Text-Based Insights into Stock Market Behavior

Professor Steven J. Davis

ABFER Industry Outreach Dialogue
Singapore, 2 August 2018

Abstract

U.S. stocks rose sharply in reaction to Donald Trump's surprise victory in the November 2016 presidential election. The boom perplexed many analysts, including prominent economists who had predicted a market crash if Trump won.

To throw light on the market reaction, I look to firm-level equity returns in the wake of the election. In particular, I relate firm-level returns to text-based measures of their exposures to government policy and regulatory risks. I construct these measures using text in their mandatory 10-K filings.

While average returns responded positively to Trump's win (and Clinton's loss), firm-level reactions vary enormously. For example, firms with high exposure to regulatory risks enjoyed especially high returns on 9 November and the next 2 days, while firms with high exposure to healthcare policy risks saw large relative and, in some cases, absolute equity price drops.

The results suggest that equity prices do not immediately and fully adjust to surprise events that (a) involve unusual shifts in the structure of price-relevant risks and (b) require large information processing resources to fully assess.

Text as Data

My remarks today draw on two projects that use text as data to develop new insights into stock market behavior and economic performance.

- "What Triggers Stock Market Jumps?" with Scott Baker, Nick Bloom and Marco Sammon.
  - Human readings of newspaper articles about thousands of large daily jumps in national equity markets for 14 countries.
  - Key result for today's talk: News from and about the United States triggers national stock market jumps around the globe.

- "Diagnosing the Stock Market Reaction to Trump's Surprise Election Victory," with Cristhian Seminario
  - Automated readings of about 61,000 regulatory filings with the U.S. Securities and Exchange Commission.

3

Coding National Equity Market Jumps

1. Set daily jump threshold: Aim for about 1% of daily moves → a threshold of |2.5%| for most countries.
2. Pull dates with market moves > threshold
3. Use ***own-country*** newspaper articles to code jumps
   A. Go to online newspaper archive
   B. Enter newspaper, date range (next day) and search criteria (e.g., "stock market")
   C. Select article
4. One or more humans read and code the article(s), according to our coding guide.
   – Rely on native-language speakers to code articles.
5. Record the jump reason per the journalist, the geographic source of the news that triggered the jump, journalist confidence in the jump explanation, and more.

Key Result for Today's Talk

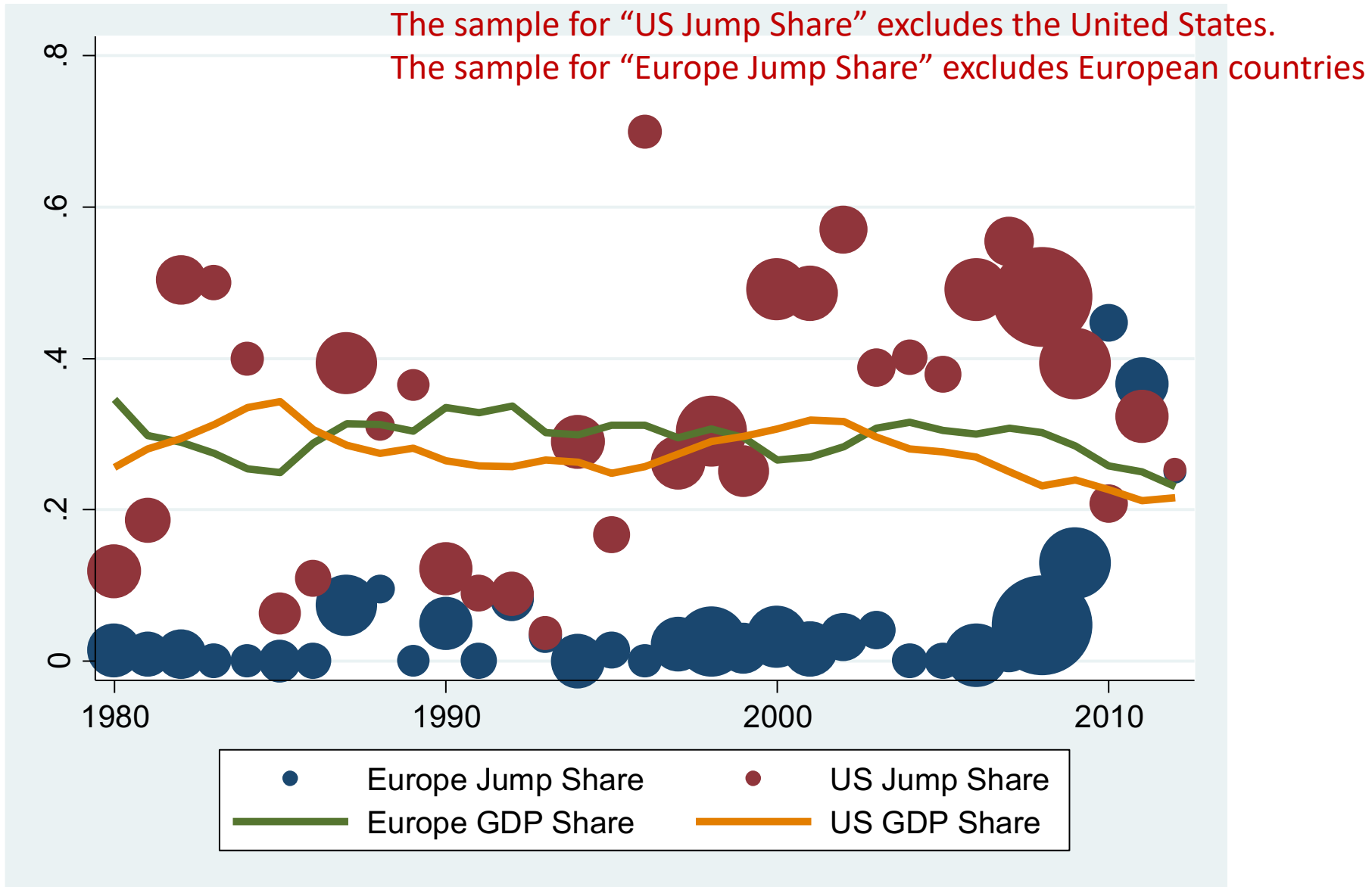U.S. developments trigger a huge share of equity market jumps across the globe.

- *Excluding data for the United States,* leading local newspapers attribute 34% of jumps in their national stock markets to news from or about the U.S.
- The U.S. role in this regard dwarfs the role of Europe, China and other large regions and countries.
- The U.S. role is especially pronounced during the Global Financial Crisis.

