Good News, Bad News, and Your Money
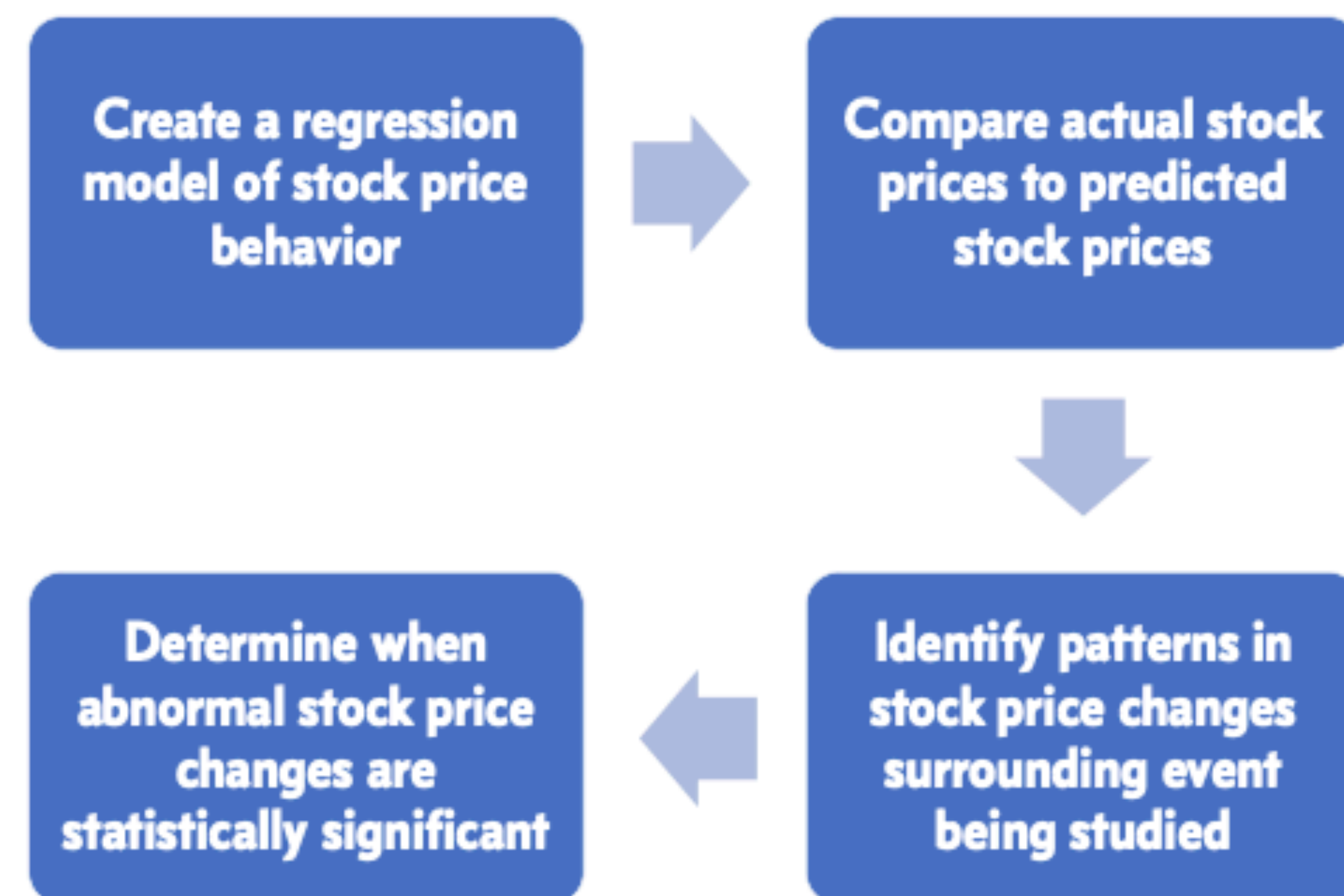## *Empirical Investigation of Cognitive Bias in Investment Decisions*

Arul Nigam

Methods and Data

Event Study Methodology (Time Series Analysis)

Identify abnormal changes in stock prices related to an event

Create a regression model of stock price behavior → Compare actual stock prices to predicted stock prices → Identify patterns in stock price changes surrounding event being studied → Determine when abnormal stock price changes are statistically significant

