

# STOCK VOLATILITY AND THE GREAT DEPRESSION

---

**GUSTAVO S. CORTES**

*University of Illinois  
at Urbana-Champaign*

**MARC D. WEIDENMIER**

*Claremont McKenna College  
& NBER*

**Emory University Seminar**

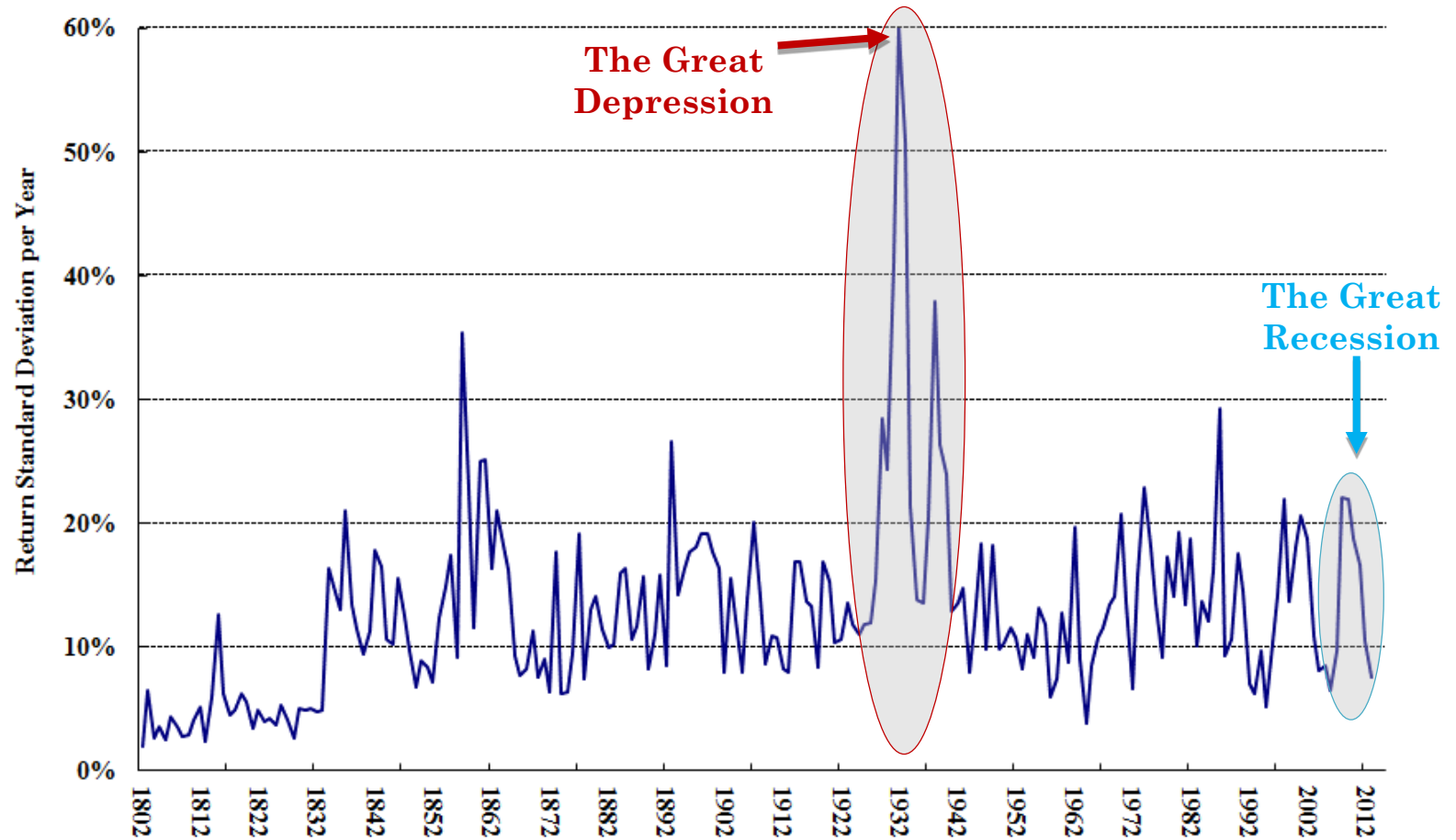
May 2017

# Volatility in the Great Depression

- The Great Depression is the largest financial and macroeconomic shock in U.S. history
- Financial and real-side variables display extremely volatile behavior in this period
- For example: *Stock Volatility is almost 3x higher than in any other period*, including the Great Recession of 2008-2010

# 200+ Years of Stock Volatility

Source: Schwert (2013)



# Stock volatility in the Depression: Still a puzzle

- But *why was stock volatility so high* during the Depression?
  - Still a Puzzle in the Finance Literature!
  - In theory, the extreme volatile behavior of *other series* (either in the real or financial side) *could explain the huge spikes in stock volatility* observed in the 1930s
  - **Example:** Industrial Production was extremely volatile, so *IP Vol* in the GD could explain *Stock Vol* well. **Right?**
  - **Wrong!** *What happens in practice?*
    - *Schwert (1989): "Why does stock volatility change over time?"*
    - Uses several (10+) econ/financial series to explain Stock Volatility
    - Examples: *IP Volatility*, *Inflation Volatility*, *Interest Rate Volatility*
    - **Conclusion:** They *poorly* explain stock volatility during the Great Depression period: *"there's a volatility puzzle"* in the 1930s