Share of Jumps Attributed to U.S. Developments
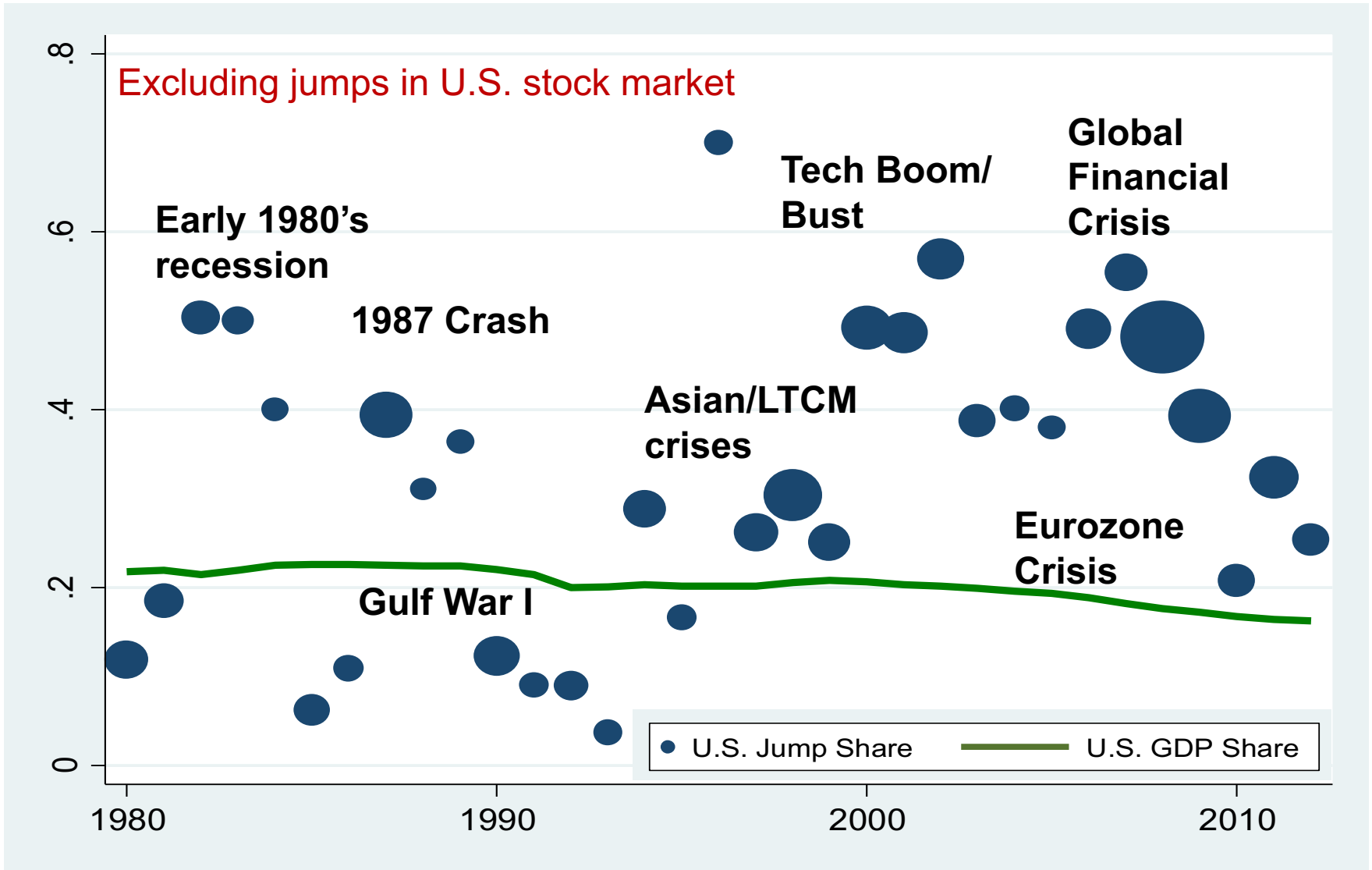
Notes: Average share of jumps attributed to U.S. developments by year in Australia, Canada, China (HK), China (Shanghai), Germany, Greece, Ireland, Japan, New Zealand, Saudi Arabia, Singapore, South Africa, South Korea and UK. Dot size is proportional to the average number of jumps by country/year. U.S. Share of PPP-adjusted global GDP using IMF data.

News about the U.S. Moves Equity Markets Much More than News about Europe

The sample for "US Jump Share" excludes the United States.
The sample for "Europe Jump Share" excludes European countries

Legend:
- Europe Jump Share
- US Jump Share
- Europe GDP Share
- US GDP Share

GDP shares computed using contemporaneous exchange rates.

Why the Outsized Role for the U.S.?

1. The U.S. has been the chief architect and guarantor of the global economic and security order since WW II.
2. It remains the world's foremost military power.
3. Most international trade is invoiced in a few currencies, mainly the Dollar.
4. Many countries tie their currency values to the Dollar.
5. The Dollar is the world's dominant reserve currency.
6. The U.S. is the world's major supplier of safe, liquid debt.
7. Much of the world's offshore bank lending is in Dollars.
8. Portfolio investors around the world exhibit a strong preference for dollar-denominated securities.
9. The Fed is the world's leading monetary policymaker.
10. It's also the world's chief central bank, as illustrated by Fed swap lines with other central banks during and after the GFC.

Turning to the U.S. stock market ...

... and its reaction to Donald Trump's surprise election as U.S. President

CNN politics   45   CONGRESS   SECURITY   THE NINE   TRUMPMERICA   2018   f

Political Prediction Market: Clinton's odds rise again

By Caroline Kenny, CNN

Updated 12:17 PM ET, Tue November 8, 2016   Noon on Election Day!

Washington (CNN) Hillary Clinton's odds of winning the presidency rose from 78% last week to 91% Monday before Election Day, according to CNN's Political Prediction Market.
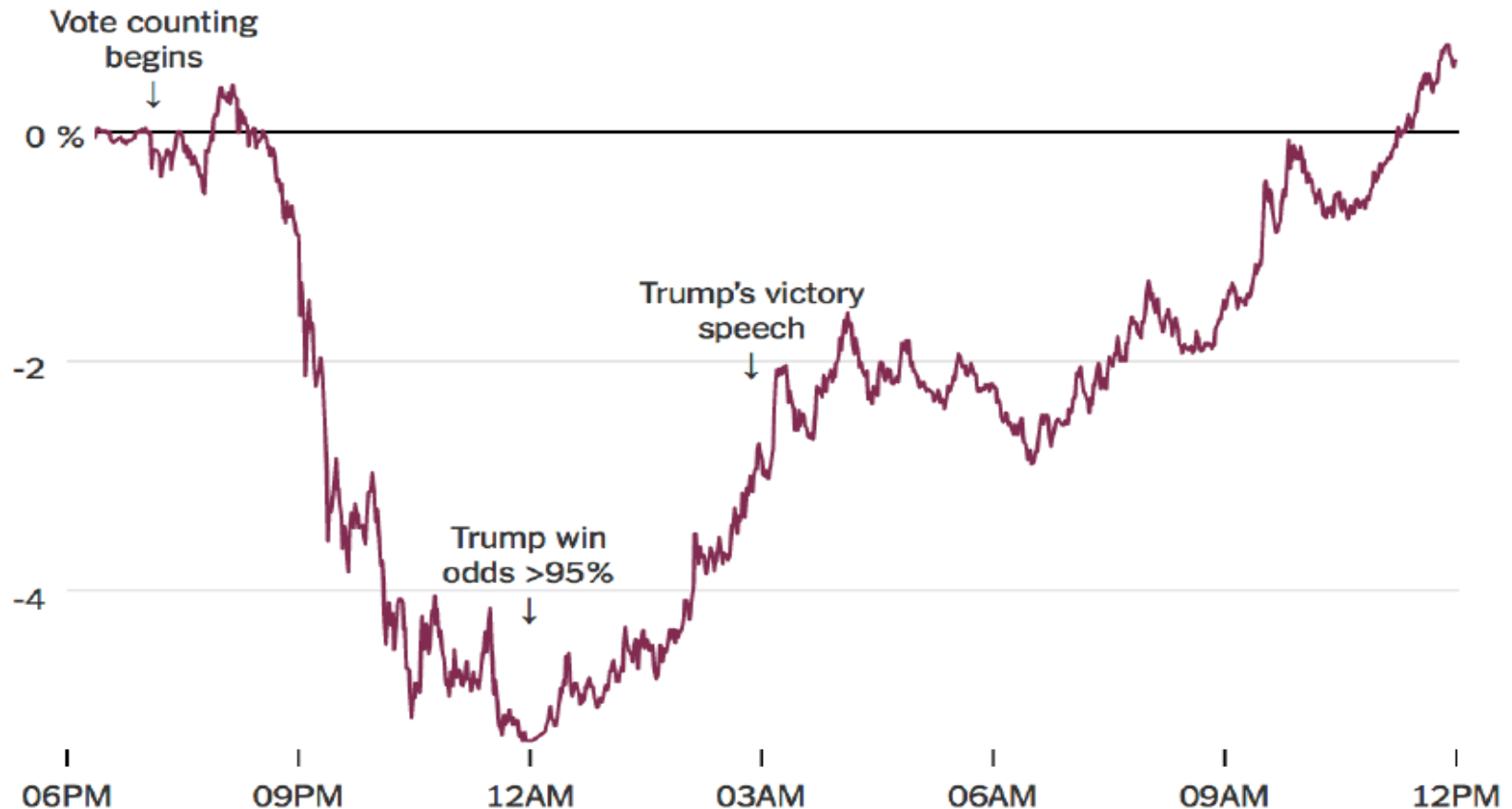
A big surprise!

