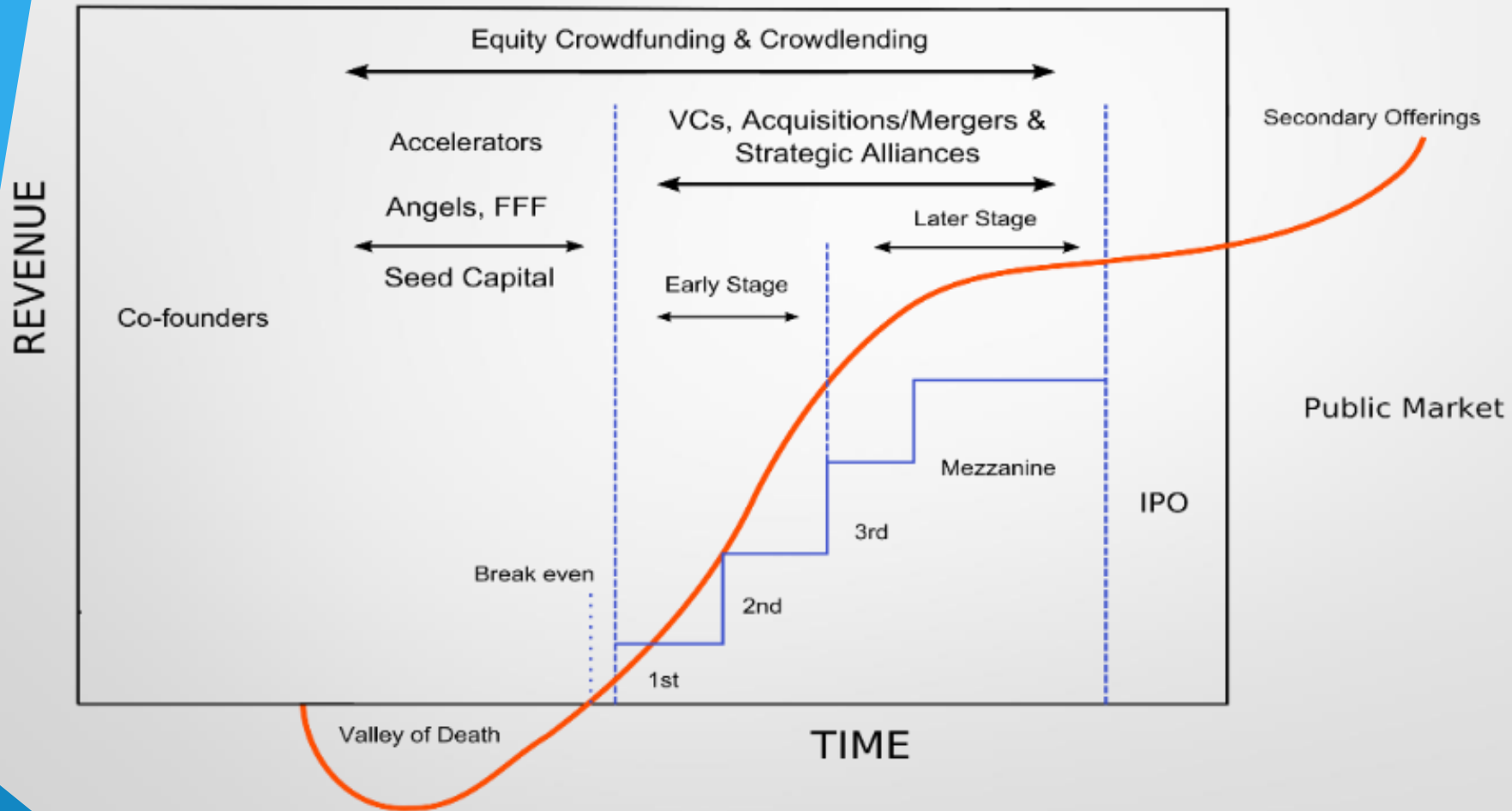# Venture Capital

Robust features that influence change in industry specific deals

Harrison Zhao and Andrew Koe

Startup Financing Cycle

Data

- Venture capital data obtained from PriceWaterhouseCoopers (PWC)

- NASDAQ data obtained from Yahoo finance.