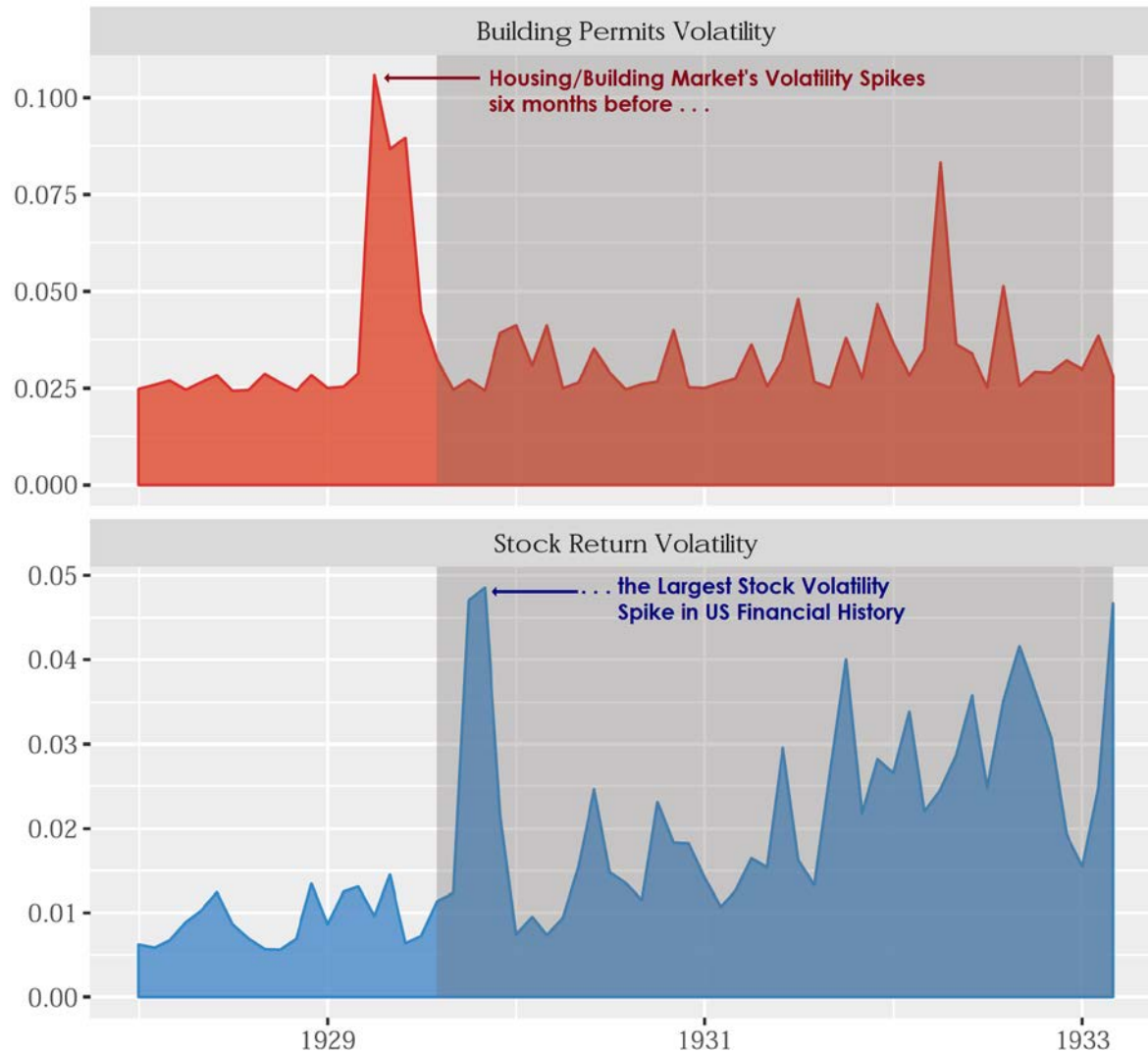
# Possible explanations for the puzzle

- Economic and financial factors are not able to predict the high levels of stock volatility. *Alternative Explanations?*
- *Shiller (1981)*. Irrational behavior by investors
- *Merton (1985) & Schwert (1989)*. **Political Explanation:** the rise of communism led investors to fear *increased expropriation risk* and the *demise of capitalism*
- *“The Russian Revolution occurred only 12 years before the 1929 crash (...) With the benefit of hindsight, we know that the U.S. and world economies came out of the Depression quite well. At the time, however, investors couldn’t have had such confident expectations.” (Schwert, 1989)*
  - *Voth (2002)* finds some evidence that political turmoil explains stock volatility for a panel of 10 countries between 1919-1939.
  - *“Fear of worker militancy and a possible revolution can explain a substantial part of the increase in stock market volatility during the GD.”*
  - However, Voth does not control for *corporate leverage* (a key determinant of stock volatility).

# Main Contributions

- What we do:
  - Revisit the puzzle with new data
  - We assess the ability of *Leading Indicators* (variables that are good at predicting recessions) to predict stock volatility
  - We also test alternative explanations (e.g. politics, using hand-collected data from newspapers)
- What we find:
  - Volatility of Building/Construction Markets largely explains the puzzle
  - Political instability events (e.g. *anti-government demonstrations*) **do not** predict stock volatility
  - More specifically, the huge spikes of stock volatility are reduced to **normal** residuals after controlling for only 2 variables (*leverage* and *building permit volatility*)
  - *One possible interpretation*: the puzzle is a result of using mostly **coincident** indicators. Including **forward-looking** indicators of the business cycle solves it.