Initially, stocks fell sharply in after-hours trading

The Stock Market's Reaction to Trump's Election

One measure of the stock market fell drastically as it became clear that Donald Trump was winning the election. But then it reversed course.

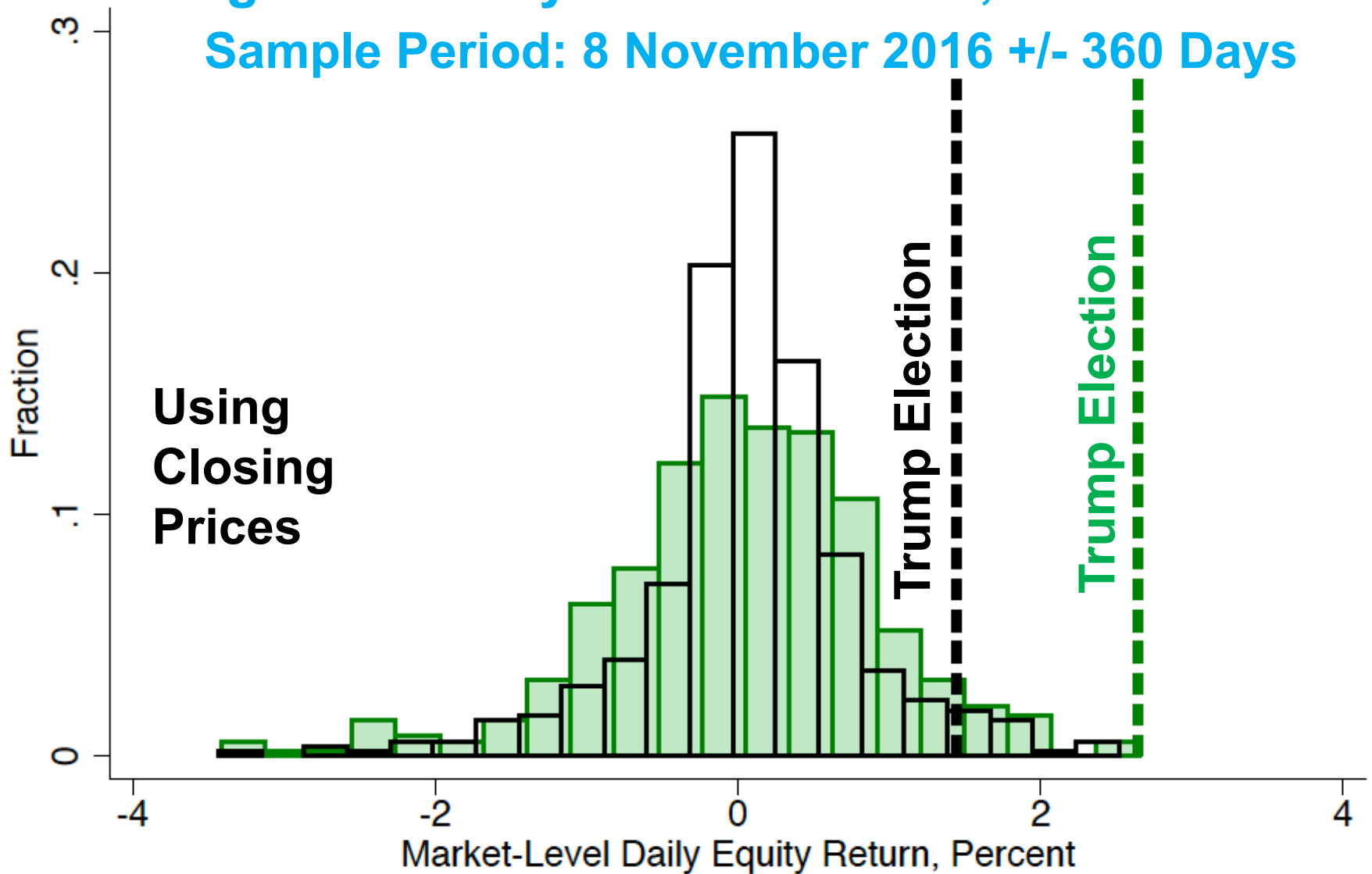**Change in the S.&.P 500 futures index**

From "Markets Sent a Strong Signal on Trump ... Then Changed Their Minds," Justin Wolfers, *New York Times*, 18 November 2016

But Stocks Boomed on 9 November

Histogram of Daily Market Returns, U.S. Stocks
Sample Period: 8 November 2016 +/- 360 Days

Using
Closing
Prices

Trump Election

Trump Election

Market-Level Daily Equity Return, Percent

Fraction

equal-weighted   value-weighted

… Confounding Prominent Economists

Justin Wolfers, *New York Times,* 18 November 2016: "Throughout the campaign, stocks rose whenever campaign developments made it less likely that Mr. Trump would be elected."

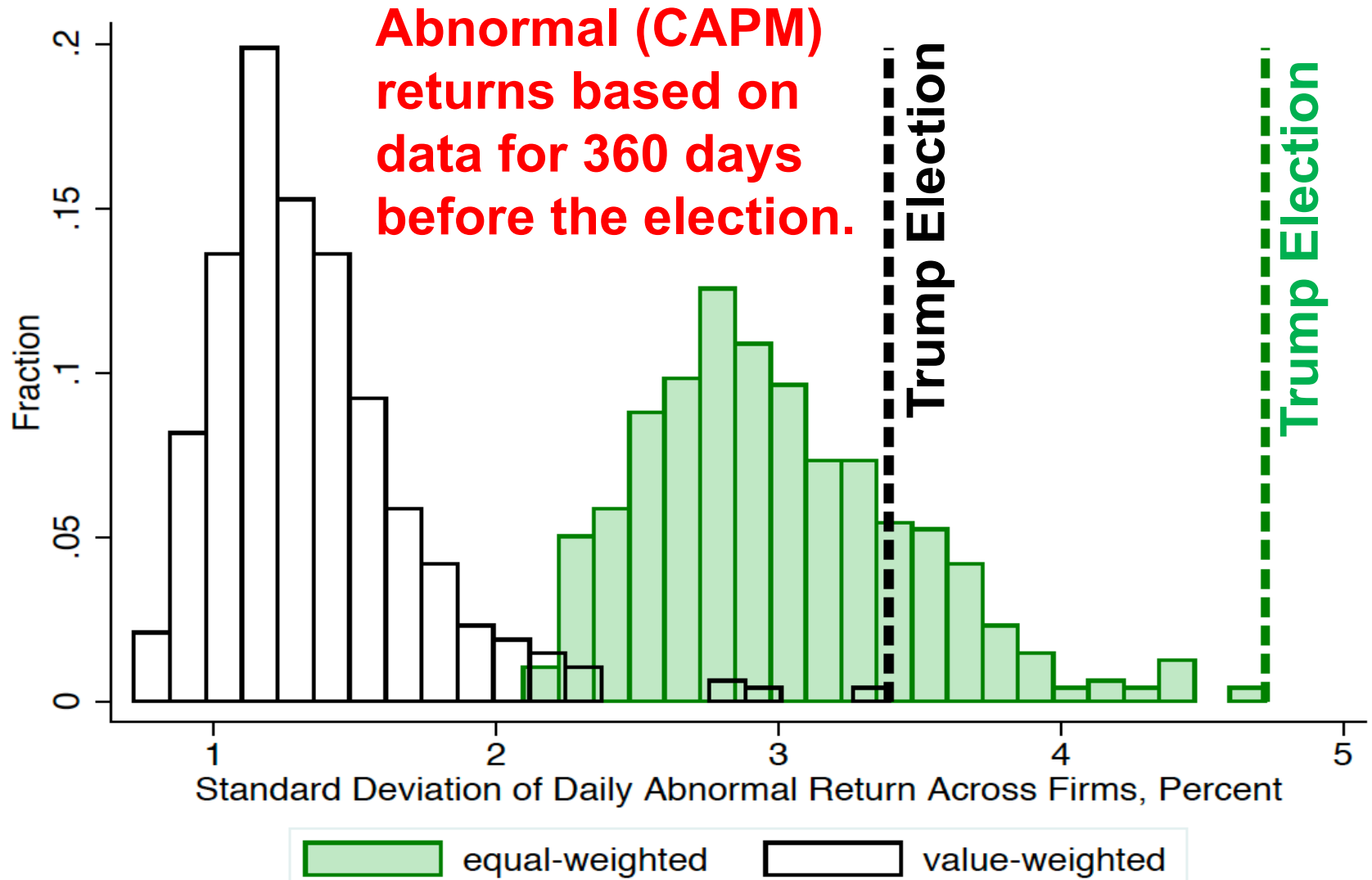This assessment rests on Wolfers' pre-election empirical study with Erik Zitzewitz.

