. M. Nixon*	12	small	incumbent	same
1976	1977	*J. Carter*	13	small	new	change
1980	1981	*R. Reagan*	14	big	new	change
1984	1985	*R. Reagan*	15	small	incumbent	same
1988	1989	*G. Bush*	16	big	new	same
1992	1993	*W. J. Clinton*	17	small	new	change
1996	1997	*W. J. Clinton*	18	big	incumbent	same
2000	2001	*G. W. Bush*	19	big	new	change
2004	2005	*G. W. Bush*	20	big	incumbent	same
2008	2009	*B. H. Obama*	21	big	new	change
2012	2013	*B. H. Obama*	22	big	incumbent	same
2016	2017	*D. J. Trump*	23	big	new	change

4: Methodology

We applied both t-test and ARCH/GARCH model to analyse whether there is a significant change between the pre-event and post-event market volatility during different event windows: (-10, -1) vs. (+1, +10), (-20, -1) vs. (+1, +20), (-30, -1) vs. (+1, +30), … (-90, -1) vs. (+1, +90), with null hypothesis:

$$H_0 = (post\text{-}event\ volatility) - (pre\text{-}event\ volatility) = 0$$

4.1 *t*-test

4.1.1 Election Days

Setting election days as event days, we select 9 different event windows (with number indicating days before/after the event day), upon which we calculated market volatility as the standard deviation of CRSP daily return: (-10, -1) vs. (+1, +10), (-20, -1) vs. (+1, +20), (-30, -1) vs. (+1, +30), … (-90, -1) vs. (+1, +90).

i. 2-Sample *t*-test on volatility around event day:

The first set of tests being performed is a 2-sample t-test on the difference between the pre-event volatility mean and the post-event volatility mean, where volatility is measured based on the standard deviation of daily return over the windows of [-10, -1] and [1, 10] for pre-event and post-event volatility, respectively. As a result, we have a sample of 23 observations of pre-event volatility and 23 observations of post-event volatility. We conduct *t*-tests to see if there is a difference in volatility between these two periods. We also repeat the analysis for more event windows of 20, 30, 40… 90, where in all cases the event window is based on the same number of days for the pre- and post-period respectively.

ii. 1-Sample *t*-test on the percentage change in market volatility:

We generate a new variable $diff^{\%}$ as the percentage change in market volatility around event days under selected event windows, with $diff^{\%}$ calculated as:

$$diff^{\%} = \left(\frac{post\text{-}event\ volatility}{pre\text{-}event\ volatility} - 1\right)$$

A 1-sample *t*-test is therefore conducted upon $diff^{\%}$, and is repeated for 9 event windows accordingly.

iii. 1-Sample *t*-test on the value change in market volatility:

Similarly, to analyze the value change in market volatility around event days, we generate another new variable $diff^{\#}$, calculated as:

$$diff^{\#} = post\text{-}event\ volatility - pre\text{-}event\ volatility$$

Accordingly, a 1-sample t-test is performed upon diff$^{\#}$, and is repeated for 9 event windows.

4.1.2 Election Days with Partitions

In the hope of separating the influence under each type of political uncertainty, we divide the sample of 23 elections based on 3 **election characteristics**:

1) Surprise (11 elections of big surprise, and 12 of small surprise);
2) Incumbency (14 elections of new presidents, and 9 of incumbents);
3) Ruling party (10 elections of changing ruling party, 13 of same party);

iv. 1-sample *t*-test on *difference in difference* among partition

Because we can measure for each election the difference in volatility (post-event volatility minus pre-event volatility) with two different measures ($diff^{\%}$, $diff^{\#}$), we are also able to conduct a difference in difference analysis to see whether the changes observed around the event differ across different election characteristics.

4.1.3 Inauguration Days (and with Partitions)

We repeat the identical procedure for inaugurations, with inauguration days as event days. Same *t*-tests **i. – iv.** are performed on the inauguration sample and sub-samples for 9 event windows respectively. Since none of the partition induce any discrepancy in segmentation between election and inauguration, the size of inauguration sample and sub-samples are the same as their corresponding election sample.

4.2 ARCH / GARCH

For a dynamic modelling of the volatility changes, we also employ the ARCH and GARCH models to better describe the variance of excess returns around a 90-day event window. The autoregressive conditionally heteroscedastic model, which is known as ARCH model, is used to analyse the variance of returns over a given period.

We use a ARCH (1/1) models in the following format to test whether there is a difference between the volatility before and after the event day: The GARCH (1,1) model being employed is as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \beta_2 \, post\text{-}election + Error \ (1)$$

, where ε_{t-1} is the residual in the previous trading day, and σ_{t-1}^2 is the volatility in the previous day. The post-election is an indicator that equals one during the 90 days after the event, and zero otherwise. We also analyze the data with a more elaborated GARCH (1,1) specification, where in Eq. (1) we also include 23 election indicators, as well as 23 interaction terms (where the post-election) is interacted with if of the election indicators. As follows,

$$\sigma_t^2 = \alpha_1\, \varepsilon_{t-1}^2 \; + \beta_1\, \sigma_{t-1}^2 + \sum_{i=1}^{23} \gamma_i\, Election_i + \sum_{i=1}^{23} \delta_i \;\; Post\text{-}election_i + \; Error \quad (2)$$

Where $Election_i$ are the 23 indicators (one for each election) and $Post\text{-}election_i$ are 23 indicators that equals one only in the post period of the election.

v. Chi-square test within partitions

Additionally, to further utilize the partitions between election characteristics, we perform a set of Chi-square test to see whether the coefficient of the interaction terms (δ_i in eq. (2)) are significantly different across the various election characteristics.

5: Empirical Results

The results are presented in the following tables, with Panel A exhibiting test results for election days and Panel B exhibiting results for inauguration days. *, **, and *** represent 10%, 5%, and 1% significance, respectively, indicating we can reject our previously stated null hypothesis:

$$H_0 = (post\text{-}event\ volatility) - (pre\text{-}event\ volatility) = 0$$

5.1 *t*-test

5.1.1 Volatility changes around event dates

As displayed in Table 2, we find no significant volatility change around election days, and few volatility changes around inauguration days, where market volatility tends to increase after the president moves into the White House 10 days, 30 days and 40 days around. One possible interpretation could be, now that the new president can officially implement his / her political stands and strategies, policy changes are made, resulting in changes in market expectations and higher volatility. The test result affirms our intention to isolate individual types of political uncertainty by concentrating on the previously stated election characteristics; surprise, incumbency and change in ruling party.