# A preview of the main result



# Roadmap

---

1. More on Leading Indicators
2. Data
3. Empirical Strategy
4. Results + Robustness
5. Conclusion



# Housing / Construction variables as Leading Indicators

- **Building Permits**
  - A variable known to be good at predicting recessions for its *forward-looking* nature. Famous in the forecasting literature (e.g. *Stock & Watson, 1991*)
  - Frequently included in leading indicators (e.g. *Conference Board*)
- **Historically: construction/housing matters *big time***
  - In post-war U.S. data (1950-2010), almost all recessions **[9 out of 11]** were preceded by housing market declines (*Leamer, 2007*)
  - *“Housing is the single most critical part of the U.S. business cycle, certainly in a predictive sense and, I believe, also in a causal sense.”* (*Leamer, 2015*)


EDWARD E. LEAMER

## Housing Really Is the Business Cycle: What Survives the Lessons of 2008–09?

The downturn of 2008–09 has confirmed that: (i) housing is the single most critical part of the U.S. business cycle, (ii) the proper conduct of monetary policy needs to be cognizant that choices made at one point in time affect the options later, and (iii) the best time to intervene in the housing cycle is when the volume of building is above normal and growing more so. What was different this time was the rapid and substantial decline in home prices.

*JEL* codes: E32, E58, L74, R31

Keywords: business cycle, homes, housing.



I WAS ASKED IN 2006 to prepare a paper for the 2007 Jackson Hole conference titled “Housing and the Business Cycle.” For rhetorical purposes, I changed the title to “Housing IS the Business Cycle” (Leamer 2008). Six years later I have been asked by the organizers of the November 2013 Fed/IMF/JMCB conference to comment on how my opinion has changed in light of the recession that the U.S. suffered in 2008–09. For that purpose, I change my title to “Housing REALLY IS the Business Cycle.”

# Using *Leading* Indicators as a solution to the puzzle

- So... *maybe not so surprising* that housing/construction indicators could help explain the Depression's *Stock Vol* puzzle?
- The list of plausible leading indicators available for this period also includes financial-side variables, e.g. *credit spreads*  
*Estrella & Mishkin (1998); Stock & Watson (1989; 1991)*
- Two important spreads are available:  
[1] Aa Corporate Bonds *vs.* Prime Commercial Paper;  
[2] Junk Corporate Bonds *vs.* Aa Bonds  
*Basile, Kang, Landon-Lane & Rockoff (2015)*
- For completeness, we also test for *coincident* indicators such as Industrial Production, Retail Sales, M1, etc. as in *Schwert (1989)*

# Data

- **Building Permits**

- Data constructed from building inspector reports
- Includes the value of both *commercial* and *residential* permits.
- Collected by *F.W. Dodge Division* (a *McGraw-Hill* company), provided to the *Bureau of Labor Statistics*, *Federal Reserve Bulletin*, and to the monthly financial publication *Dun & Bradstreet's* (our source)
- **Representativeness:** spans major cities + small towns all over the US.  
**Total: 215 cities starting in 1928:M1**  
(variable number of cities before that)

- **Sample:** 1928:M1–1938:M12

- **Financial Leverage**

- From *Moody's Manuals*, built by *Graham, Leary & Roberts* (2015)
- Defined as  $Debt / (Debt + Market Equity)$  for non-financial firms

# Data

- **Political Instability**

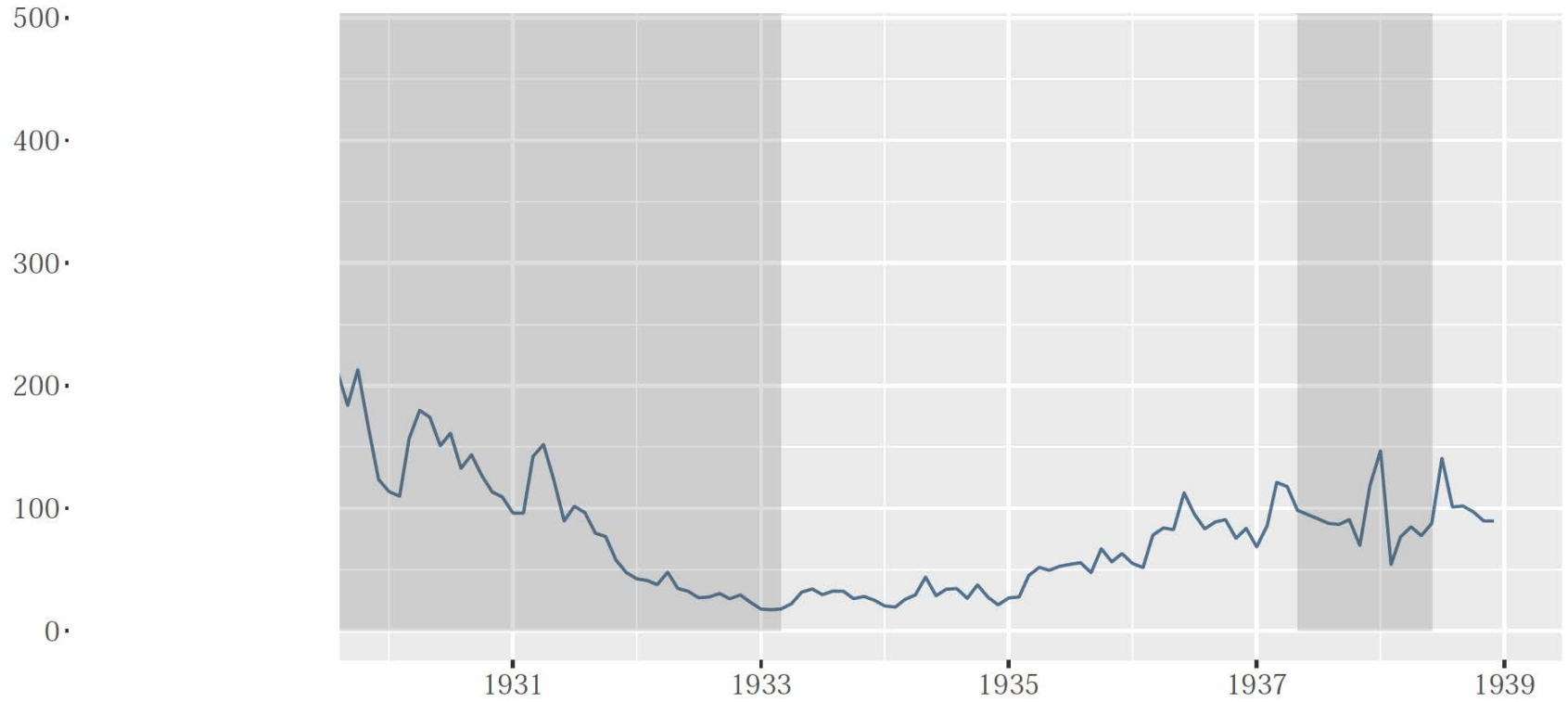
- We construct a monthly version for the United States using the cross-country annual dataset assembled by *Banks (1976)* [*Cross-Polity Time Series*]
- It's a newspaper-based count of events related to political instability, e.g. **[1] riots**, **[2] anti-govt. demonstrations**, **[3] political assassinations (or attempts)**, and **[4] general strikes**
- Each event must have at least 100 people involved to be included
- The four political events proxy for the **communist scare** and **expropriation risk** discussed by *Merton (1985)/Schwert (1989)*.
- **Example:** Riot in February 10, 1931