Their bottom line: "[W]e estimate that market participants believe that a Trump victory would reduce the value of the S&P 500, the UK, and Asian stock markets by 10-15%."

Our Approach: Examine the Cross-Section of Abnormal Equity Returns in Reaction to Trump's Victory

1. Trump and Clinton were far apart on many policy issues: regulation, healthcare, trade, etc. **Not a Tweedledee vs. Tweedledum election!!**
2. Firms differ in their exposures to policy risks.
3. Quantify these risks using Part 1a ("Risk Factors") of listed firms' annual 10-K filings.
4. Trump's surprise victory abruptly shifted the level and structure of important policy risks.
5. We look to the cross-section of firm-level returns to assess the effects of that shift and gain insight into the market's reaction to Trump's win.

The Cross-Firm Dispersion of Abnormal Returns Was Very High in the Wake of Trump's Victory

Histogram of Cross-Firm St. Dev. of Daily Abnormal Returns
Sample Period: 8 November 2016 +/- 360 Days

Abnormal (CAPM) returns based on data for 360 days before the election.

Trump Election

Trump Election

Fraction

Standard Deviation of Daily Abnormal Return Across Firms, Percent

equal-weighted   value-weighted

Analysis Sample

- Common equity securities (primary issue) traded on AMEX, NYSE and NASDAQ of firms incorporated in the United States, with prices quoted in U.S. Dollars.

- **Daily closing prices**, shares outstanding and shares traded from Compustat North America, with adjustments for stock splits, reverse splits, dividends, etc. Market return data from Ken French's website.

- Sample period: **±360 calendar days from Nov 8, 2016**

- 3,606 firms with closing prices on 8 and 9 November.

- Matched to 3,383 firms with at least one 10-K filing (with non-empty Part 1a) from January 2006 to July 2016.
  - Part 1a is not obligatory for all listed firms.

- Drop 102 firms with no NAICS code. Drop 20 with fewer than 126 daily return observations in pre-election window.

- **3,261 firms in the final sample**.
  - About 1.5 million daily return observations

Part 1A of the 10-Ks

- Since 2006 (for FY 2005) the SEC requires most publicly held firms to include a separate discussion of "Risk Factors" in Part 1a of their annual 10-K filings.

- In explaining "How to Read a 10-K" at www.sec.gov/answers/reada10k.htm, the SEC describes Part 1a as follows:

  - **Item 1A - "Risk Factors"** includes information about the most significant risks that apply to the company or to its securities. Companies generally list the risk factors in order of their importance. In practice, this section focuses on the risks themselves, not how the company addresses those risks. Some risks may be true for the entire economy, some may apply only to the company's industry sector or geographic region, and some may be unique to the company.
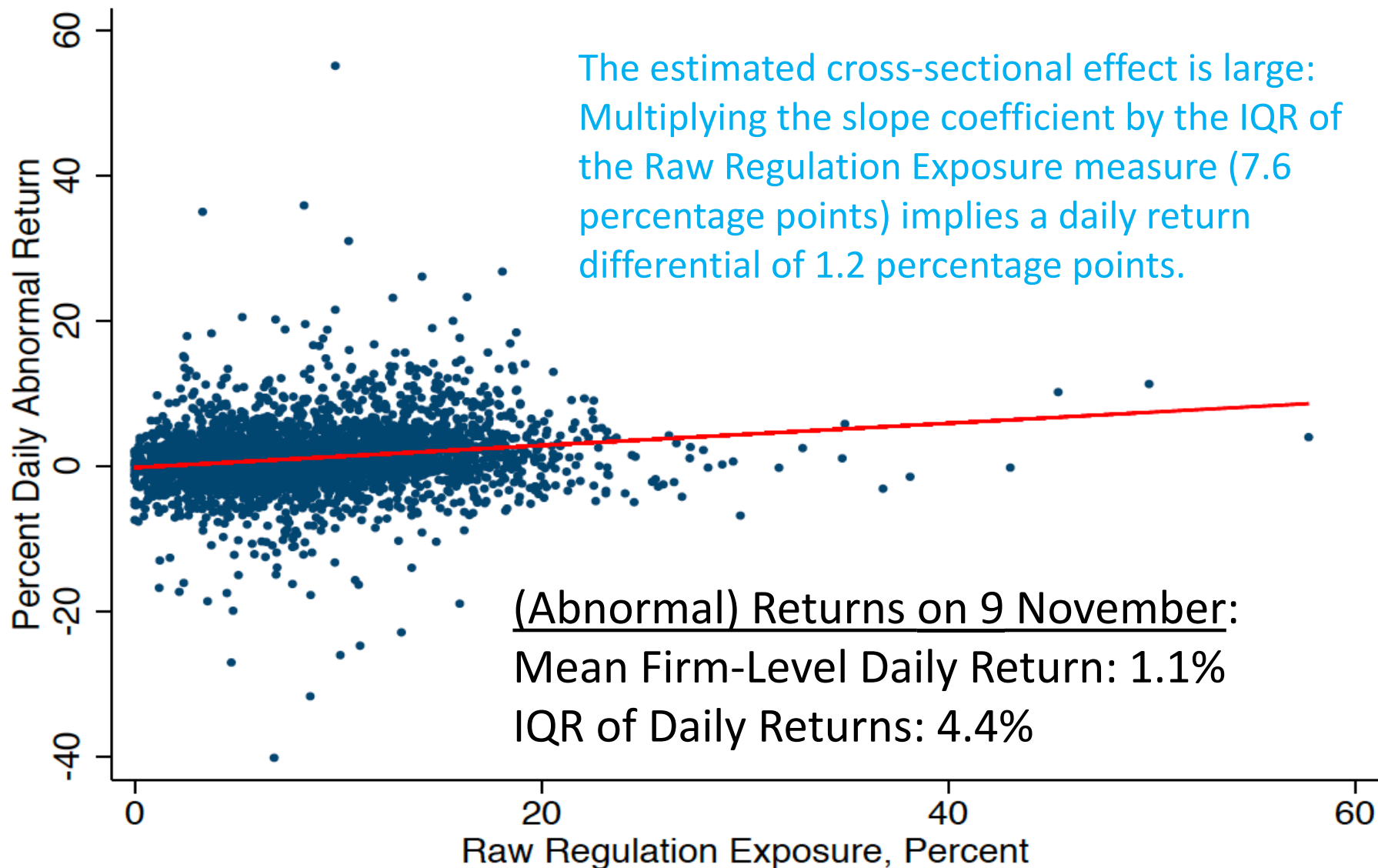
How We Use the 10-Ks

1. Develop term sets that correspond to various policy risk categories. Examples: Tax policy, trade policy, government spending, healthcare policy, financial regulation, etc.