- Data starts at Q1 1997 and ends Q3 2015

Venture Sectors

- Biotechnology
- Energy
- Financial
- Healthcare
- Industrial

- IT
- Software
- Telecommunication
- Semiconductors

NASDAQ Sector Indices

- Bank
- Biotechnology
- Computer
- Industrial

- Insurance
- Other finance
- Telecommunication

PWC Historical Venture Capital

Historical trend data

Source: PwC/NVCA MoneyTree™ Report, Data: Thomson Reuters
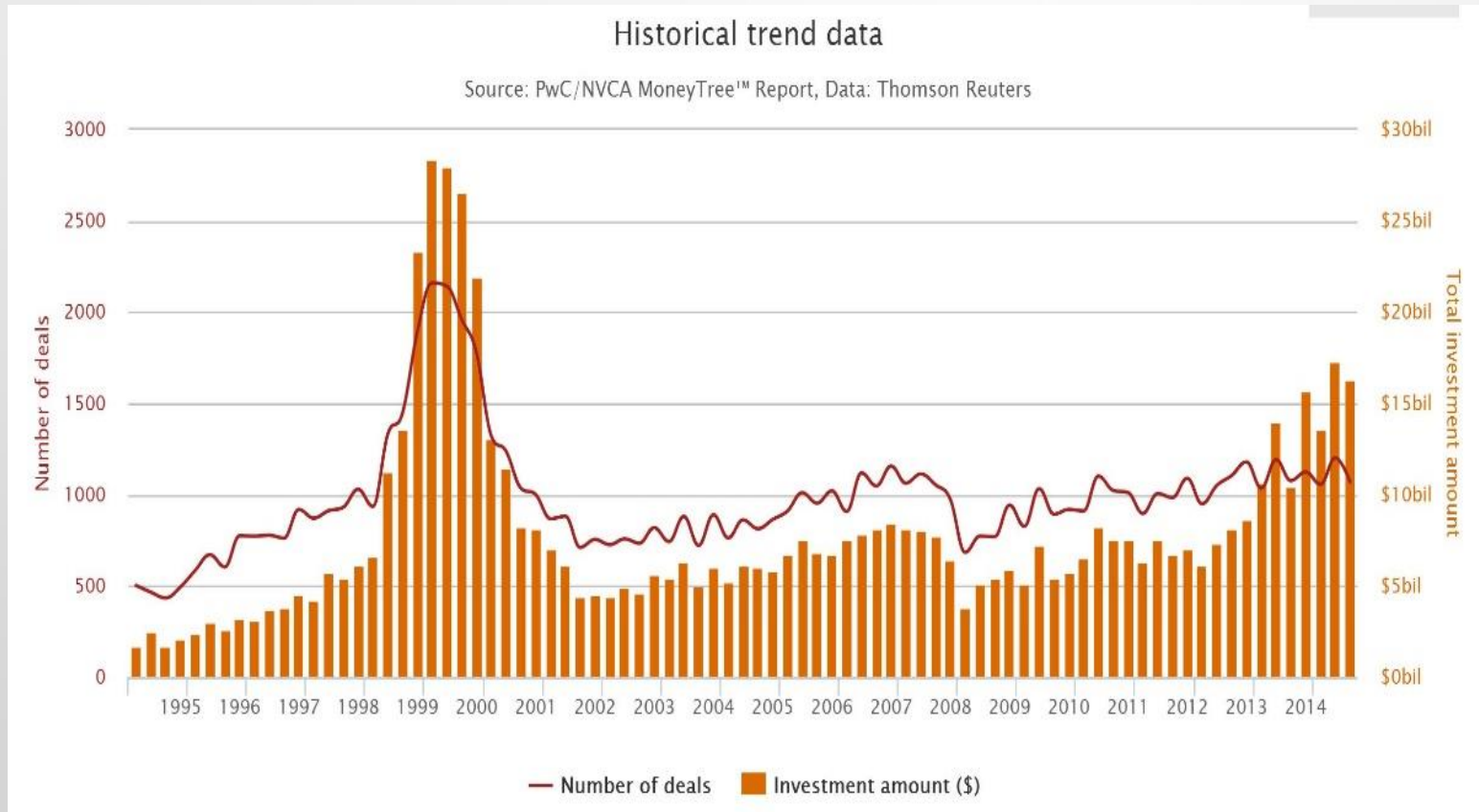
Preprocessing Data - PWC

- Formatted as quarterly data
- Raw data features are:
  - Number of deals and total amount of dollars invested
- Number of deals is highly correlated with total dollar amount invested
- Features used are:
  - Number of deals
- De-mean and standardize