Table ***2***

Changes in volatility around elections (1928-2016) and inaugurations (1929-2017)

Table 2 provides difference *t*-test results between market volatility before and after event day. The event is the 23 election days (during the period 1928-2016) in Panel A and the 23 inauguration days in Panel B. Market volatility is measured for 9 different time horizons before and after the event day, as shown under Number of Days. Volatility is the standard deviation of excess value-weighted return (market return minus risk-free return) during the respective period. The last three 't-score' columns provide different mean tests: (1) *t*-tests that compares the sample of 23 ex-post volatilities to 23 ex-ante volatilities, (2) *t*-test whether (ex-post volatility)/(ex-ante volatility)-1=0, (3) *t*-test whether ex-post volatility=ex-ante volatility.*, **, *** represent 10%, 5%, 1% significance, respectively.

Panel A: Election Day 1928-2016

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00914	0.01032	0.00118 (0.434)	0.20899 (1.198)	0.00118 (1.103)
20	0.00957	0.01018	0.00060 (0.200)	0.17412 (1.189)	0.00060 (0.810)
30	0.00964	0.00979	0.00014 (0.052)	0.11725 (1.203)	0.00014 (0.192)
40	0.00952	0.00938	-0.00014 (-0.052)	0.09546 (1.160)	-0.00014 (-0.157)
50	0.00927	0.00903	-0.00024 (-0.101)	0.07022 (0.996)	-0.00024 (-0.299)
60	0.00899	0.00871	-0.00027 (-0.121)	0.04323 (0.665)	-0.00027 (-0.365)
70	0.00908	0.00861	-0.00047 (-0.222)	0.00636 (0.119)	-0.00047 (-0.646)
80	0.00908	0.00859	-0.00050 (-0.238)	0.00894 (0.173)	-0.00050 (-0.649)
90	0.00894	0.00861	-0.00033 (-0.163)	0.01267 (0.237)	-0.00033 (-0.467)

Panel B: Inauguration Day 1929 - 2017

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00705	0.00846	0.00141 (0.527)	***0.13608 (1.460)**	0.00141 (1.111)
20	0.00815	0.00864	0.00049 (0.237)	0.09276 (1.064)	0.00049 (0.507)
30	0.00799	0.00872	0.00073 (0.377)	***0.12063 (1.564)**	0.00073 (0.805)
40	0.00817	0.00882	0.00065 (0.301)	***0.12743 (1.615)**	0.00065 (0.671)
50	0.00841	0.00878	0.00037 (0.174)	0.08736 (1.290)	0.00037 (0.426)
60	0.00871	0.00882	0.00011 (0.055)	0.05726 (0.890)	0.00011 (0.136)
70	0.00906	0.00885	-0.00021 (-0.101)	0.04198 (0.634)	-0.00021 (-0.223)
80	0.00906	0.00872	-0.00034 (-0.164)	0.02390 (0.371)	-0.00034 (-0.357)
90	0.00894	0.00869	-0.00025 (-0.124)	0.03671 (0.547)	-0.00025 (-0.265)

5.1.2 Result with Partition: Surprise

As shown in Table 3, we find no significant volatility change during the selected event windows around election days. This means that there is no change in volatility according to three types of analysis: (1) No change in volatility between the pre-election and post-election periods for big surprise elections (panel A.1), (2) No change in volatility between the pre-election and post-election periods for small surprise elections (panel A.2), and (3) No difference in change in volatility (between the pre-election and post-election period) between big surprise and small surprise elections (panel A.3). On the contrary, we find that during the one- to two-month event period around inaugurations where the president elected had won the election with a small surprise, market volatility tends to increase in react to the event. One possible interpretation is that in a small surprise election, the volatility level around election results is not large (and does not change much), and only after inauguration are the policy decision made which creates volatility in the market.

Table 3

Big Surprise vs Small Surprise

Table 3 provides t-test results on the change in market volatility before and after event day. We rank 23 elections by the surprise of the election results, where surprise is calculated as: the negative of the absolute value of ('winner ratio' -0.5), where winner's ratio is the winner's popular votes divided by total votes. Surprise is a negative number, but the higher it is (closer to zero), the larger the surprise. Panel A displays t-test results with 11 highest surprise elections days as event days. and compares it to t-test results with 12 lowest surprise election days. Panel B repeats the same procedure for inauguration days. Volatility calculation is described in Table 1. *, **, *** represent 10%, 5%, 1% significance, respectively.

Panel A

A.1: Election Day 1928-2016: Big Surprise

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.01062	0.01225	0.00164 (0.358)	0.31331 (1.274)	0.00164 (1.031)
20	0.01155	0.01239	0.00084 (0.150)	0.21366 (0.971)	0.00084 (0.733)
30	0.01129	0.01166	0.00037 (0.074)	0.09376 (0.802)	0.00037 (0.414)
40	0.01079	0.01128	0.00049 (0.109)	0.11971 (1.141)	0.00049 (0.470)
50	0.01048	0.01063	0.00015 (0.038)	0.05435 (0.618)	0.00015 (0.168)
60	0.01005	0.01033	0.00027 (0.073)	0.04868 (0.559)	0.00027 (0.355)
70	0.00988	0.01005	0.00016 (0.047)	0.01836 (0.249)	0.00016 (0.245)
80	0.00994	0.00992	-0.00003 (-0.008)	-0.01893 (-0.328)	-0.00003 (-0.047)
90	0.00980	0.00993	0.00013 (0.041)	-0.01930 (-0.324)	0.00013 (0.227)