2. For each 10-K filing – and each term set – calculate the **percentage** of sentences in Part 1a with one or more terms in the set.

3. Average the percentage over available years for each firm and term set to get our risk exposure measures.

A Warm-Up Investigation

1. For each 10-K filing with a non-empty Part 1a:
   - Calculate the **percentage** of sentences in Part 1a that contains "regulation," "regulate" or "regulatory."
   - Average this percentage over years for each firm.
2. This average value is our measure of Raw Regulation (Risk) Exposure for the firm.
3. Compute the firm's daily return as 100 X log change in the closing price from November 8 to November 9.
4. Obtain the CAPM abnormal return for each firm from November 8 to 9.
5. Relate Raw Regulation Exposure to abnormal equity returns in reaction to Trump's surprise election victory.
6. Plot the firm's daily return against its Raw Regulation Exposure.

Firms with greater exposure to regulatory risks had higher abnormal returns on 9 November

Coeff (t-stat): 15.3 (10.5), R2: 3.2, N: 3261

The estimated cross-sectional effect is large: Multiplying the slope coefficient by the IQR of the Raw Regulation Exposure measure (7.6 percentage points) implies a daily return differential of 1.2 percentage points.

(Abnormal) Returns on 9 November:
Mean Firm-Level Daily Return: 1.1%
IQR of Daily Returns: 4.4%

Extending Our Approach

1. Relate firm-level (abnormal) equity returns on 9 November 2016 to a range of policy risks.

2. Consider 20+ distinct policy risk categories.

3. Measure each firm's policy risk exposures using text from 10-K filings in the years *before* the election.

4. Use multiple regression models to estimate firm-level stock returns on November 9 as a function of their policy risk exposures.

Full Set of Policy Risk Categories

- Regulation (6 categories): Labor, financial, intellectual property, environmental and energy, food and drug, generic and other regulation

- Taxes (8 categories): ~~Individual income taxes~~, business profit taxes, business tax credits, ~~tax treatment of foreign earnings~~, ~~tax-filing services~~, ~~property taxes~~, sales and excise taxes, generic and other taxes.

  - A ~~strikethrough~~ denotes a category we consider but do not use in our preferred statistical model.