Regression of VC investment
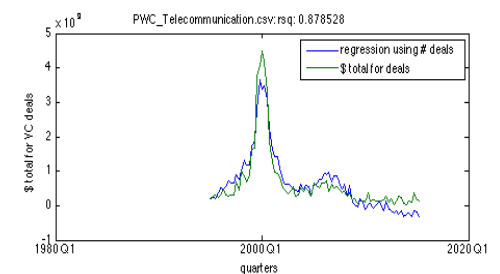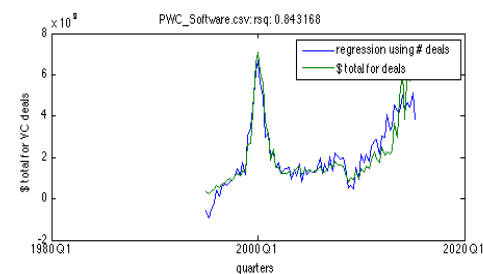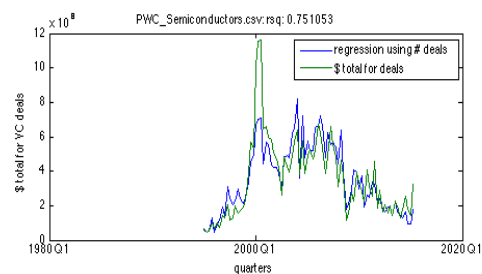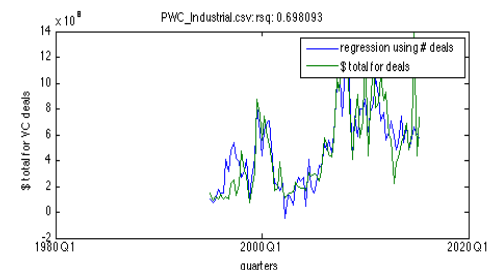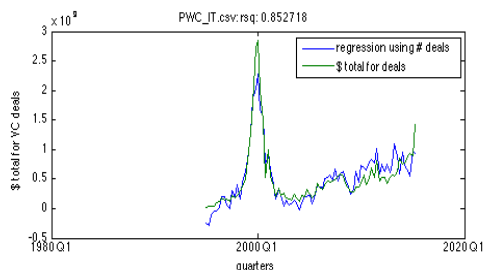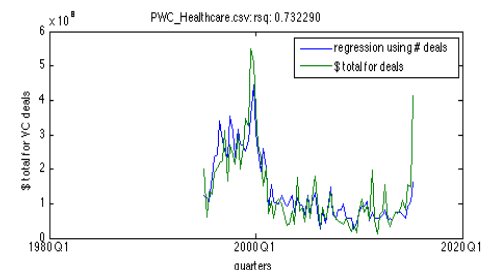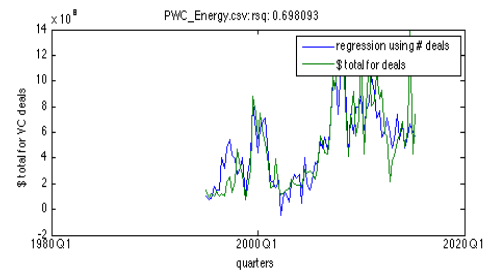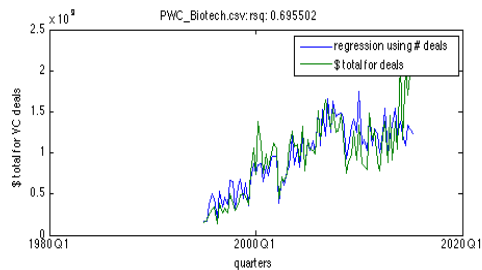
Preprocessing Data - NASDAQ

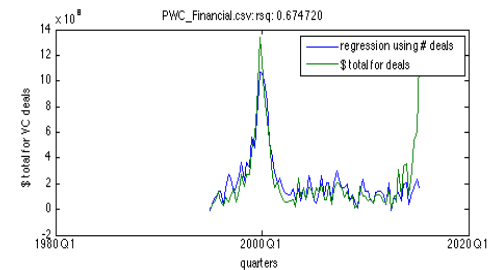- Monthly data converted to quarterly data

- Raw data features are:

    - Opening, high, low, and close indices

- Features extracted are:

    - Opening, high, low, close indices, momentum, and swing

- De-mean and standardized

- All features other than momentum are converted to units of % change since last quarter