*“200 Communists and sympathizers and about as many police staged a series of fights and scuffles along the Boston Common today, providing an hour’s excitement and several traffic jams.”*

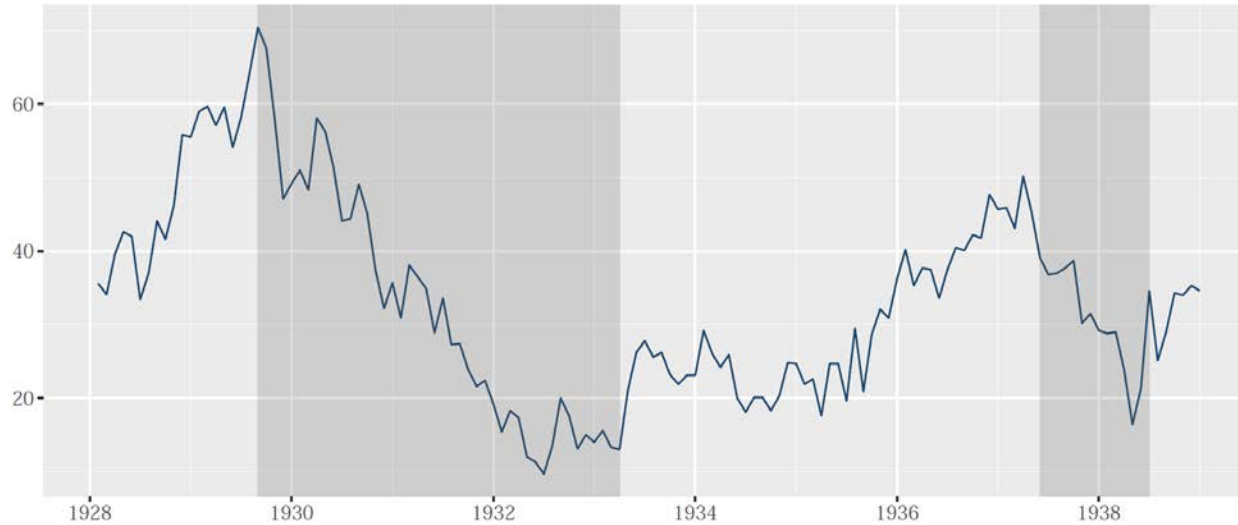
- **Financial/Macroeconomic Data**

- Federal Reserve Bulletins, otherwise noted

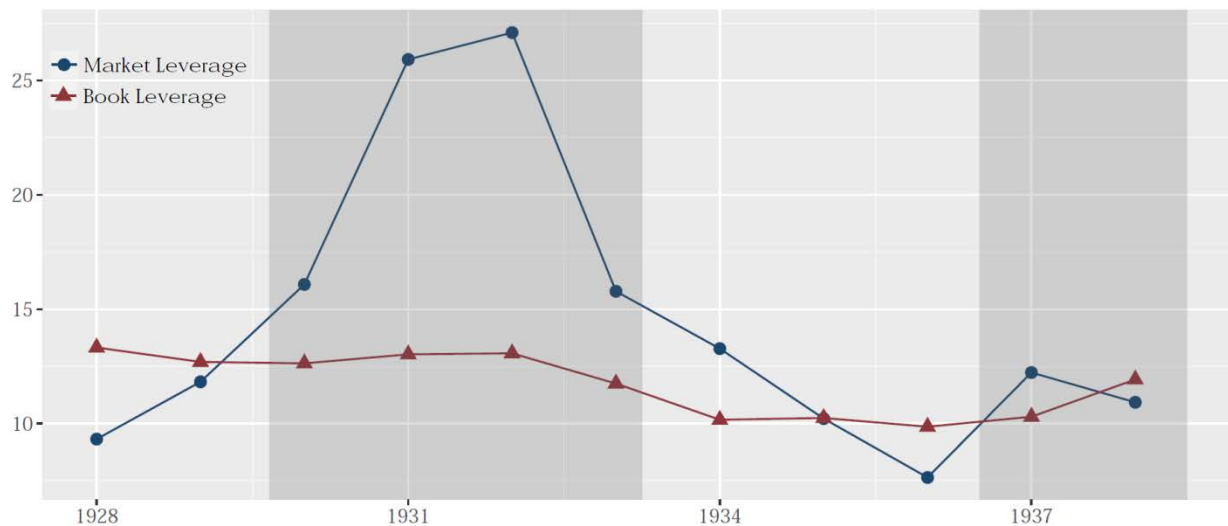
## *Value of Building Permits (Million USD)*