- Entitlement and welfare programs

- Government purchases and fiscal policy

- Government-sponsored enterprises

- Monetary policy

- Healthcare policy

- Trade and exchange rate policy

Example: The Term Set for Financial Regulation

Financial Regulation: {bank supervision}, {thrift supervision}, {financial reform}, {truth in lending}, {firrea}, {Glass-Steagall}, {Dodd-frank}, {tarp, Troubled Asset Relief Program}, {Volcker rule}, {Basel}, {stress test}, {deposit insurance, fdic}, {federal savings and loan insurance corporation, fslic}, {office of thrift supervision, ots}, {comptroller of the currency, occ}, {commodity futures trading commission, cftc}, {Financial Stability Oversight Council}, {house financial services committee}, {Bureau of Consumer Financial Protection, Consumer Financial Protection Bureau, CFPB}, {SBA loan program}
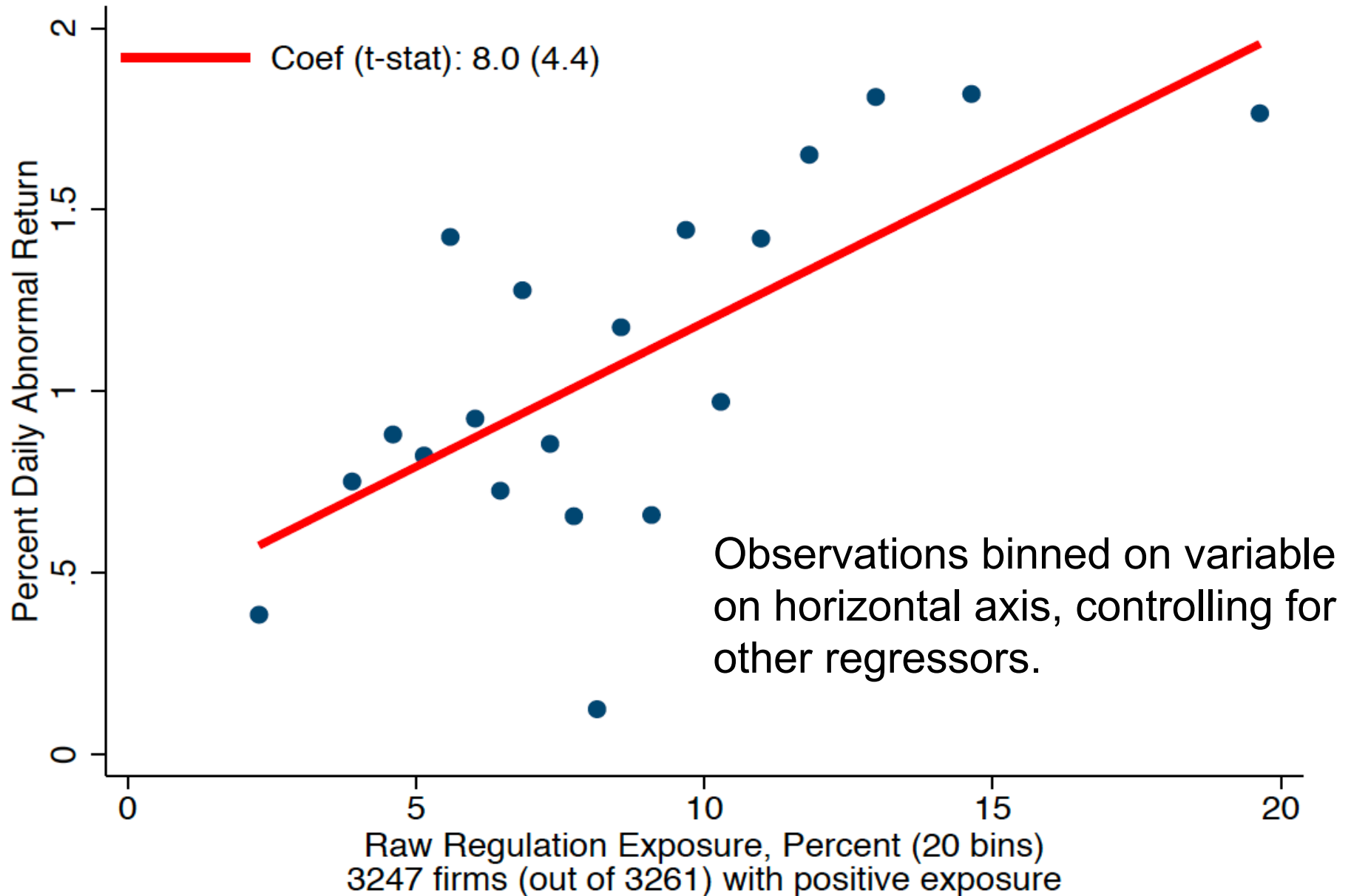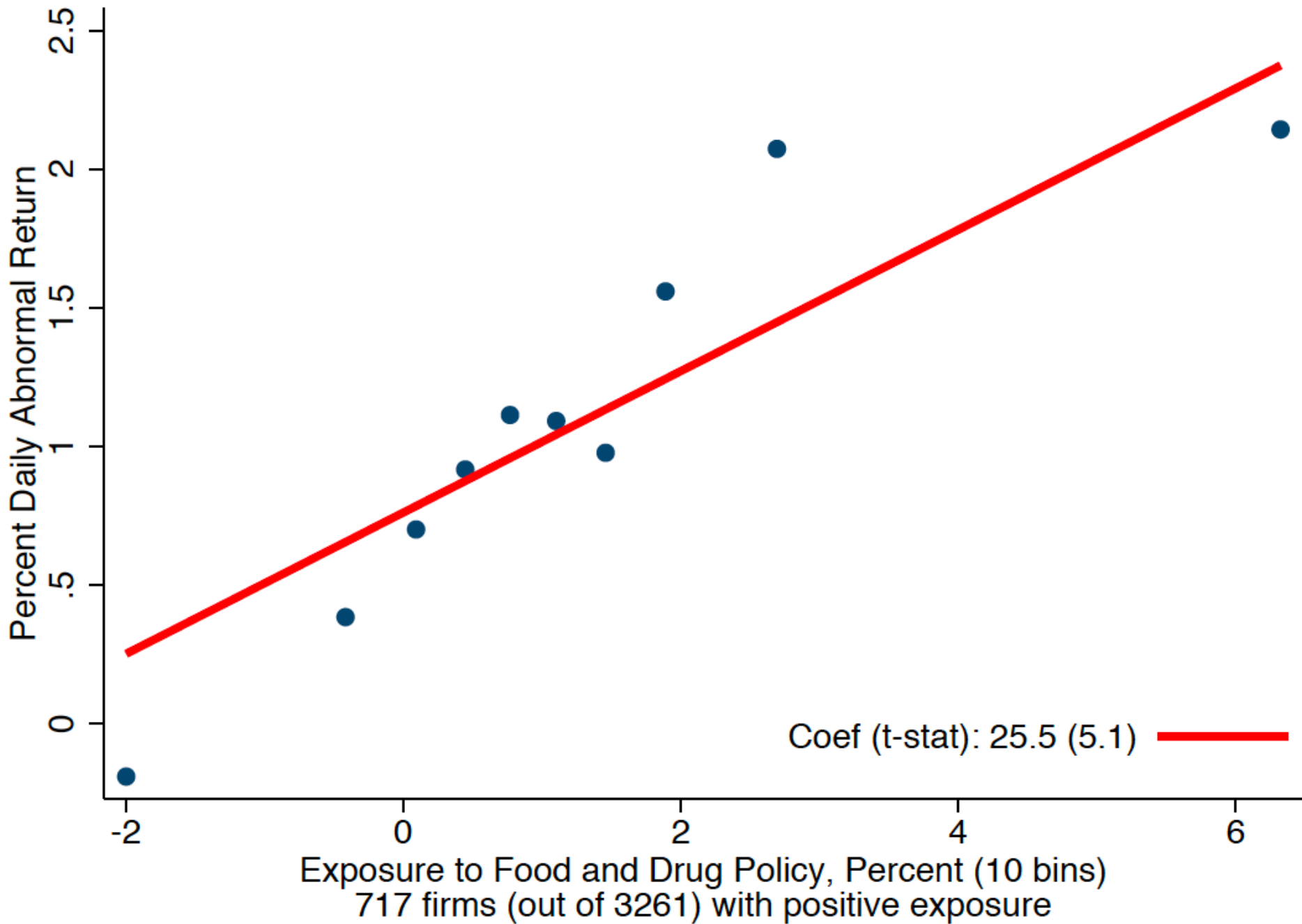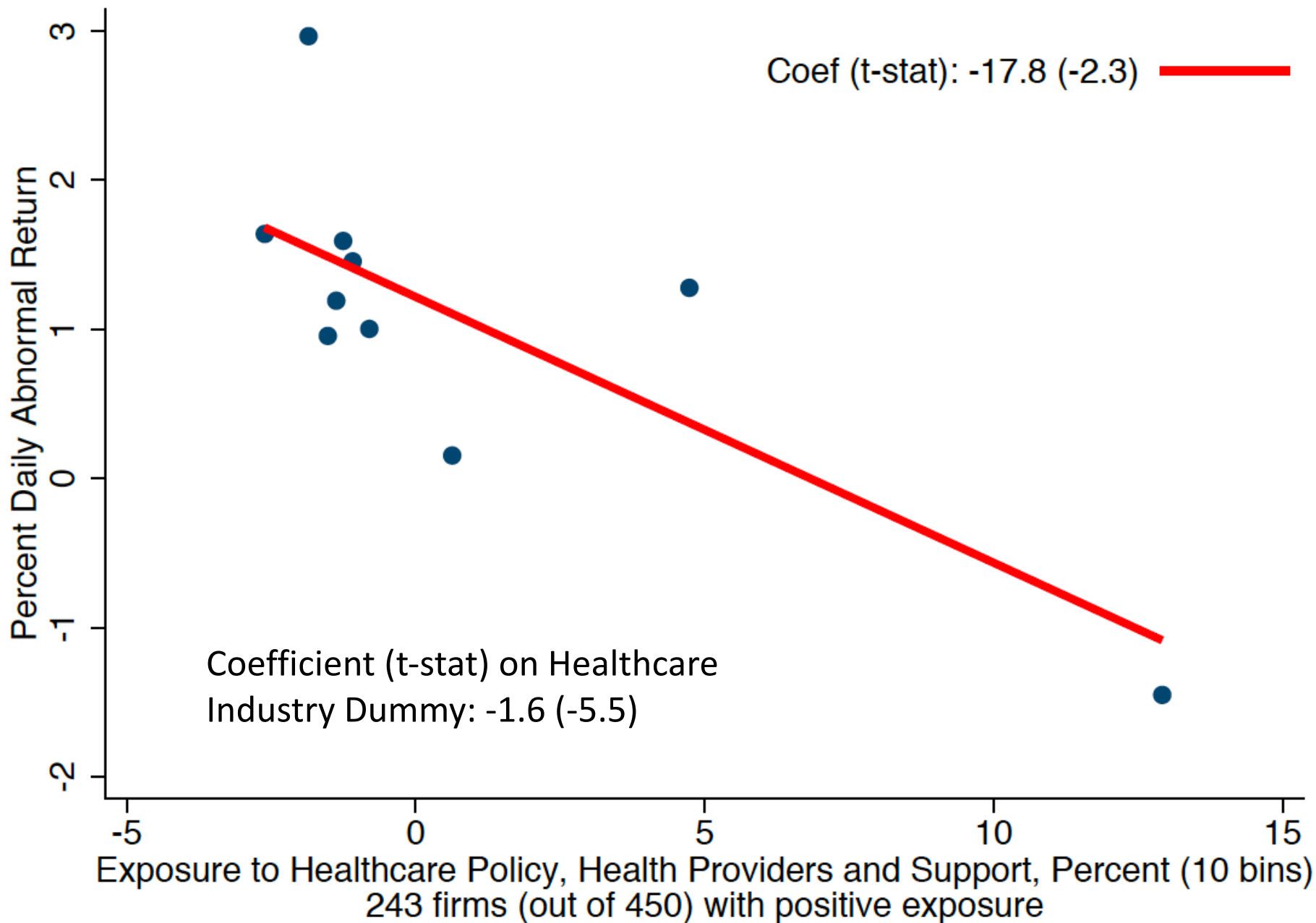
What Do We Find?

- Our policy risk exposure measures account for more than 20% of firm-level return differences on 9 November 2016.

- Firms with greater exposure to regulatory risks had higher (abnormal) equity returns on 9 November.