Preliminary Analysis

- Perform regression analysis on atypical periods of time

    - Dotcom bubble (Q1 1998 – Q1 2004)

    - Subprime Mortgage Crisis (Q1 2006 – Q1 2013)

- Use related NASDAQ industries as independent variables

- Use F-test to identify relevant variables

Dotcom Bubble Analysis

regression for % change VC software deals during dotcom era
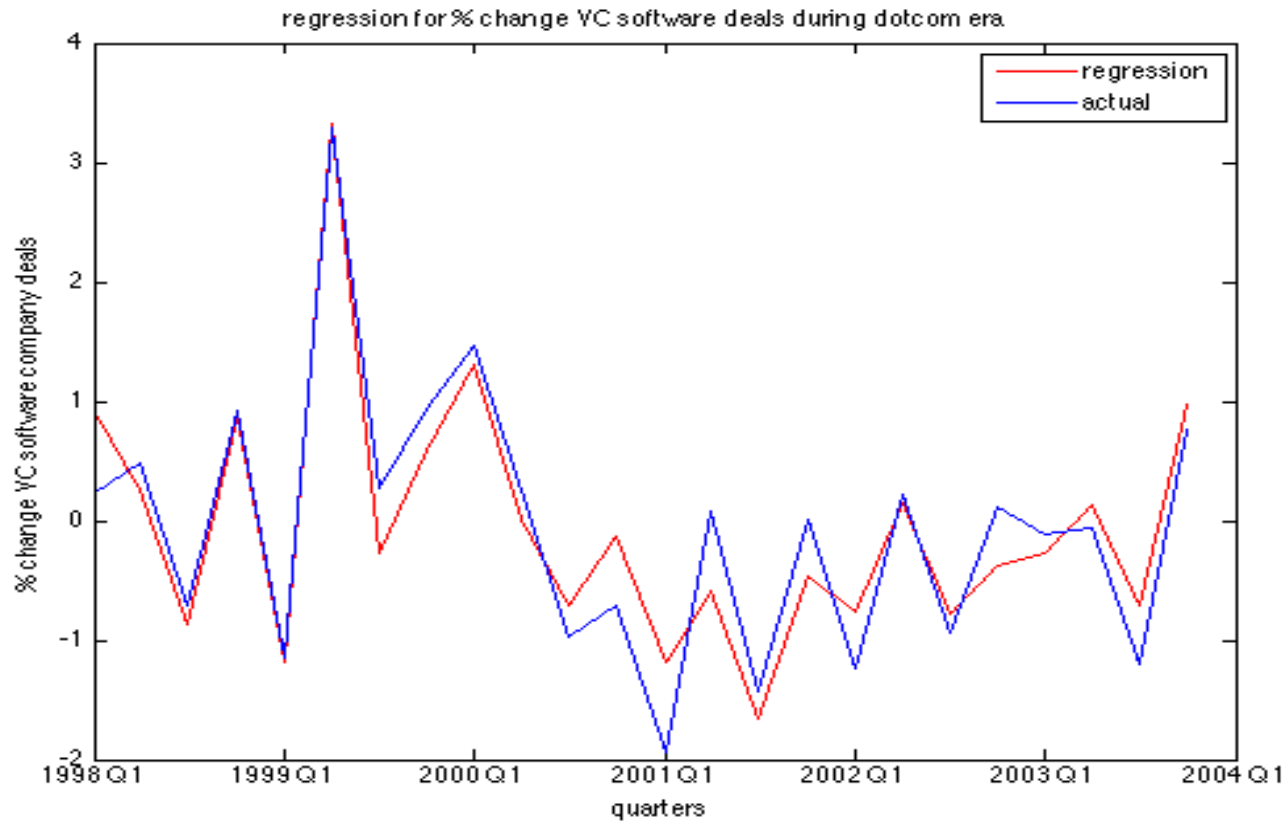
Subprime Mortgage Crisis Analysis