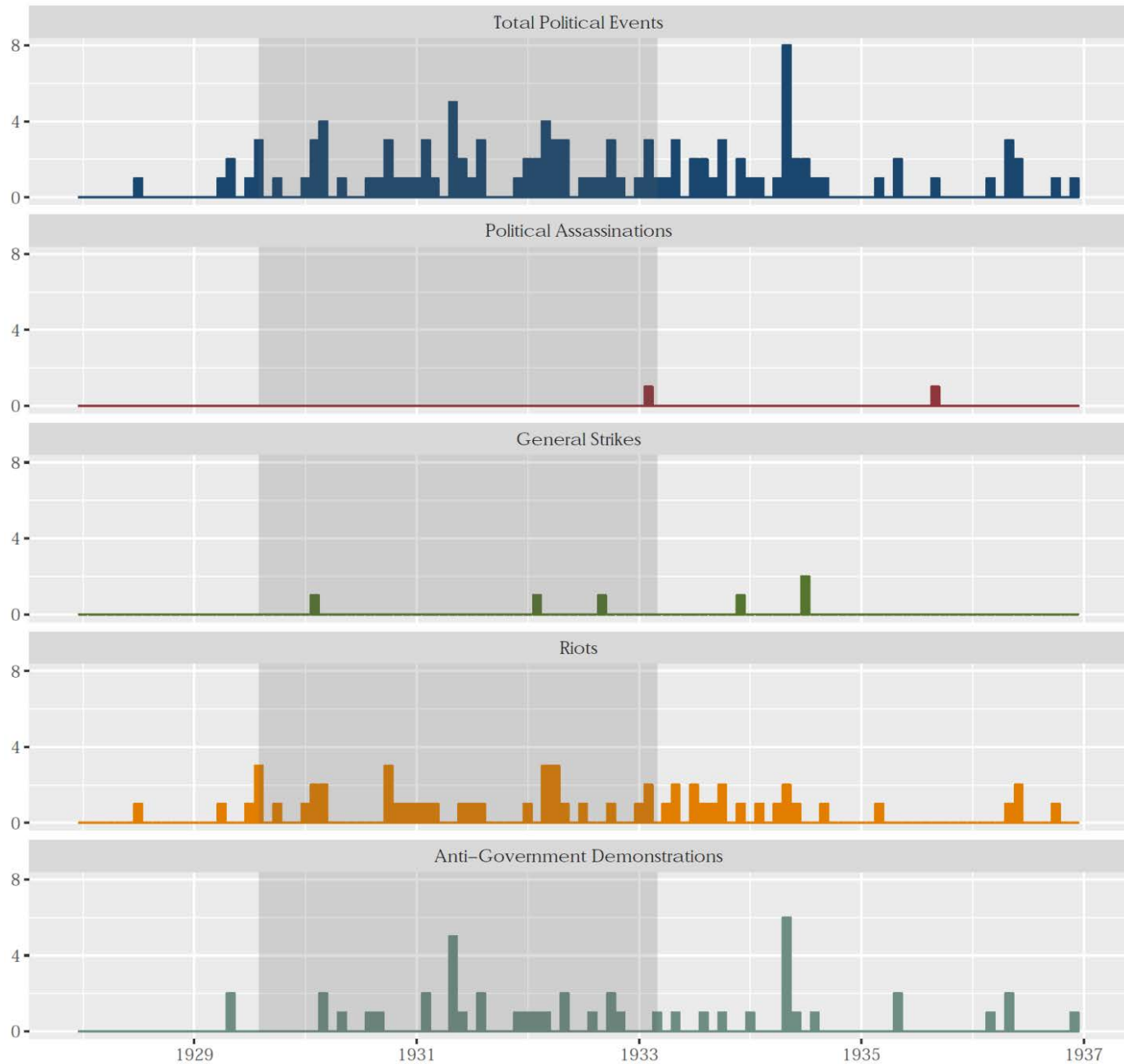
## *Aggregate Market Value of Equity (1928:M1-1938:M12)*



## *Aggregate Corporate Leverage: Book and Market Value (1928-1938)*



# Politics (1928:M1-1938:M12)





## *Descriptive Stats: Full Sample (1928:M1-1938:M12)*

Variable	Mean	Median	Std. Dev.	N. Obs.	Min	Max	Percentile, conditional on non-zero			
							10 <sup>th</sup>	25 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>
Stock Return Vol	0.017	0.014	0.009	132	0.005	0.049	0.007	0.010	0.022	0.031
Mkt Value Leverage	14.606	12.236	6.155	132	7.648	27.093	9.326	10.222	16.086	25.918
Building Permit Vol	0.037	0.028	0.025	132	0.024	0.193	0.025	0.026	0.038	0.052
Assassinations	0.015	0.000	0.123	132	1	1	1	1	1	1
General Strikes	0.046	0.000	0.244	132	1	2	1	1	1	2
Riots	0.435	0.000	0.745	132	1	3	1	1	2	2
Anti-Government Demonstrations	0.397	0.000	0.883	132	1	6	1	1	2	2
Total Political Events	0.908	0.000	1.267	132	1	8	1	1	2	3