  – An exception: Greater exposure to regulations that favor "green" jobs and energy sources.

- Firms with greater exposure to risks associated with Labor Regulation, Food and Drug Policy, and IP Policy had especially high returns on 9 November.

- Healthcare delivery firms and those with high exposures to healthcare policy risks had poor returns on November 9 in relative terms and, in some case, absolute terms.

- Firms with greater exposure to risks associated with Trade Policy, Entitlement and Welfare Programs, and Government-Sponsored Enterprises had lower returns.
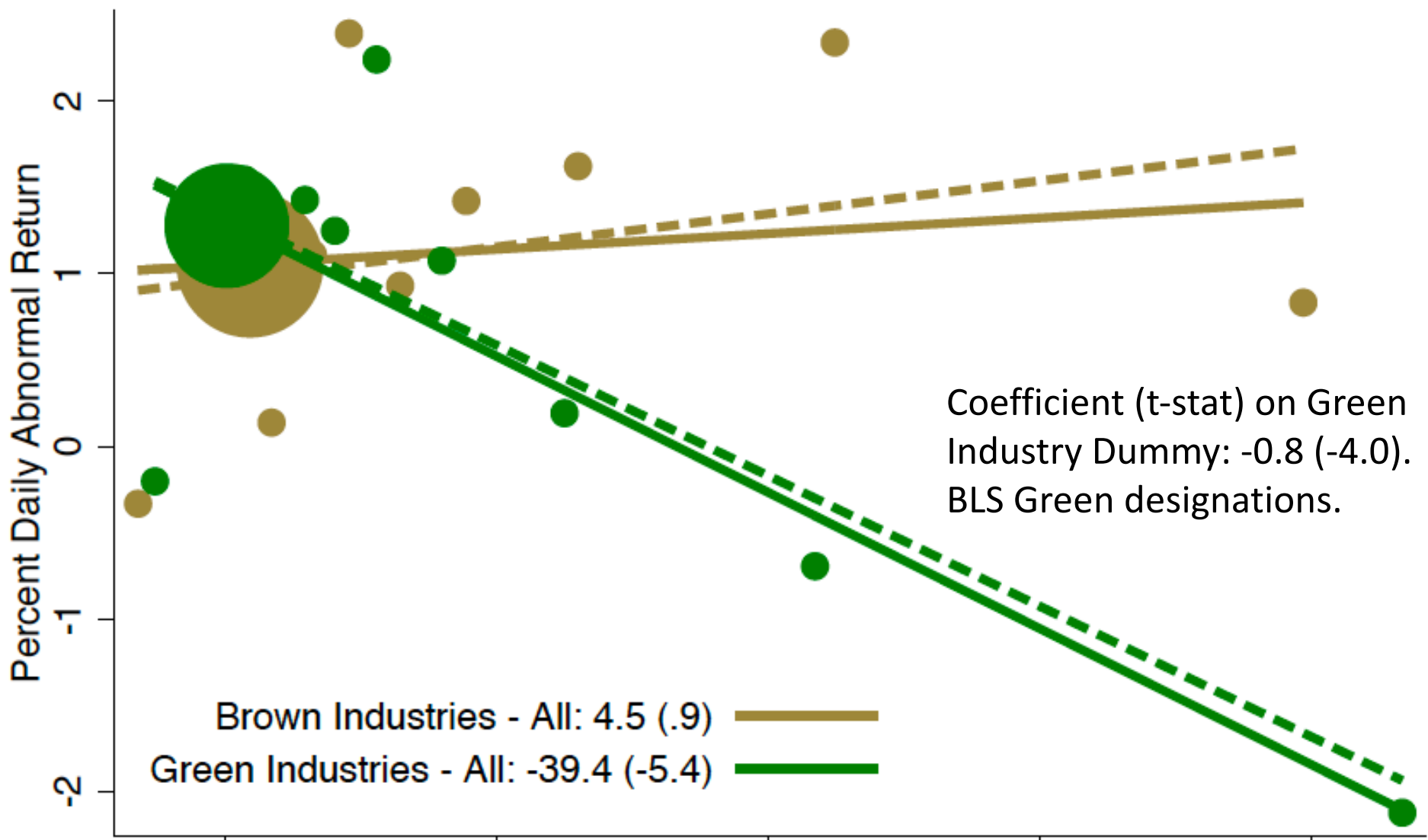
The next few slides illustrate some of these results

Partial Regression Scatter Plots for Firm-Level Stock Returns on 9 November 2016

Coef (t-stat): 8.0 (4.4)

Percent Daily Abnormal Return

Observations binned on variable on horizontal axis, controlling for other regressors.

Raw Regulation Exposure, Percent (20 bins)
3247 firms (out of 3261) with positive exposure

Coef (t-stat): 25.5 (5.1)

Exposure to Food and Drug Policy, Percent (10 bins)
717 firms (out of 3261) with positive exposure

Coef (t-stat): -17.8 (-2.3)

Coefficient (t-stat) on Healthcare
Industry Dummy: -1.6 (-5.5)

Percent Daily Abnormal Return

Exposure to Healthcare Policy, Health Providers and Support, Percent (10 bins)
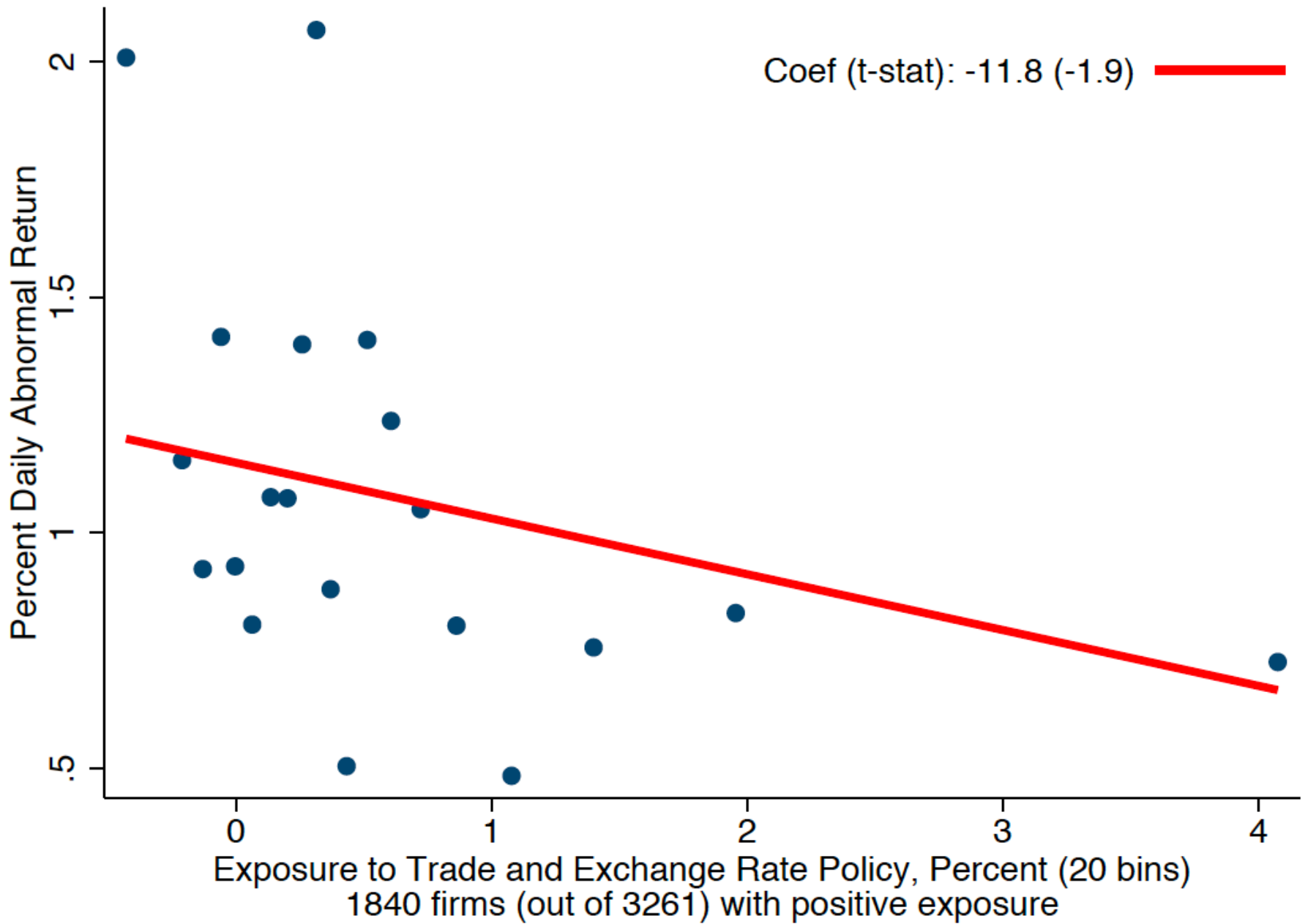243 firms (out of 450) with positive exposure