regression for % change VC industrial deals during subprime mortgage crisis
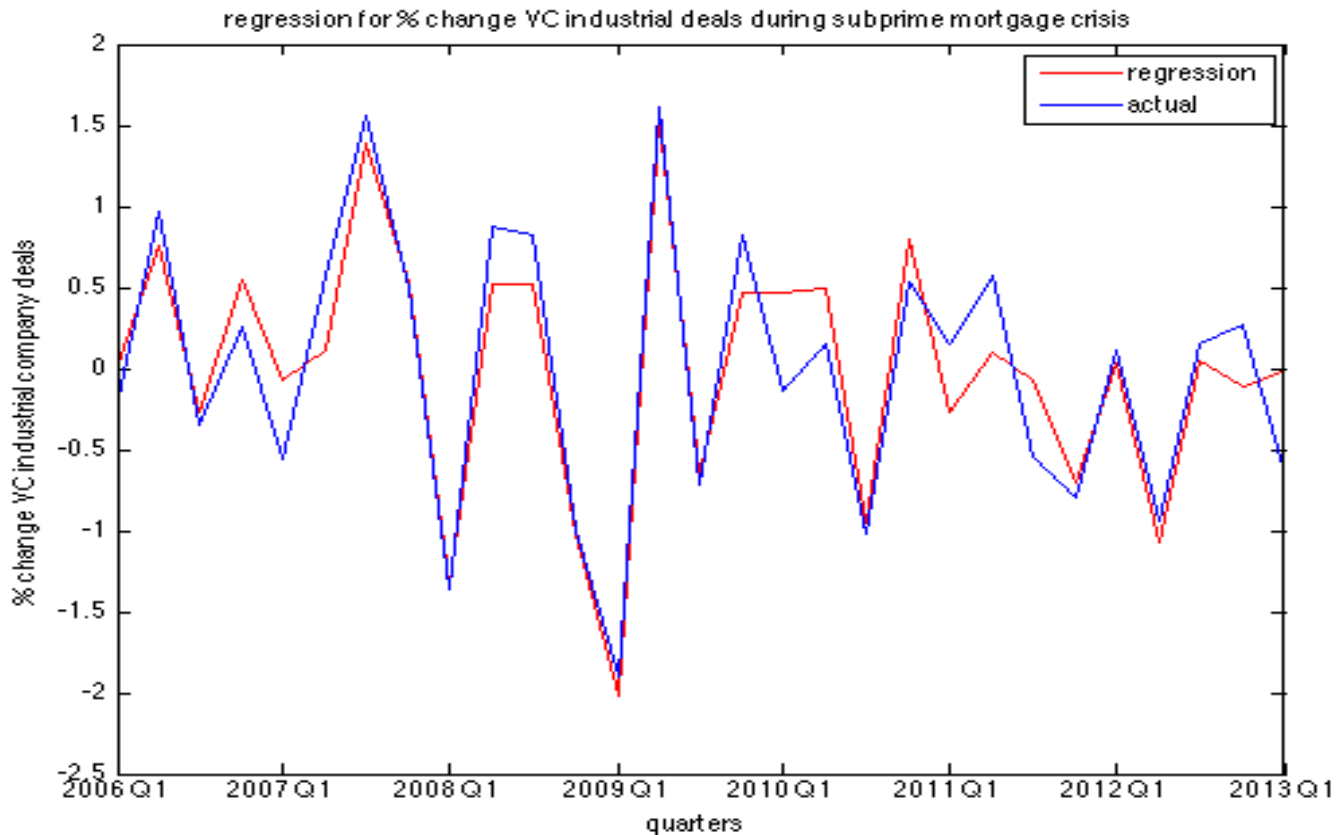
Rolling Window Analysis

- Perform regressions on 3, 4, and 5 year windows on the PWC data

- Roll the window forward one quarter and iteratively perform regressions

- Identify NASDAQ features that are valuable independent variables

- Choose independent variables that yield stable regression coefficients throughout the analysis

Data in Rolling Window Analysis

- All the features extracted from the NASDAQ data are candidate independent variables