A.2: Election Day 1928-2016: Small Surprise

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00795	0.00840	0.00045 (0.143)	0.09788 (0.387)	0.00045 (0.319)
20	0.00754	0.00810	0.00056 (0.218)	0.14267 (0.701)	0.00056 (0.569)
30	0.00819	0.00802	-0.00017 (-0.059)	0.13636 (0.860)	-0.00017 (-0.133)
40	0.00836	0.00759	-0.00076 (-0.257)	0.07931 (0.612)	0.00076 (-0.519)
50	0.00819	0.00754	-0.00065 (-0.225)	0.08437 (0.749)	-0.00065 (-0.467)
60	0.00804	0.00720	-0.00084 (-0.306)	0.03796 (0.380)	-0.00084 (-0.625)
70	0.00831	0.00726	-0.00105 (-0.405)	-0.00420 (-0.052)	-0.00105 (-0.824)
80	0.00822	0.00733	-0.00089 (-0.339)	0.03483 (0.406)	-0.00089 (-0.652)
90	0.00815	0.00737	-0.00078 (-0.289)	0.04282 (0.482)	-0.00078 (-0.592)

A.3: Election Day 1928-2016: Big vs. Small Surprise

Number of days	Volatility Change under Big Surprise	Volatility Change under Small Surprise	(4) Difference in Value Change in Volatility (*t*-Statistic)	(5) Difference in Percentage Change (*t*-Statistic)
10	0.00165	0.00075	-0.00089 (-0.410)	-0.20679 (-0.583)
20	0.00084	0.00038	-0.00046 (-0.302)	-0.07829 (-0.261)
30	0.00036	-0.00006	-0.00042 (-0.274)	0.04610 (0.231)
40	0.00046	-0.00068	-0.00114 (-0.644)	-0.02960 (-0.176)
50	0.00015	-0.00061	-0.00076 (-0.454)	0.03175 (0.220)
60	0.00027	-0.00077	-0.00104 (-0.678)	-0.00752 (-0.056)
70	0.00016	-0.00106	-0.00122 (-0.821)	-0.02159 (-0.196)

80	-0.00003	-0.00093	-0.00090 (-0.580)	0.05391 (0.512)
90	0.00012	-0.00075	-0.00087 (-0.600)	0.06446 (0.592)

Panel B

B.1: Inauguration Day 1929-2017: Big Surprise

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00726	0.00787	0.00061 (0.261)	****0.22862 (2.002)**	0.00061 (1.027)
20	0.00896	0.00807	-0.00089 (-0.366)	-0.01818 (-0.191)	0.00089 (-0.740)
30	0.00922	0.00838	-0.00084 (-0.330)	0.00796 (-0.093)	-0.00084 (-0.894)
40	0.00992	0.00892	-0.00100 (-0.306)	0.01782 (0.248)	-0.00100 (-1.068)
50	0.01022	0.00915	-0.00107 (-0.319)	0.00084 (0.012)	-0.00107 (-1.139)
60	0.01031	0.00937	-0.00094 (-0.276)	0.02317 (0.293)	-0.00094 (-0.866)
70	0.01064	0.00940	-0.00124 (-0.344)	0.03423 (0.411)	-0.00124 (-0.856)
80	0.01066	0.00919	-0.00148 (-0.416)	0.00861 (0.097)	-0.00148 (-0.979)
90	0.01050	0.00901	-0.00148 (-0.430)	0.00256 (0.029)	-0.00148 (-0.994)

B.2: Inauguration Day 1929-2017: Small Surprise

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00698	0.00923	0.00225 (0.471)	0.07229 (0.505)	0.00225 (0.935)
20	0.00728	0.00943	0.00215 (0.641)	****0.25394 (1.884)**	***0.00215 (1.531)**
30	0.00680	0.00922	0.00242 (0.820)	****0.27858 (2.451)**	***0.00242 (1.728)**
40	0.00657	0.00886	0.00229 (0.801)	****0.24964 (1.913)**	***0.00229 (1.494)**
50	0.00670	0.00866	0.00196 (0.740)	****0.21390 (1.991)**	***0.00196 (1.493)**
60	0.00708	0.00848	0.00139 (0.563)	***0.14205 (1.374)**	0.00139 (1.152)
70	0.00724	0.00850	0.00126 (0.532)	0.11402 (1.182)	0.00126 (1.088)
80	0.00725	0.00843	0.00118 (0.502)	0.09803 (1.112)	0.00118 (1.087)
90	0.00719	0.00851	0.00132 (0.565)	0.12458 (1.342)	0.00132 (1.223)

B.3: Inauguration Day 1929-2017: Big vs. Small Surprise

Number of days	Volatility Change under Big Surprise	Volatility Change under Small Surprise	(4) Difference in Value Change in Volatility (*t*-Statistic)	(5) Difference in Percentage Change (*t*-Statistic)
10	0.00051	0.00225	0.00174 (0.674)	-0.13336 (-0.706)
20	-0.00132	0.00215	****0.00347 (1.890)**	****0.33702 (2.071)**
30	-0.00111	0.00242	****0.00353 (2.076)**	****0.33025 (2.349)**
40	0.00229	0.00229	****0.00000 (1.880)**	***0.25554 (1.684)**
50	-0.00137	0.00196	****0.00333 (2.074)**	****0.26458 (2.098)**
60	-0.00128	0.00139	***0.00268 (1.670)**	***0.17728 (1.407)**
70	-0.00182	0.00126	***0.00307 (1.674)**	0.15063 (1.145)
80	-0.00200	0.00118	****0.00318 (1.743)**	0.15501 (1.213)
90	-0.00196	0.00132	****0.00328 (1.816)**	***0.18374 (1.398)**

5.1.3 Results with Partition: Incumbency

Table 4 presents *t*-test results under the partition of new president elected vs. incumbent elected. Election days yet again display no significant volatility change during selected event windows, whereas 10 and 40 days around inaugurations, market volatility present rather weak results that show an increase when an incumbent was elected. This is weakly consistent with the pervious results, that after inauguration volatility tends to increase, if the election is perceived with a relatively stable pre-election period (i.e. re-election of incumbent). Furthermore, according to the 22^{nd} Amendment to the U.S. Constitution, a president can only be elected to two full terms (except for Franklin D. Roosevelt, who have won the record of four presidential elections from 1932 to 1944, before the 22^{nd} Amendment was passed in 1947 (Franklin D. Roosevelt Presidential Library and Museum 2016)) (U.S. Const. amend. XXII). With an incumbent elected, market interprets it as an indicator for a guaranteed political change during the next election. However, why market reacts to incumbency during the inauguration event window instead of election event window would require further investigations.