Coefficient (t-stat) on Green Industry Dummy: -0.8 (-4.0). BLS Green designations.

Brown Industries - All: 4.5 (.9)
Green Industries - All: -39.4 (-5.4)

Exposure to Energy and Environmental Regulations, Percent (11 bins each)
Brown: 570 firms (out of 2454) with positive exposure
Green: 240 firms (out of 807) with positive exposure

Coef (t-stat): -11.8 (-1.9)

Percent Daily Abnormal Return

Exposure to Trade and Exchange Rate Policy, Percent (20 bins)
1840 firms (out of 3261) with positive exposure

A Slow Market Reaction

The stock market did not fully digest the implications of the election outcome by market close on 9 November.

- Instead, (conditional) firm-level abnormal returns over the next 2 trading days strongly reinforced the initial market response to the election surprise.

- The shift in (conditional) firm-level abnormal returns over the next 2 trading days was 65% as large as the initial reaction on 9 November.

  – See charts on the next slide.

  – We exclude firms with very small market caps for this analysis. Including them yields very similar results, except it takes 3 trading days after 9 November for the market to fully price the election outcome.

Stock Prices Continued Moving in the Same Direction over the Next 2 Trading Days
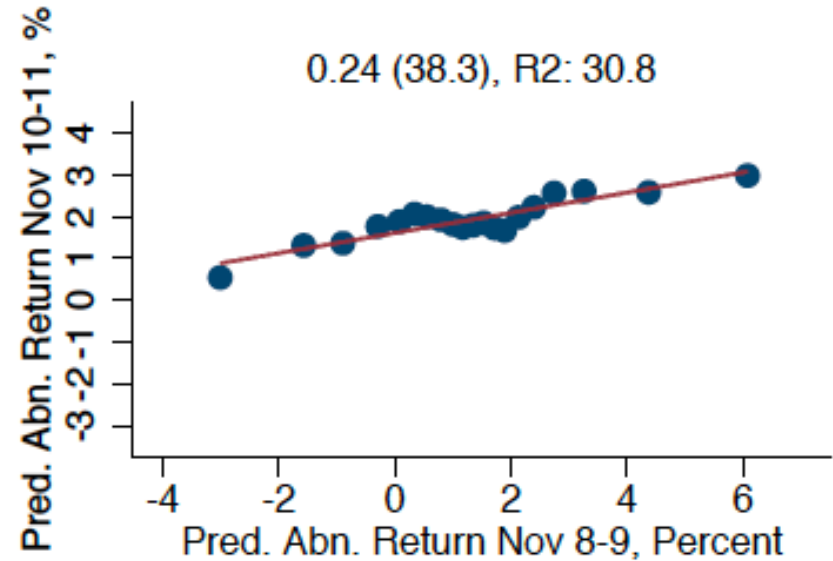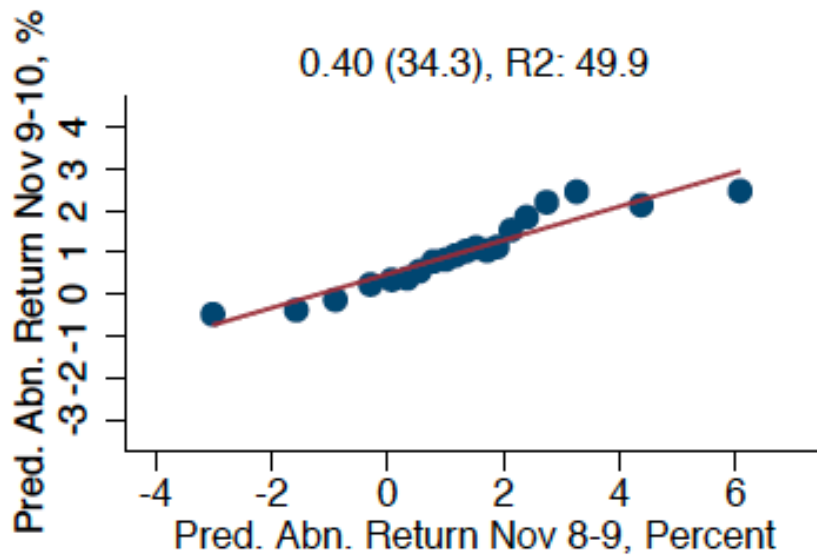
How we construct these two charts:
1. Fit our regression model separately to firm-level returns on November 9, 10 and 11, letting the coefficients vary freely across days.
2. For each trading day, recover the model's predicted values for each firm.
3. Plot the predicted values for November 10 (left chart) or November 11 (right) on the predicted values for November 9.
4. To improve visual clarity, group the firm-level data into 20 bins defined on predicted returns for 9 November. The reported coefficient (t-statistic) and R-squared values are for the underlying firm-level regression.

Similar Market Behavior on Other Days? No!

1. We reran our regression model on each day in a one-year window before 8 November 2016 (election day).

2. We find no evidence that daily firm-level equity returns respond systematically to policy risk exposures before the election.

3. The same conclusion holds for the 3 best and the 3 worst market days in the one-year pre-election window.

What does this mean?

- Our results for 9 November 2016 do not reflect some omitted factor that is systematically related to daily firm-level equity returns.

- Trump's surprise election victory shifted firm-level equity prices in an unusual manner.

Summing Up & Taking Stock

1. The election surprise triggered a large, positive stock market response on 9 November, strongly contradicting pre-election assessments of how market would react.

2. The structure of firm-level equity returns on 9 November was highly dispersed, highly unusual, and clearly tied to firm-level policy risk exposures, as derived from 10-Ks.

   - Firms with high exposures to regulatory risks saw especially high equity returns on 9 November

   - Healthcare delivery firms and those with high exposures to healthcare policy risks fared poorly in relative terms and, in some case, in absolute terms.

3. The stock market did not fully digest the implications of the election outcome by market close on 9 November. It took 2 more trading days to fully price the election.

4. These results suggest that equity prices do not immediately and fully adjust to surprise events that (a) involve unusual shifts in the structure of price-relevant risks and (b) require large information processing resources to fully assess.

   – Human collection and processing of available information is costly, and it takes time. Thus, the surprise realization of events that satisfy (a) and (b) need not be fully and immediately incorporated into equity prices.

   – This explanation might sound like common sense. But it's at odds with the Efficient Markets Hypothesis, which says that stock prices quickly adjust to publicly available information. A pricing response that settles in over 3 trading days is not quick.

5. Asset price responses to prediction-market probability changes are unreliable guides to the actual price effects of major surprise outcomes when (a) and (b) hold.