## *Great Depression Sub-sample (1929:M8-1933:M3)*

Variable	Mean	Median	Std. Dev.	N. Obs.	Min	Max	Percentile, conditional on non-zero			
							10 <sup>th</sup>	25 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>
Stock Return Vol	0.023	0.021	0.011	44	0.007	0.049	0.009	0.013	0.028	0.040
Mkt Value Leverage	21.055	25.918	6.052	44	11.830	27.093	11.830	16.086	27.092	27.092
Building Permit Vol	0.033	0.029	0.010	44	0.024	0.083	0.025	0.026	0.036	0.046
Assassinations	0.022	0.000	0.015	44	1	1	1	1	1	1
General Strikes	0.066	0.000	0.252	44	1	1	1	1	1	1
Riots	0.755	1.000	0.933	44	1	3	1	1	2	3
Anti-Government Demonstrations	0.578	0.000	0.965	44	1	5	1	1	2	2
Political Events	1.422	1.000	1.322	44	1	5	1	1	3	3

# Empirical Strategy

- **First Step:** extract a measure of volatility from raw data
  - Standard approach: *GARCH(1,1)*
  - **Exception:** Stock Returns Volatility! Values too extreme for model to be estimated by ML, so we follow *Schwert (1989)* and take *monthly standard deviations* from daily returns data
- **Second Step:** run the family of regressions (*7 lags chosen by AIC*)

$$\begin{aligned} \text{Stock Vol}_t = & \beta_0 + \sum_{m=1}^{11} D_m + \sum_{p=1}^7 \beta_{1,p} \cdot \text{Stock Vol}_{t-p} + \sum_{p=1}^7 \beta_{2,p} \cdot \text{Lev}_{t-p} \\ & + \sum_{p=1}^7 \beta_{3,p} \cdot \text{Permit Vol}_{t-p} + \sum_{p=1}^7 \beta_{4,p} \cdot \text{Politics}_{t-p} + \varepsilon_t \end{aligned}$$

# Empirical Strategy

We estimate the following models:

1. **Autoregressive Model:** only the lags of *Stock Vol* and seasonal dummies to measure how much of current volatility is explained by historical volatility
2. **Pure Leverage Model:** adds the lags of leverage to the above
3. **Economic Model:** leverage model + *Building Permit Growth Vol*
4. **Political Model:** leverage model + *Politics* ( $\Sigma$  political events)
5. **Joint Econ-Political Model:** combining the 2 models above

As in *Schwert (1989)* and *Flannery & Protopapadakis (2002)*, we can assess each model's capability of explaining the time series variation in stock volatility by comparing the R-squared values

**Full Sample**  
(1928:M1-1938:M12)

[1]

Autoregressive  
Model

**Lags of Variable:**

R<sup>2</sup> = 0.60

<b><i>Stock Vol</i></b>	Sum Coeff	0.843
(Std. Dev. of Stock Returns)	F-Test Stat	157.91
	p-value	0.000***
<b><i>Lev</i></b>	Sum Coeff	-
(Market Leverage)	F-Test Stat	-
	p-value	-
<b><i>Permit Vol</i></b>	Sum Coeff	-
(Vol of Building Permit Growth)	F-Test Stat	-
	p-value	-
<b><i>Politics</i></b>	Sum Coeff	-
(Sum Political Conflict Variables)	F-Test Stat	-
	p-value	-
Seasonal Dummies		YES
N. Observations		132

# What if we focus only on the Great Depression?

---

USING NBER RECESSION DATES

**Great Depression  
Subsample**  
(1929:M8-1933:M3)

[1]

Autoregressive  
Model

**Lags of Variable:**

R<sup>2</sup> = 0.42

<b><i>Stock Vol</i></b>	Sum Coefficients	0.683
(Std. Dev. of Stock Returns)	F-Test Statistic	34.36
	p-value	0.000***
<b><i>Lev</i></b>	Sum Coefficients	-
(Market Leverage)	F-Test Statistic	-
	p-value	-
<b><i>Permit Vol</i></b>	Sum Coefficients	-
(Vol of Building Permit Growth)	F-Test Statistic	-
	p-value	-
<b><i>Politics</i></b>	Sum Coefficients	-
(Sum of Political Variables)	F-Test Statistic	-
	p-value	-
Seasonal Dummies		NO
N. Observations		44