  - 7 NASDAQ indices

  - 6 features per index

  - 42 total features

- Regression is performed for each of the 9 PWC sector indices

- NASDAQ features are filtered down using the F-test

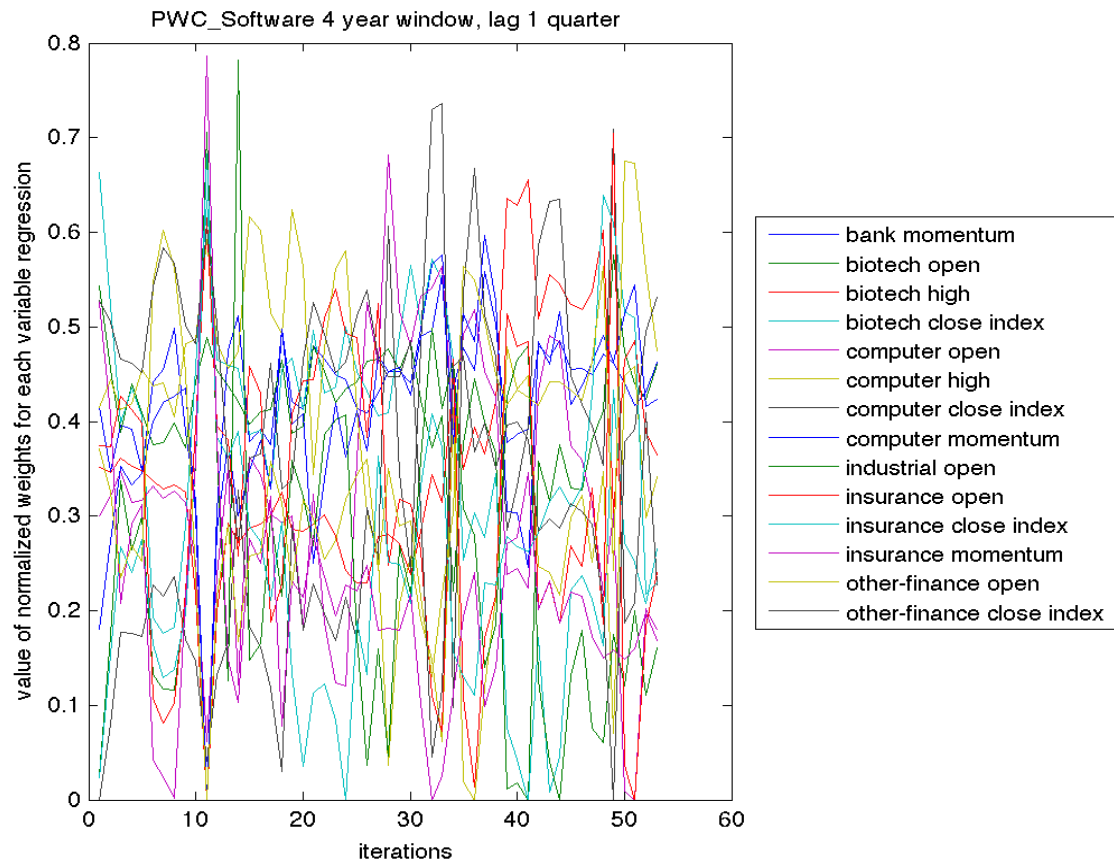# Rolling Window Analysis
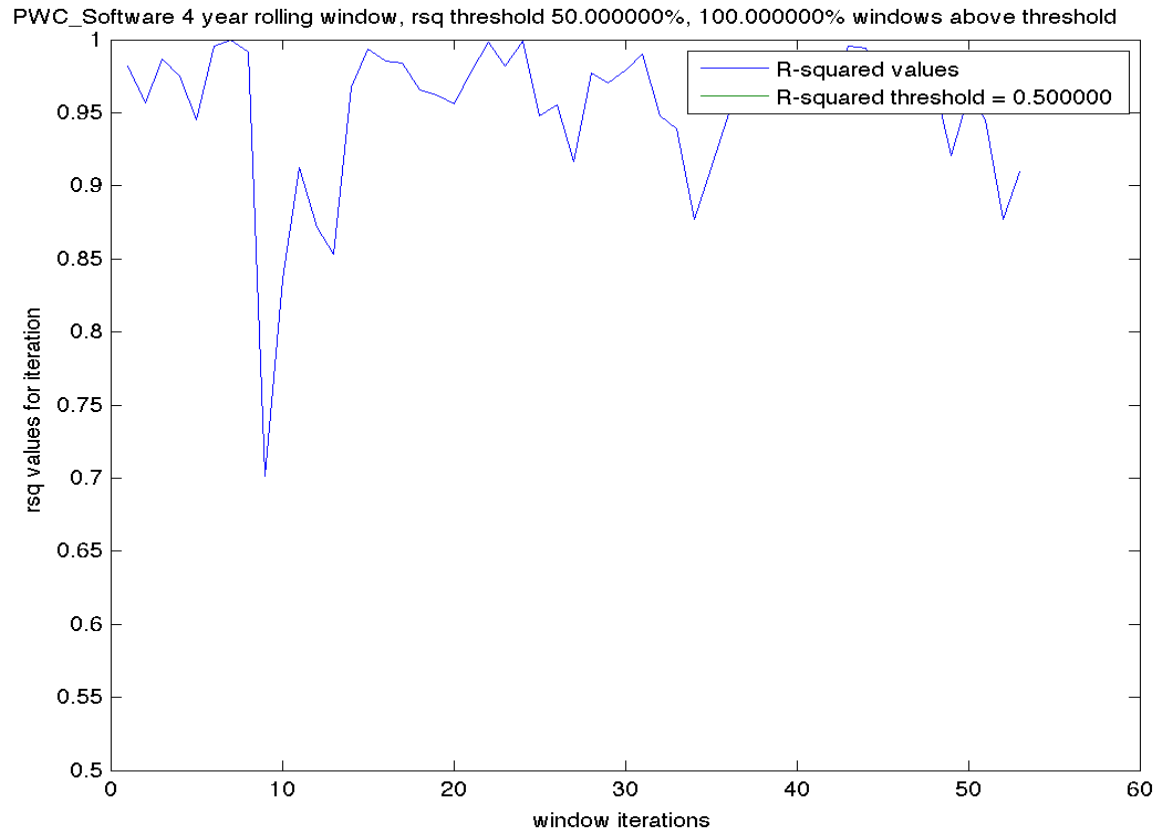
Relevant Variables and Weights