Data

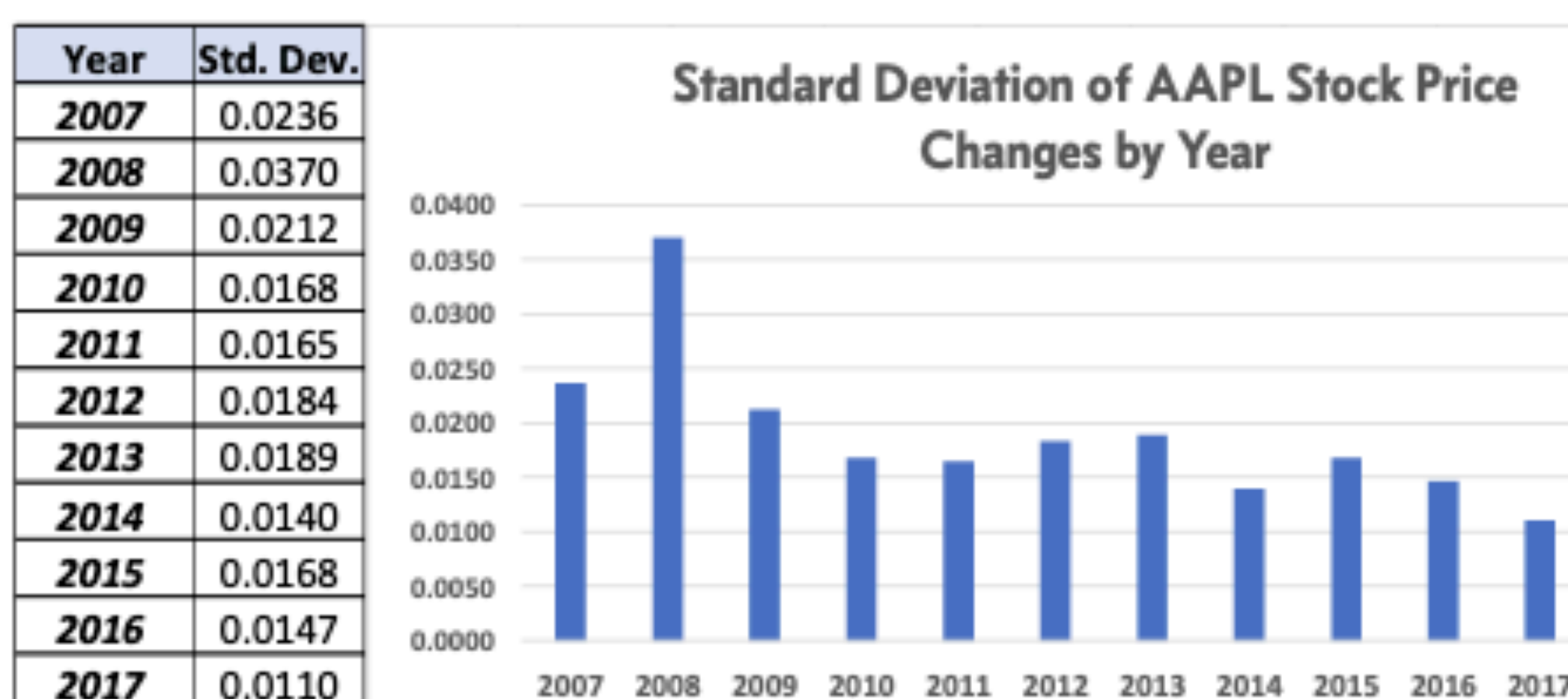Past seven Apple iPhones announcements (2012-2018)

- Dates obtained from review of news sources

Apple Stock Prices (pre-processed)

- Adjusted for dividends and splits
- Adjusted closing prices obtained from Yahoo Finance
- Compute Log-Return: $r_t = \ln\left(\frac{v_t}{v_{t-1}}\right) - 1$
- Period: 100 days prior to iPhone announcement to 50 days afterwards

SPDR® S&P 500 ETF Prices

- Adjusted closing price obtained from Yahoo Finance
- ETF used instead of S&P 500 Index to better reflect a tradable security