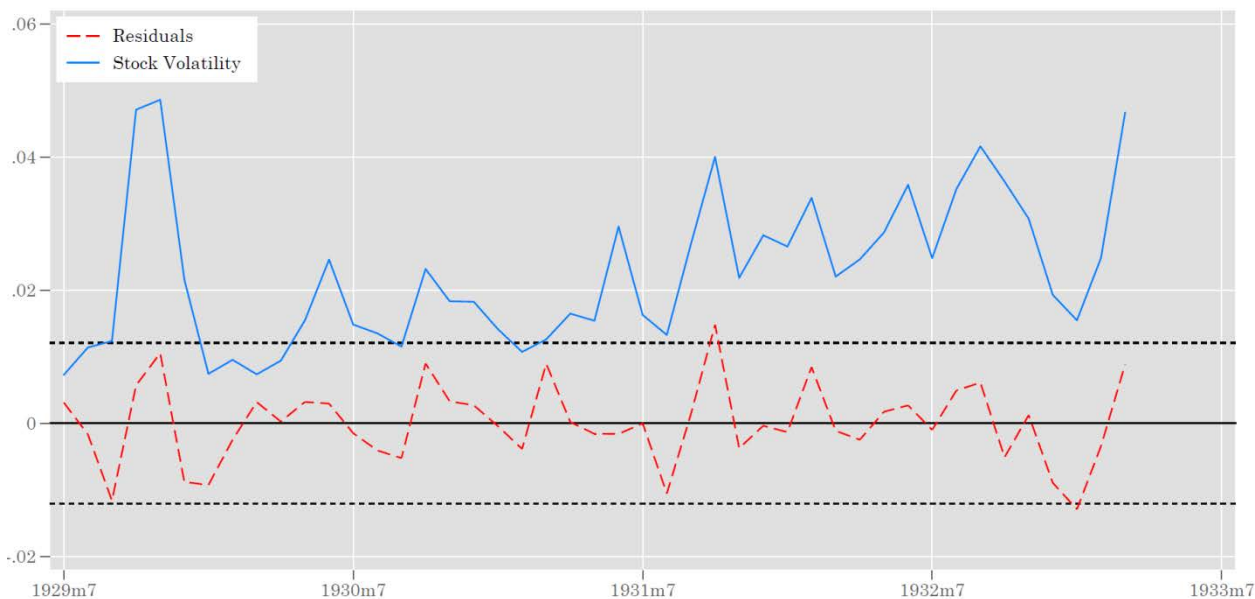
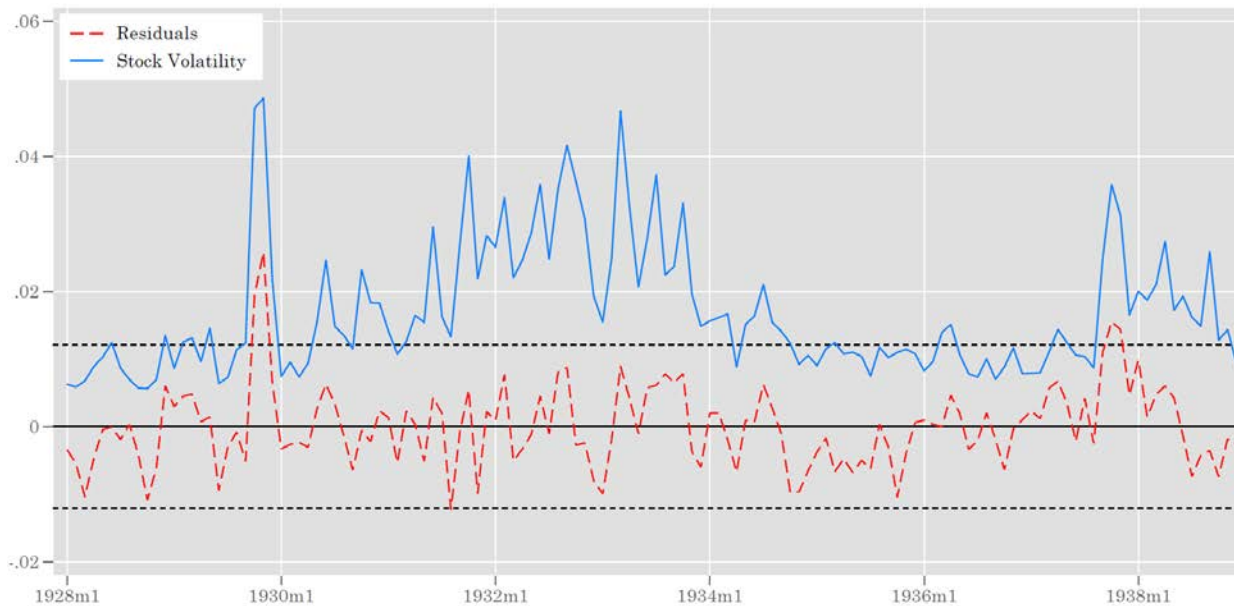
# Residuals Analysis

---

WHAT HAPPENS TO THE **HUGE SPIKES OF STOCK VOLATILITY** ONCE WE CONTROL FOR **OUR MOST IMPORTANT REGRESSORS**?

To be parsimonious, include only 2 variables:

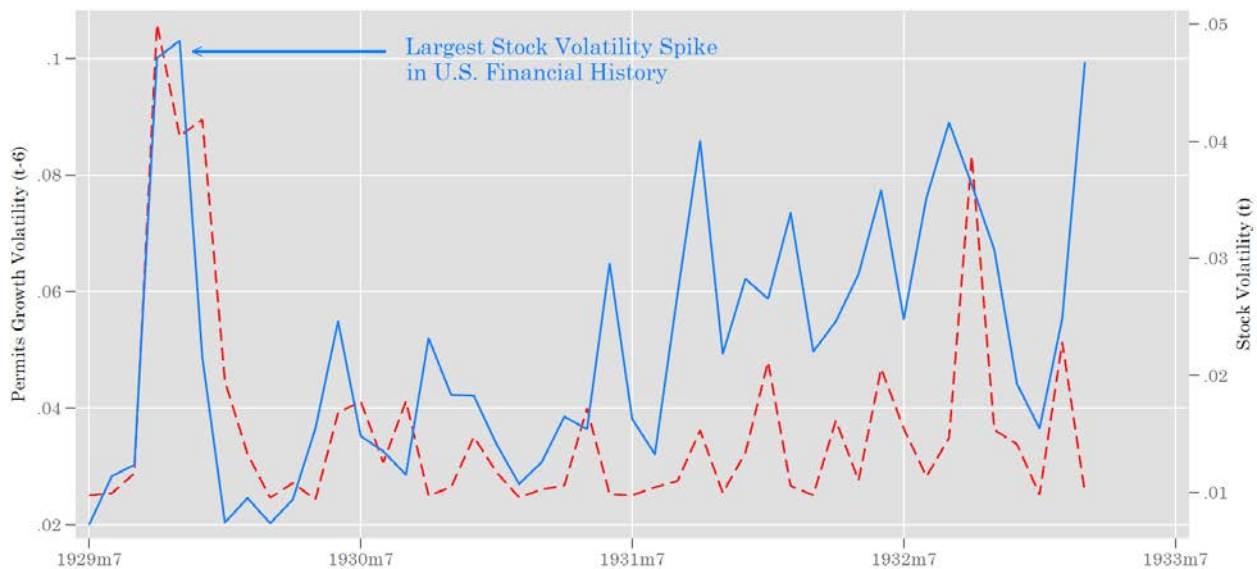
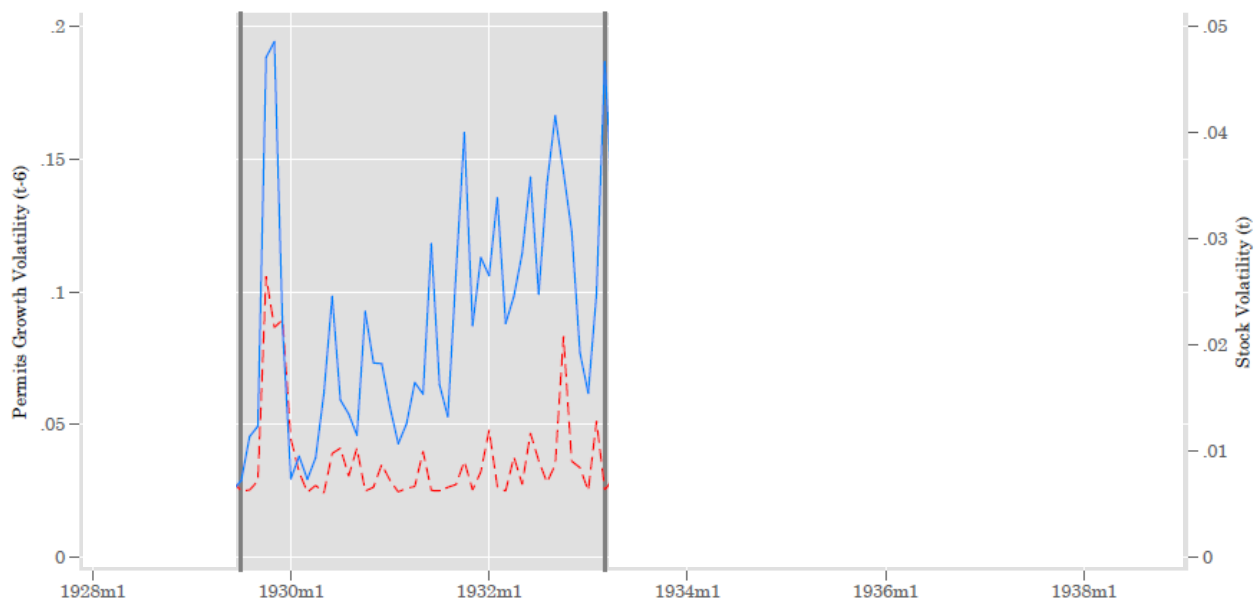
*leverage* and *building permit vol*  
[not even stock volatility lags!]





**Surprising the model does better in the GD?** Maybe not so much...

## GREAT DEPRESSION



# Robustness

---

CAN OTHER INDICATORS BEAT **BUILDING  
PERMIT VOLATILITY?**

**Full Sample**  
(1928:M1-1938:M12) [1]

Retail  
Sales

**Lags of Variable:** R<sup>2</sup> = 0.76

<b><i>Stock Vol</i></b>	Sum Coefficients	0.458
(Std. Dev. of Stock Returns)	F-Test Statistic	32.09
	p-value	0.000***
<b><i>Lev</i></b>	Sum Coefficients	0.001
(Market Leverage)	F-Test Statistic	27.50
	p-value	0.000***
<b><i>Permit Vol</i></b>	Sum Coefficients	0.090
(Vol of Building Permit Growth)	F-Test Statistic	27.54
	p-value	0.000***
<b><i>Retail Sales Vol</i></b>	Sum Coefficients	0.000
(Retail Sales Volatility)	F-Test Statistic	10.19
	p-value	0.178

# A follow-up question

---

IF **PERMIT VOLATILITY** IS SO IMPORTANT FOR EXPLAINING STOCK VOLATILITY, WHAT COULD BE DRIVING THE GROWTH RATE OF **PERMIT VOL** IN THE FIRST PLACE?

# Drivers of Building Permit Volatility

We estimate the following models:

1. **Autoregressive:** only the lags of *Permit Vol* and seasonal dummies to measure how much of current volatility is explained by historical volatility
2. **Real Channel:** adds lags of *Retail Sales Vol* to the AR model
3. **Monetary Channel:** adds lags of *M2 Vol* to the AR model
4. **Credit Channel 1:** adds lags of *Junk-Aa Spread* to AR model
5. **Credit Channel 2:** adds lags of *Prime CP-Aa Spread* to the AR model
6. **All Channels:** combining all models above

---

**Full Sample**  
(1928:M1-1938:M12)

[1]

Autoregressive  
Model

---

**Lags of Variable:**

$R^2 = 0.24$

---

<b><i>Permit Vol</i></b>	Sum Coefficients	0.434
(Vol of Building Permit	F-Test Statistic	12.02
Growth)	p-value	0.100*

# Concluding Remarks

- Leading indicators largely solve the Great Depression's stock volatility puzzle
- The *political explanation* as measured by the risk of a communist takeover is *at odds with the data*
- Forecasting scholars (e.g. Leamer) were right on the *financial side* of the Great Depression too: housing/construction market is one of the most important drivers of stock market volatility
- We still need more work to uncover what's behind the high volatility in housing/construction markets in the period preceding the Great Crash of 1929

# THANK YOU!

---

**GUSTAVO S. CORTES**

*University of Illinois  
at Urbana-Champaign*

***DSLVCRT2@ILLINOIS.EDU***

**MARC D. WEIDENMIER**

*Claremont McKenna College  
& NBER*

***MARC.WEIDENMIER@CMC.EDU***