Table 4
New Presidents vs. Incumbents

Table 4 provides *t*-test results on the change in market volatility before and after event day. We segment 23 elections by whether there is a new president elected vs. an incumbent. Panel A displays *t*-test results with 14 elections days with new presidents as event days, and compares it to *t*-test results with 9 election days with incumbents. Panel B repeats the same procedure for inauguration days. Volatility calculation is described in Table 1. *, **, *** represent 10%, 5%, 1% significance, respectively.

Panel A
A.1: Election Day 1928-2016: New Presidents

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.01072	0.01195	0.00122 (0.288)	0.17308 (0.858)	0.00122 (0.905)
20	0.01174	0.01193	0.00019 (0.040)	0.12305 (0.685)	0.00019 (0.203)
30	0.01179	0.01151	-0.00028 (-0.012)	0.09056 (0.694)	-0.00028 (-0.254)
40	0.01164	0.01094	-0.00070 (-0.167)	0.07297 (0.613)	-0.00070 (-0.510)
50	0.01122	0.01041	-0.00081 (0.209)	0.04902 (0.447)	-0.00081 (-0.616)
60	0.01071	0.00997	-0.00075 (-0.206)	0.02183 (0.217)	-0.00075 (-0.616)
70	0.01051	0.00974	-0.00077 (-0.223)	0.00752 (0.087)	-0.00077 (-0.639)
80	0.01050	0.00970	-0.00080 (-0.237)	0.01586 (0.189)	-0.00080 (-0.632)
90	0.01024	0.00976	-0.00048 (-0.144)	0.03135 (0.364)	-0.00048 (-0.405)

A.2: Election Day 1928-2016: Incumbents

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00667	0.00778	0.00111 (0.571)	0.26484 (0.798)	0.00111 (0.602)
20	0.00620	0.00745	0.00125 (0.959)	0.25357 (0.974)	0.00125 (0.998)
30	0.00631	0.00711	0.00081 (0.826)	0.15875 (1.038)	0.00081 (0.908)
40	0.00621	0.00696	0.00074 (0.869)	0.13045 (1.215)	0.00074 (1.129)
50	0.00625	0.00688	0.00063 (0.919)	***0.10312 (1.558)**	***0.00063 (1.450)**
60	0.00630	0.00677	0.00046 (0.777)	0.07653 (1.240)	0.00046 (1.192)
70	0.00686	0.00685	-0.00001 (-0.023)	0.00455 (0.115)	-0.00001 (-0.051)
80	0.00689	0.00686	-0.00003 (-0.056)	-0.00182 (-0.061)	-0.00003 (-0.139)
90	0.00691	0.00680	-0.00011 (-0.200)	-0.01638 (-0.464)	-0.00011 (-0.442)

A.3: Election Day 1928-2016: New Presidents vs. Incumbents

Number of days	Volatility Change under Incumbents	Volatility Change under New Presidents	(4) Difference in Value Change in Volatility (*t*-Statistic)	(5) Difference in Percentage Change (*t*-Statistic)
10	0.00111	0.00122	0.00012 (0.052)	-0.09175 (-0.251)
20	0.00125	0.00019	-0.00105 (-0.681)	-0.13052 (-0.427)
30	0.00081	-0.00028	-0.00109 (-0.698)	-0.06819 (-0.335)
40	0.00074	-0.00070	-0.00144 (-0.799)	-0.05748 (-0.334)
50	0.00063	-0.00081	-0.00144 (-0.855)	-0.05418 (-0.367)
60	0.00046	-0.00075	-0.00121 (-0.776)	-0.05470 (-0.403)
70	-0.00001	-0.00077	-0.00076 (-0.495)	0.00297 (0.026)
80	-0.00003	-0.00080	-0.00077 (-0.481)	0.01769 (0.163)
90	-0.00011	-0.00044	-0.00037 (-0.247)	0.04773 (0.427)

Panel B
B.1: Inauguration Day 1929-2017: New Presidents

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00835	0.01008	0.00173 (0.396)	0.07804 (0.581)	0.00173 (0.826)
20	0.00929	0.01000	0.00071 (0.212)	0.11118 (0.863)	0.00071 (0.455)
30	0.00905	0.00992	0.00087 (0.276)	0.11771 (1.155)	0.00087 (0.594)
40	0.00949	0.01012	0.00063 (0.181)	0.10783 (1.015)	0.00063 (0.401)
50	0.00976	0.00998	0.00023 (0.067)	0.05419 (0.607)	0.00023 (0.164)
60	0.00993	0.00997	0.00004 (0.012)	0.04601 (0.523)	0.00004 (0.029)
70	0.01053	0.00990	-0.00063 (-0.186)	0.00168 (0.019)	-0.00063 (-0.411)
80	0.01056	0.00965	-0.00091 (0.273)	-0.03581 (-0.445)	-0.00091 (-0.602)
90	0.01043	0.00955	-0.00088 (-0.270)	-0.03417 (-0.435)	-0.00088 (-0.589)

B.2: Inauguration Day 1929-2017: Incumbents

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00502	0.00594	****0.00092 (1.808)**	****0.22635 (1.931)**	***0.00092 (1.775)**
20	0.00637	0.00652	0.00015 (0.296)	0.06411 (0.605)	0.00015 (0.231)
30	0.00634	0.00686	0.00052 (0.899)	0.12518 (1.005)	0.00052 (0.817)
40	0.00612	0.00679	***0.00068 (1.427)**	0.15792 (1.288)	0.00068 (1.173)
50	0.00632	0.00691	0.00058 (1.050)	0.13896 (1.294)	0.00058 (0.994)
60	0.00681	0.00704	0.00023 (0.372)	0.07476 (0.770)	0.00023 (0.411)
70	0.00678	0.00722	0.00044 (0.675)	0.10467 (1.035)	0.00044 (0.749)
80	0.00673	0.00728	0.00055 (0.842)	0.11677 (1.110)	0.00055 (0.879)
90	0.00661	0.00734	0.00073 (1.054)	0.14696 (1.265)	0.00073 (1.082)