PWC_Software 4 year window, lag 1 quarter

Legend:
- bank momentum
- biotech open
- biotech high
- biotech close index
- computer open
- computer high
- computer close index
- computer momentum
- industrial open
- insurance open
- insurance close index
- insurance momentum
- other-finance open
- other-finance close index

x-axis: iterations

y-axis: value of normalized weights for each variable regression

Stable Weights for Analysis

PWC_Software 4 year window, stable weights with variance of < 0.020000

Legend:
- bank momentum
- biotech open
- biotech high
- computer momentum
- insurance momentum
- other-finance open
- other-finance close index

x-axis: window iterations
y-axis: normalized weight values
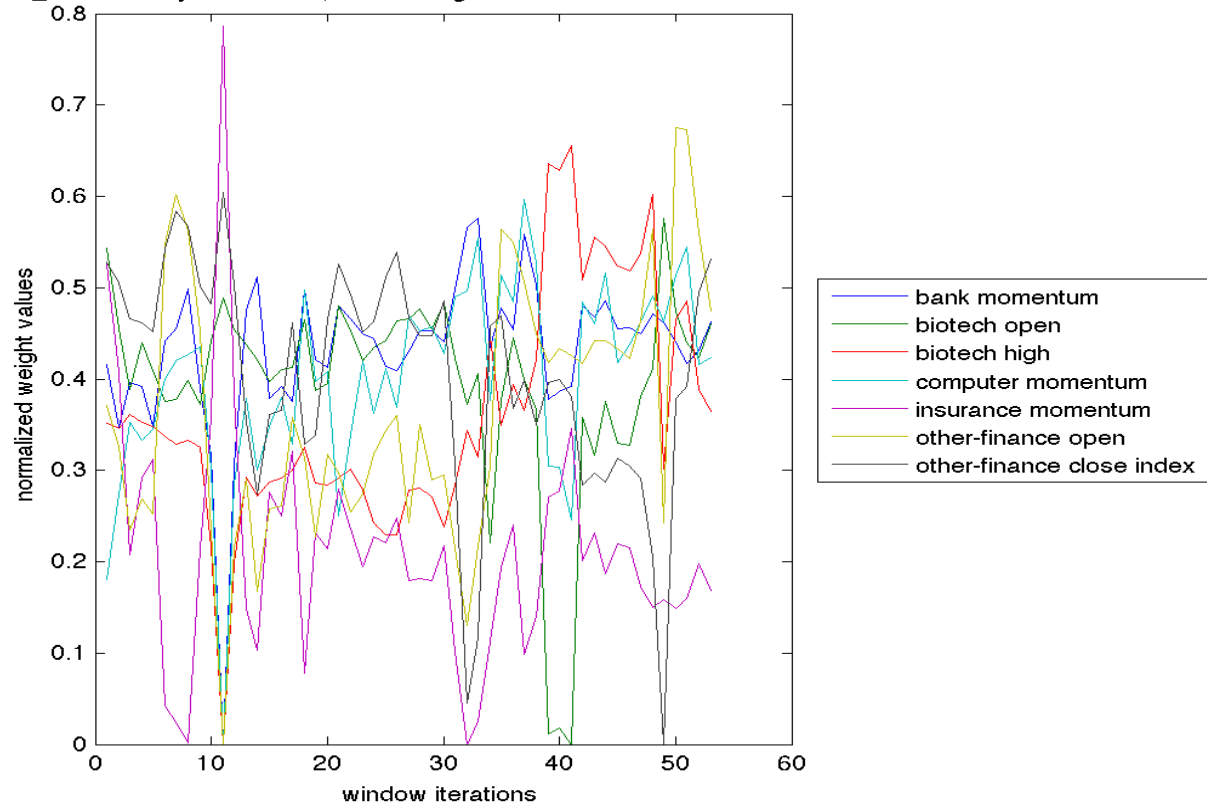
Examining Stable Weights