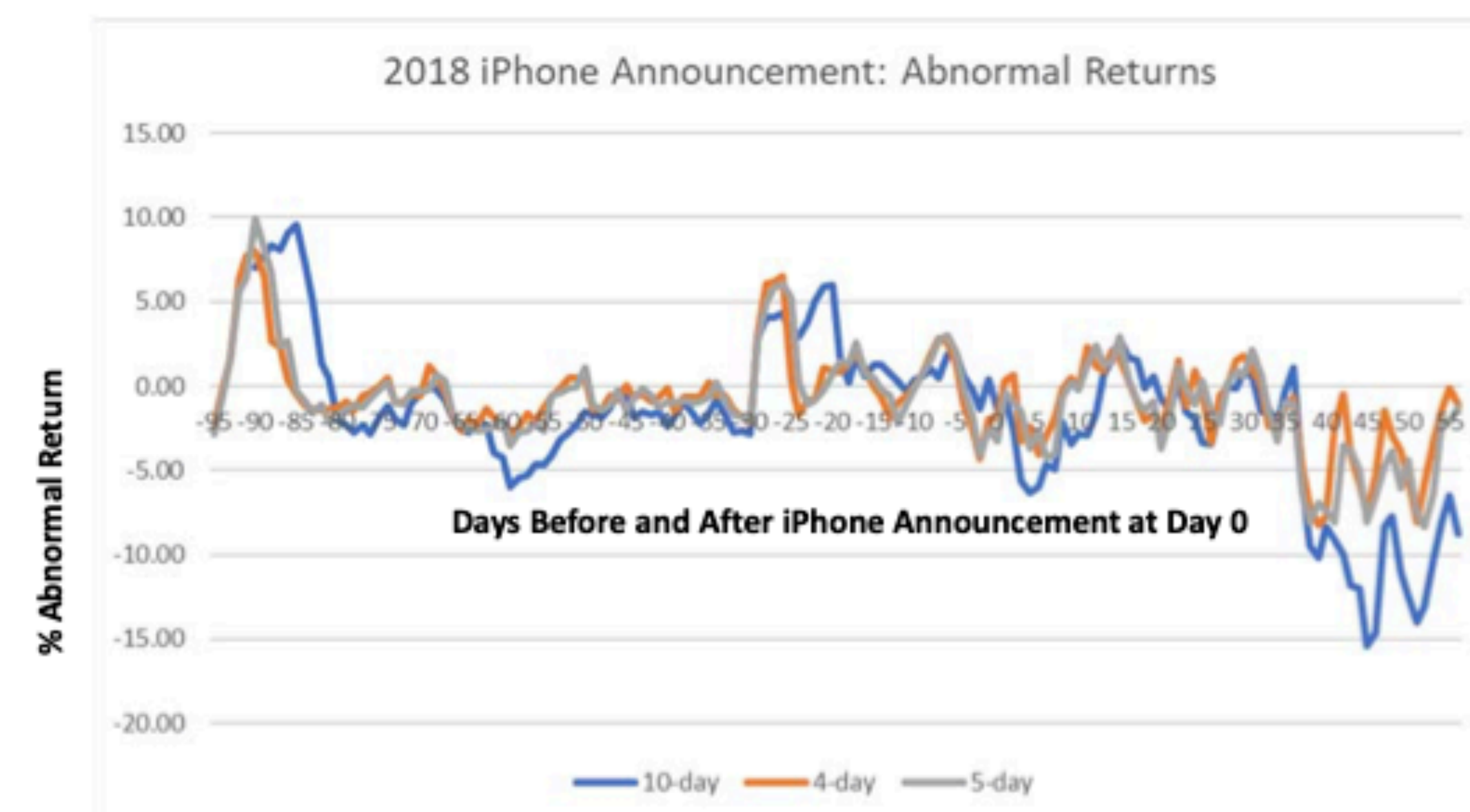| Year	Std. Dev.
2007	0.0236
2008	0.0370
2009	0.0212
2010	0.0168
2011	0.0165
2012	0.0184
2013	0.0189
2014	0.0140
2015	0.0168
2016	0.0147
2017	0.0110

Standard Deviation of AAPL Stock Price Changes by Year

Introduction and Background

The semi-strong form of Efficient Market Hypothesis asserts that current stock prices reflect both historical price information and all publicly available information relevant to a company's securities. It implies that any public information about a company will not yield abnormal economic profits.

Neuroscience and studies of investor psychology show that the influence of social media may irrationally magnify the impact on new public information on investors in a way that nullifies the semi-strong form of Efficient Market Hypothesis and makes it possible to attain abnormal profits.

Data Analysis

Average Abnormal Returns Before and After New iPhone Announcement

% Abnormal Return

Days Before and After iPhone Announcement at Day 0

2018 iPhone Announcement: Abnormal Returns

% Abnormal Return

Days Before and After iPhone Announcement at Day 0

— 10-day — 4-day — 5-day

Regression Results

	a (intercept)	b (slope)	S (standard error)
2012 iPhone 5	0.00157	1.00709	0.01512
2013 iPhone 5c/5s	0.00384	0.36266	0.01558
2014 iPhone 6/6+	0.00323	0.96432	0.01249
2015 iPhone SE	0.00144	1.13125	0.01332
2016 iPhone 7/7+	-0.00043	0.81893	0.01376
2017 iPhone XS/8/8+	0.00058	1.57393	0.01036
2018 iPhone XS/XS+/XR	0.00241	0.83492	0.01152

Regression Formula

intercept $a = \bar{y} - b\,\bar{x}$; slope $b = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2}$

standard error $S = \sqrt{\frac{1}{(n-2)}\left[\sum(y-\bar{y})^2\right] - \frac{\left[\sum(x-\bar{x})(y-\bar{y})\right]^2}{\sum(x-\bar{x})^2}}$

Test for Significance

$t\ value = \frac{Abnormal\ Return}{Standard\ Error\ S}$ and

Abnormal Return Significant when $|t\ value| > 1.96$

Objectives

1. Build a statistical tool to determine whether stock price changes are attributable to an event (e.g, tweetstorms)

2. Apply that tool to a specific company (Apple) and event (iPhone announcement) to test if the Efficient Market Hypothesis holds

Discussion

Computed a regression formula with standard error for each event.

Slope corresponds to β-value of Apple stock at that time, to limit impact of overall market movement

Calculated daily abnormal returns, then determined five-day rolling average.

No material difference across range of 1-10 day rolling averages

Averaged and performed significance tests for seven events

Showed abnormal gains in the period from 32 to 25 days prior to the announcement of a new iPhone

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