B.3: Inauguration Day 1929-2017: New Presidents vs. Incumbents

Number of days	Volatility Change under Incumbents	Volatility Change under New Presidents	(4) Difference in Value Change in Volatility (*t*-Statistic)	(5) Difference in Percentage Change (*t*-Statistic)
10	0.00092	0.00173	0.00081 (0.302)	-0.14831 (-0.769)
20	0.00015	0.00071	0.00056 (0.275)	0.04707 (0.258)
30	0.00052	0.00087	0.00035 (0.181)	-0.00748 (0.046)
40	0.00068	0.00063	-0.00005 (-0.024)	-0.05009 (-0.304)
50	0.00058	0.00023	-0.00036 (-0.198)	-0.08477 (-0.602)
60	0.00023	0.00004	-0.00019 (0.109)	-0.02874 (-0.213)
70	0.00044	-0.00063	-0.00107 (-0.538)	-0.10299 (-0.752)
80	0.00055	-0.00091	-0.00147 (-0.744)	-0.15257 (-1.164)
90	0.00073	-0.00088	-0.00161 (-0.824)	***-0.18113 (-1.342)**

5.1.4 Results with Partition: Change in Ruling Party

Table 5 shows the *t*-test results for volatility change under the partition of change in ruling party vs. same ruling party. Market volatility increases more after the election when the same party continues to rule as opposed to a different party. Admittedly, this is counter intuitive as one expects volatility to be higher with a new ruling party.

The results concerning inauguration days are rather weak and not significant relation is found.

Table 5
Change vs. Same Party

Table 5 provides *t*-test results on the change in market volatility before and after event day. We segment 23 elections by whether there is a change in party being elected from previous year vs. the same party elected. Panel A displays *t*-test results with 10 elections days with a change in party as event days, and compares it to *t*-test results with 13 election days with the same party. Panel B repeats the same procedure for inauguration days. Volatility calculation is described in Table 1. *, **, *** represent 10%, 5%, 1% significance, respectively.

Panel A
A.1: Election Day 1928-2016: Change Party

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.01296	0.01275	-0.00021 (-0.038)	-0.05773 (-0.755)	-0.00021 (-0.266)
20	0.01407	0.01321	-0.00086 (-0.133)	***-0.10763 (-1.746)**	***-0.00086 (-1.581)**
30	0.01440	0.01243	-0.00198 (-0.327)	****-0.13476 (-1.897)**	***-0.00198 (-1.714)**
40	0.01416	0.01194	-0.00221 (-0.390)	0.10085 (-0.921)	-0.00221 (-1.266)
50	0.01352	0.01143	-0.00209 (-0.399)	-0.09358 (-0.928)	-0.00209 (-1.247)
60	0.01285	0.01092	-0.00194 (-0.395)	***-0.11937 (-1.454)**	-0.00194 (-1.227)
70	0.01240	0.01069	-0.00171 (-0.368)	-0.09966 (-1.278)	-0.00171 (-1.105)
80	0.01222	0.01058	-0.00164 (-0.362)	-0.07794 (-1.063)	-0.00164 (-1.013)
90	0.01201	0.01073	-0.00129 (-0.287)	-0.06428 (-0.860)	-0.00129 (-0.818)

A.2: Election Day 1928-2016: Same Party

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00635	0.00831	0.00196 (1.083)	0.39986 (1.351)	0.00196 (1.139)
20	0.00590	0.00779	***0.00189 (1.616)**	***0.39527 (1.641)**	***0.00189 (1.655)**
30	0.00603	0.00770	***0.00167 (1.645)**	****0.30887 (2.135)**	****0.00167 (1.904)**
40	0.00595	0.00737	***0.00142 (1.640)**	****0.25207 (2.446)**	****0.00142 (2.206)**
50	0.00603	0.00716	***0.00113 (1.477)**	****0.19586 (2.289)**	****0.00113 (2.165)**
60	0.00604	0.00699	***0.00095 (1.339)**	****0.16805 (2.018)**	****0.00095 (1.913)**
70	0.00649	0.00698	0.00049 (0.739)	0.08832 (1.301)	0.00049 (1.169)
80	0.00660	0.00702	0.00041 (0.633)	0.07609 (1.108)	0.00041 (1.026)
90	0.00657	0.00696	0.00039 (0.591)	0.07265 (0.986)	0.00039 (0.925)

A.3: Election Day 1928-2016: Change vs. Same Party

Number of days	Volatility Change under Change Party	Volatility Change under Same Party	Difference in Value Change in Volatility (*t*-Statistic)	Difference in Percentage Change (*t*-Statistic)
10	0.00015	0.00197	0.00183 (0.842)	0.44597 (1.286)
20	-0.00107	0.00189	****0.00297 (2.123)**	****0.51119 (1.819)**
30	-0.00184	0.00167	*****0.00350 (2.592)**	****0.43964 (2.486)**
40	-0.00212	0.00139	****0.00351 (2.145)**	****0.34308 (2.248)**
50	-0.00203	0.00113	****0.00316 (2.055)**	****0.28761 (2.189)**
60	-0.00186	0.00094	****0.00280 (1.955)**	****0.28411 (2.386)**
70	-0.00172	0.00048	***0.00221 (1.534)**	****0.18709 (1.811)**
80	-0.00168	0.00041	***0.00210 (1.382)**	***0.15394 (1.518)**
90	-0.00126	0.00038	0.00164 (1.144)	0.13471 (1.263)

Panel B
B.1: Inauguration Day 1929-2017: Change Party

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.01015	0.01212	0.00197 (0.332)	0.03305 (0.198)	0.00197 (0.668)
20	0.01036	0.01111	0.00075 (0.165)	0.09303 (0.533)	0.00075 (0.342)
30	0.01023	0.01098	0.00075 (0.176)	0.08296 (0.621)	0.00075 (0.364)
40	0.01092	0.01139	0.00047 (0.099)	0.08937 (0.636)	0.00047 (0.212)
50	0.01118	0.01137	0.00019 (0.041)	0.06587 (0.536)	0.00019 (0.096)
60	0.01138	0.01135	-0.00003 (-0.007)	0.05748 (0.475)	-0.00003 (-0.017)
70	0.01173	0.01124	-0.00050 (-0.108)	0.04799 (0.420)	-0.00050 (-0.232)
80	0.01186	0.01093	-0.00092 (-0.203)	-0.00663 (-0.063)	-0.00092 (-0.435)
90	0.01177	0.01083	-0.00094 (-0.213)	-0.01772 (-0.172)	-0.00094 (-0.450)