PWC_Software 4 year window, weights with variance of 0.006758 < 0.020000 threshold
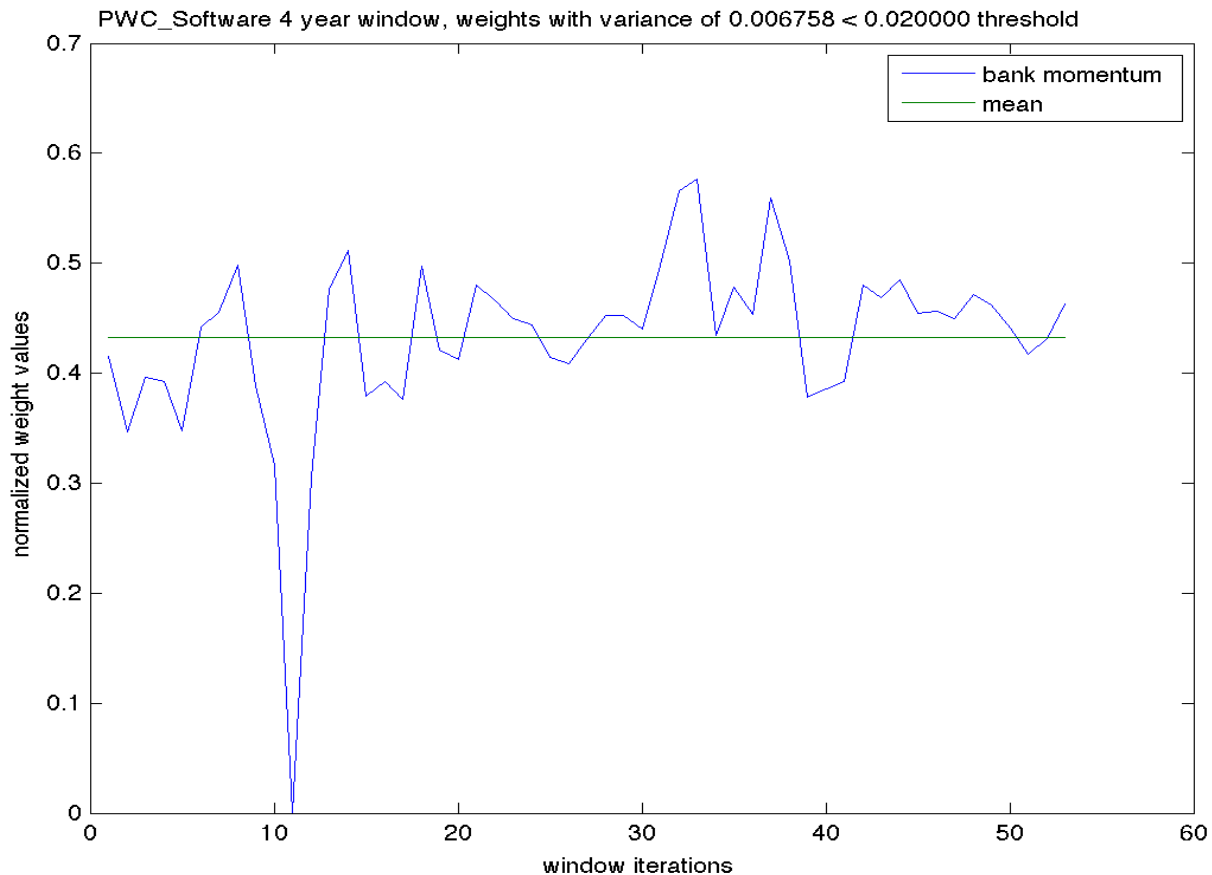
Conclusions

- During atypical periods for the public market, market volatility and investor uncertainty was also reflected in private investments

- Performance of related sectors are also strong indicators of investors' willingness to invest in startups

Questions?