B.2: Inauguration Day 1929-2017: Same Party

Number of days	Volatility Before Event	Volatility After Event	(1) Difference in Volatility (*t*-Statistic)	(2) Percentage Change in Volatility (*t*-Statistic)	(3) Value Change in Volatility (*t*-Statistic)
10	0.00466	0.00565	***0.00099 (1.342)**	****0.21532 (2.059)**	****0.00099 (2.076)**
20	0.00645	0.00674	0.00029 (0.332)	0.09255 (1.103)	0.00029 (0.569)
30	0.00626	0.00698	0.00072 (0.886)	***0.14961 (1.592)**	***0.00072 (1.443)**
40	0.00605	0.00684	0.00078 (1.160)	***0.15670 (1.686)**	***0.00078 (1.733)**
50	0.00629	0.00679	0.00051 (0.755)	0.10389 (1.332)	0.00051 (1.172)

60	0.00666	0.00688	0.00022 (0.327)	0.05709 (0.810)	0.00022 (0.538)
70	0.00701	0.00702	0.00001 (0.006)	0.03736 (0.458)	0.00001 (0.009)
80	0.00691	0.00702	0.00011 (0.132)	0.04738 (0.566)	0.00011 (0.193)
90	0.00676	0.00703	0.00028 (0.352)	0.07857 (0.871)	0.00028 (0.485)

B.3: Inauguration Day 1929-2017: Change vs. Same Party

Number of days	Volatility Change under Change Party	Volatility Change under Same Party	Difference in Value Change in Volatility (*t*-Statistic)	Difference in Percentage Change (*t*-Statistic)
10	0.00197	0.00099	-0.00098 (-0.373)	0.18227 (0.968)
20	0.00075	0.00029	-0.00046 (-0.228)	-0.00047 (-0.003)
30	0.00075	0.00072	-0.00003 (-0.015)	0.06666 (0.420)
40	0.00047	0.00078	0.00032 (0.160)	0.06733 (0.415)
50	0.00019	0.00051	0.00032 (0.179)	0.03801 (0.272)
60	-0.00003	0.00022	0.00026 (0.149)	-0.00039 (-0.003)
70	-0.00050	0.00001	0.00050 (0.255)	-0.01064 (-0.078)
80	-0.00092	0.00011	0.00103 (0.527)	0.05401 (0.407)
90	-0.00094	0.00028	0.00122 (0.630)	0.09629 (0.704)

In summary, the *t*-test results are rather ambiguous. We next try to analyze the relation using the dynamic specification of the GARCH model.

5.2 ARCH / GARCH

The ARCH and GARCH models yield somehow opposite results to the *t*-tests. While in Table 4, *t*-tests demonstrate a tendency of volatility *increase* when an incumbent is elected, and Table 5 exhibits few critical findings under the ruling party indicator. However, none of the significance occurs during the 90 days event window. Hence, we approach the same issue with ARCH / GARCH models in the hope of a more robust result.

Table 6 Panel A displays test results 90 days around election day, while Panel B presents test results for inauguration day.

From Table 6 Panel A.3, we can see that market volatility reacts differently to elections with new present (with average coefficient of -0.0003 (A.3.b)) vs. incumbent (-0.0026 (A.3.b)); as well as to elections with changing ruling party (-0.0002 (A.3.d)) vs. the same party (-0.0020 (A.3.d)). We interpret the results as the market is comparatively more willing to settle after the election when there are indications for a stable environment (incumbent, same party).

For inauguration (Panel B.3), similar patterns occur. Comparing the average coefficient, we see that market volatility is more likely to decrease when a new president inaugurated (-0.0013 (B.3.b)). This is consistent with Panel A. GARCH, since for elections with incumbents, volatility has already settled down after *election* (Panel A.3.b), resulting in a comparatively higher post-election volatility (≈ pre-inauguration volatility). Market volatility tends to also decrease after the inauguration with change in ruling party. We deem the results as consistent to Panel A for the similar reason.

Table 6
ARCH: Ex-Ante vs. Ex-Post Market Volatility

Table 6 displays ARCH & GARCH model results for 23 Elections (Panel A) and 23 Inaugurations (Panel B). We use the ARCH and GARCH models to describe the variance of excess returns in a 90-day period in different scenarios. We use an indicator for each of the 23 post-election date periods. For example, the 1928 post indicator equals one for the period after the election date, respectively, and zero otherwise. We use the Z test to see whether the means of two samples are significantly different or not. *, **, *** represent 10%, 5%, 1% significance respectively.

Panel A.1 Election Day 1928 - 2016

	Observation	**Coefficient**	**z**
arch (L1)	4149	0.44262	***27.62**
garch (L1)	4149	0.50104	***26.11**
post-election indicator	4149	-0.00006	-0.28

Panel A.2 Election Day 1928 - 2016 (by Election)

	Election Indicator	**Surprise Indicator**	**Incumbent Indicator**	**Party Indicator**	**Coefficient**	**z**
arch (L1)					0.50092	***27.24**
garch (L1)					0.43782	***19.62**
1928 post indicator	1	small	new	same	-0.00095	-0.68
1932 post indicator	2	small	new	change	0.00176	1.03
1936 post indicator	3	small	incumbent	same	-0.00729	***-4.75**
1940 post indicator	4	small	incumbent	same	-0.00206	-1.22
1944 post indicator	5	big	incumbent	same	-0.00263	-1.44
1948 post indicator	6	big	new	same	-0.00012	-0.06
1952 post indicator	7	small	new	change	-0.00213	-1.17
1956 post indicator	8	small	incumbent	same	-0.00046	-0.22
1960 post indicator	9	big	new	change	-0.00106	-0.59
1964 post indicator	10	small	new	same	0.00089	0.46
1968 post indicator	11	small	new	change	-0.00086	-0.37
1972 post indicator	12	small	incumbent	same	-0.00140	-0.58
1976 post indicator	13	small	new	change	0.00195	-1.06
1980 post indicator	14	big	new	change	-0.00082	-0.41
1984 post indicator	15	small	incumbent	same	-0.00180	-1.04
1988 post indicator	16	big	new	same	-0.00240	-1.34
1992 post indicator	17	small	new	change	-0.00027	-0.16
1996 post indicator	18	big	incumbent	same	-0.00030	-0.16
2000 post indicator	19	big	new	change	0.00001	0.01
2004 post indicator	20	big	incumbent	same	-0.00880	***-5.14**
2008 post indicator	21	big	new	change	0.00055	0.30
2012 post indicator	22	big	incumbent	same	0.00121	0.80
2016 post indicator	23	big	new	change	-0.00134	-0.81

Panel A.3 Chi-Square Test

	Chi2	P>chi2		Chi2	P>chi2
(a) Difference between post big and small surprise	0.01	0.922	(b) Difference between post new president and incumbent	***14.74**	0.000
big surprise average coefficient	*-0.0014*		*Incumbent average coefficient*	*-0.0026*	
small surprise average coefficient	*-0.0011*		*New president average coefficient*	*-0.0003*	
	Chi2	P>chi2		Chi2	P>chi2
(c) Sum of post-election interaction	0.99	0.321	(d) Difference between post change party and same	***7.37**	0.007
			change party average coefficient	*-0.0002*	
			same party average coefficient	*-0.0020*	

Panel B.1 Inauguration Day 1929 - 2017

	Observation	**Coefficient**	**z**
arch (L1)	4157	0.44051	***28.74**
garch (L1)	4157	0.53003	***25.66**

post-inauguration indicator	4157		-0.00030		-1.30	

Panel B.2 Inauguration Day 1929 - 2017 (by Inauguration)						
	Election Indicator	**Surprise Indicator**	**Incumbent Indicator**	**Party Indicator**	**Coefficient**	**z**
arch (L1)					0.50272	***28.25**
garch (L1)					0.46411	***21.94**
1929 post indicator	1	small	new	same	-0.00093	-0.67
1933 post indicator	2	small	new	change	-0.00447	**-2.55**
1937 post indicator	3	small	incumbent	same	0.00717	***4.57**
1941 post indicator	4	small	incumbent	same	-0.00403	**-2.29**
1945 post indicator	5	big	incumbent	same	-0.00112	-0.60
1949 post indicator	6	big	new	same	-0.00109	-0.56
1953 post indicator	7	small	new	change	-0.00187	-1.01
1957 post indicator	8	small	incumbent	same	-0.00153	-0.81
1961 post indicator	9	big	new	change	0.00051	0.28
1965 post indicator	10	small	new	same	-0.00136	-0.71
1969 post indicator	11	small	new	change	-0.00122	-0.53
1973 post indicator	12	small	incumbent	same	-0.00133	-0.54
1977 post indicator	13	small	new	change	-0.00356	**-1.97**
1981 post indicator	14	big	new	change	-0.00219	-1.11
1985 post indicator	15	small	incumbent	same	-0.00219	-0.15
1989 post indicator	16	big	new	same	-0.00025	0.18
1993 post indicator	17	small	new	change	0.00033	-0.42
1997 post indicator	18	big	incumbent	same	-0.00071	-0.62
2001 post indicator	19	big	new	change	-0.00116	-1.52
2005 post indicator	20	big	incumbent	same	-0.00235	-1.49
2009 post indicator	21	big	new	change	-0.00151	-0.86
2013 post indicator	22	big	incumbent	same	0.00138	0.89
2017 post indicator	23	big	new	change	0.00041	0.23

Panel B.3 Chi-Square Test					
	Chi2	P>chi2		Chi2	P>chi2
(a) Difference between post big and small surprise	0.37	0.545	(b) Difference between post new president and incumbent	***4.71**	0.030
big surprise average coefficient	*-0.0008*		*Incumbent average coefficient*	*-0.0005*	
small surprise average coefficient	*-0.0012*		*New president average coefficient*	*-0.0013*	
	Chi2	P>chi2		Chi2	P>chi2
(c) Sum of post-election interaction	0.53	0.466	(d) Difference between post change party and same	***6.14**	0.013
			change party average coefficient	*-0.0015*	
			same party average coefficient	*-0.0006*	

Upon observation, we can see a significant volatility decrease around the 1936 election, where there was a small surprise, an incumbent elected and no change in ruling party. All three indicators point to less uncertainty, which aligns with 1936 election's negative z-value. Another significant volatility decrease happens around the 2004 election, where there was a big surprise, an incumbent elected and no change in ruling party. These examples suggest that the big/small surprise are less important distinctions than the continuity in party/presidency. This is also found based on the GARCH (1,1) specification of Table 6, Panel A.3.

Hence, Panel A.3. affirms our hypotheses that market tends to stabilize, and volatility would reduce when the incumbent president continues to serve. This seems to be consistent with a more stable period following the resolution of uncertainty after the election.

As for inauguration days, Panel B.3. displays results consistent with A.3, namely, given that volatility is lower following the election of incumbent (same party) president; the opposite is true following inauguration, when policy decision seems to increase volatility after inauguration.

6: Conclusions

In conclusion, the ARCH/GARCH model seem to provide interpretation that is more aligned with theoretical argument. Differently, the t-test analysis provides for rather low power, and conflicting results, suggesting that it may not be a very robust way for analysing volatility changes. We thus interpret the results based on the GARCH model as providing some evidence that volatility tends to decrease after election results when the incumbent president (or party) policies are known. The opposite seems to happen after inauguration, when policy changes are expected.

We at the same time acknowledge the following potential improvements: **(1) Sample size**: due to limited market data, we have only 23 observations in the preliminary sample which is considerably small. **(2) Partition methods**: we defined the magnitude of surprise using a simple arithmetic difference. Instead, the logarithm of pre- and post-volatility ratio can be used as a more sophisticated proxy. **(3) Event windows**: event windows can also be linked to crucial sub-events before and after the major event, such as the Presidential Debates and the Vice-Presidential Debate. **(4) Turnout rate**: U.S. citizens' turnout rate (a percentage calculated as the number of voting participants divided by the corresponding year's census voting-age population) has been around only 55% for the past 40 years (U.S. Census Bureau

2011). It implies that even though it is reasonable to see voting results as a resemblance of the aggregate market opinion towards the political events, the voting results are not a summation of *every* market participant's opinion as we would ideally like it to be. We fail to capture 45% of market expectation by depending solely on voting results. **(5) Poll prediction**: rather than utilizing only voting results, pre-election poll predictions can also be included in the model in calculating surprise; **(6) Contingency**: as much as we would like to discover a relationship between a certain political uncertainty and the market volatility, we must accept that the U.S. Presidential Elections are events that are enormously exposed to contingencies. Assassination (and therefor compassion), scandals (and therefor defection), war and crisis (and therefore a pessimistic market), partisanship (and therefor voting against interest), or simply a president elected with zero prior political experience (and therefor confusion and disagreement), can all contingently impact the empirical results. Upon developing the capability to isolate contingencies, we shall feel more confident about the empirical results.

Appendix

Table 7

U.S. Presidential Election Historical Data, 1928 – 2016 (270towin.com 2017)

Election			Electoral Data			
Year	Month	Day	Candidate	Party	Electoral Vote	Popular Vote
1920	nov	2	W. G. Harding	Rep	404	16152200
			J. M. Cox	Dem	127	9147353
			E. Debs	Soc	0	919799
1924	nov	4	C. Coolidge	Rep	382	15725016
			J. W. Davis	Dem	136	8386503
			R. M. LaFollette	Pro	13	4822856
1928	nov	6	H. C. Hoover	Rep	444	21391381
			A. E. Smith	Dem	87	15016443
1932	nov	8	F. D. Roosevelt	Dem	472	22821857
			H. C. Hoover	Rep	59	15761841
1936	nov	3	F. D. Roosevelt	Dem	523	27751597
			A. M. Landon	Rep	8	16679583
1940	nov	5	F. D. Roosevelt	Dem	449	27244160
			W. L. Willkie	Rep	82	22305198
1944	nov	7	F. D. Roosevelt	Dem	432	25602504
			T. E. Dewey	Rep	99	22006285
1948	nov	2	H. S. Truman	Dem	303	24105695
			T. E. Dewey	Rep	189	21969170
			J. S. Thurmond	State Right Dem	39	1169021
			H. Wallace	Pro	0	1157328
1952	nov	4	D. D. Eisenhower	Rep	442	33778963
			A. Stevenson	Dem	89	27314992
1956	nov	6	D. D. Eisenhower	Rep	457	35581003
			A. Stevenson	Dem	73	25738765

1960	nov	8	J. F. Kennedy	Dem	303	34227096
			R. M. Nixon	Rep	219	34107646
			H. F. Byrd	Dem	15	116248
1964	nov	3	L. B. Johnson	Dem	486	42825463
			B. M. Goldwater	Rep	52	27146969
1968	nov	5	R. M. Nixon	Rep	301	31710470
			H. H. Humphrey	Dem	191	30898055
			G. C. Wallace	American Inde	46	9906473
1972	nov	7	R. M. Nixon	Rep	520	46740323
			G. McGovern	Dem	17	28901598
1976	nov	2	J. Carter	Dem	297	40825839
			G. R. Ford	Rep	240	29147770
1980	nov	4	R. Reagan	Rep	489	43901821
			J. Carter	Dem	49	35483820
			J. Anderson	Inde	0	5719850
			Ed Clark	Lib	0	921128
1984	nov	6	R. Reagan	Rep	525	52455000
			W. F. Mondale	Dem	13	37577000
1988	nov	8	G. Bush	Rep	426	47946000
			M. S. Dukakis	Dem	111	41016000
1992	nov	3	W. J. Clinton	Dem	370	44908254
			G. Bush	Rep	168	39102343
			R. Perot	Inde	0	19743821
1996	nov	5	W. J. Clinton	Dem	379	45590703
			R. Dole	Rep	159	37816307
			R. Perot	Reform	0	8085294
2000	nov	7	G. W. Bush	Rep	271	50456062
			A. Gore, Jr.	Dem	266	50996582
			R. Nader	Green	0	2882955
2004	nov	2	G. W. Bush	Rep	286	62039073
			J. F. Kerry	Dem	251	59027478

2008	nov	4	B. H. Obama	Dem	365	69456897
			J. S. McCain	Rep	173	59934814
2012	nov	6	B. H. Obama	Dem	332	65446032
			W. M. Romney	Rep	206	60589084
			G. Johnson	Lib	0	1275971
2016	nov	8	D. J. Trump	Rep	304	62980160
			H. R. Clinton	Dem	227	65845063
			G. Johnson	Lib	0	4488931
			J. Stein	Green	0	1457050
			E. McMullin	Inde	0	728830

References

270towin.com. 2017. *Historical Presidential Elections.* Accessed November 2017. https://www.270towin.com/historical-presidential-elections/.

Allvine, Fred C., and Daniel E. O'Neill. 1980. "Stock Market Returns and the Presidential Election Cycle: Implications for Market Efficiency." *Financial Analysts Journal* 49-56.

Białkowski, Jędrzej, Katrin Gottschalk, and Tomasz Piotr Wisniewski. 2008. "Stock market volatility around national elections." *Journal of Banking & Finance* 1941-1953.

Franklin D. Roosevelt Presidential Library and Museum. 2016. *Franklin D. Roosevelt Day by Day.* Accessed December 2017. https://fdrlibrary.org/.

Goodell, John W., and Sami Vähämaa. 2013. "US presidential elections and implied volatility: The role of political uncertainty." *Journal of Banking & Finance* 1108-1117.

Li, Jinliang, and Jeffery A. Born. 2006. "Presidential Election Uncertainty and Common Stock Return in the United States." *The Journal of Financial Research* 609-622.

Santa-Clara, Pedro, and Rossen Valkanov. 2003. "The Presidential Puzzle: Political Cycles and the Stock Market." *The Journal of Finance* 1841–1872.

Sy, Oumar, and Ashraf Al Zaman. 2011. "Resolving the Presidential Puzzle." *Financial Management* 331-355.

U.S. Census Bureau. 2011. "Statistical Abstract of the United States: 2012." *U.S. Census Bureau.* August. Accessed December 1, 2017. https://www.census.gov/library/publications/2011/compendia/statab/131ed.html.

Wong, Wing-Keung, and Michael McAleer. 2009. "Mapping the Presidential Election Cycle in US stock markets." *Mathematics and Computers in Simulation* 3267-3277.

WRDS. 2017. *Wharton Research Data Services.* Accessed November 2017. https://wrds-web.wharton.upenn.edu/wrds/.

U.S. Const. amend. XXII.