Incentives to cheat in economic announcements

Social Networks
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Hypothesis

There is a large incentive to “cheat” around financial announcements such as **non-farm payrolls**, **fed minutes**, **central bank policy**, **natural resource data**, etc. The individuals familiar with this information have an incentive to leak the information to “financial agents” who can then act on this data before before it is publicly announced.

Some fun first …

showing corrupt incentives

- Four speculators are in Chicago and its 7:00 am, Feb 1 ,2019.
  - Speculator 1 is “The Awesome one” Everything is great
  - Speculator 2 is “The Pissed-off one” Everything sucks
  - Speculator 3 is “The corrupt/cynical-one” F*** all of you
  - Speculator 4 is “The biased hedger”
- Non-farm Payroll number are being released in 30 minutes (from BLS)
- If it’s a blowout number
  - Equity Futures (ES) should take off
  - Bond Futures (UB) should sell off
- If it’s a disappointing number (Mr. Pissed-off will be happy)
  - Equities should sell
  - Bond should take off
- If its mixed the market will probably jigsaw then pick a direction

Some Futures Math and Leverage

- Each speculator
  - $1 million bucks to play with
  - Will take long or short positions in ES and UB Futures
  - ES Margin - $6,300 per contract
    - At a price of 2,700, 1 ES Contract = 2700*50 = $135,000
    - Leverage Ratio = 135000/6300 = 21.4
  - UB Margin = $3,400 per contract
    - At a price of 161, 1 UB Contract = 161*1000 = $161,000
    - Leverage Ratio = 161000/3400 = 47.1
  - 50/50 Margin Account Split between ES and UB
    - ES - 500,000/6,300 = 79 Contracts
    - UB – 500,000/3,400 = 147 Contracts
    - Exposure = 79*(135000) + 147*(161000) = $34,333,000
  - On $1 Million speculators can use futures to get $34,000,000 in exposure

Pre-Announcement Positioning

For Feb 1, 2019 @ 7:20am CST

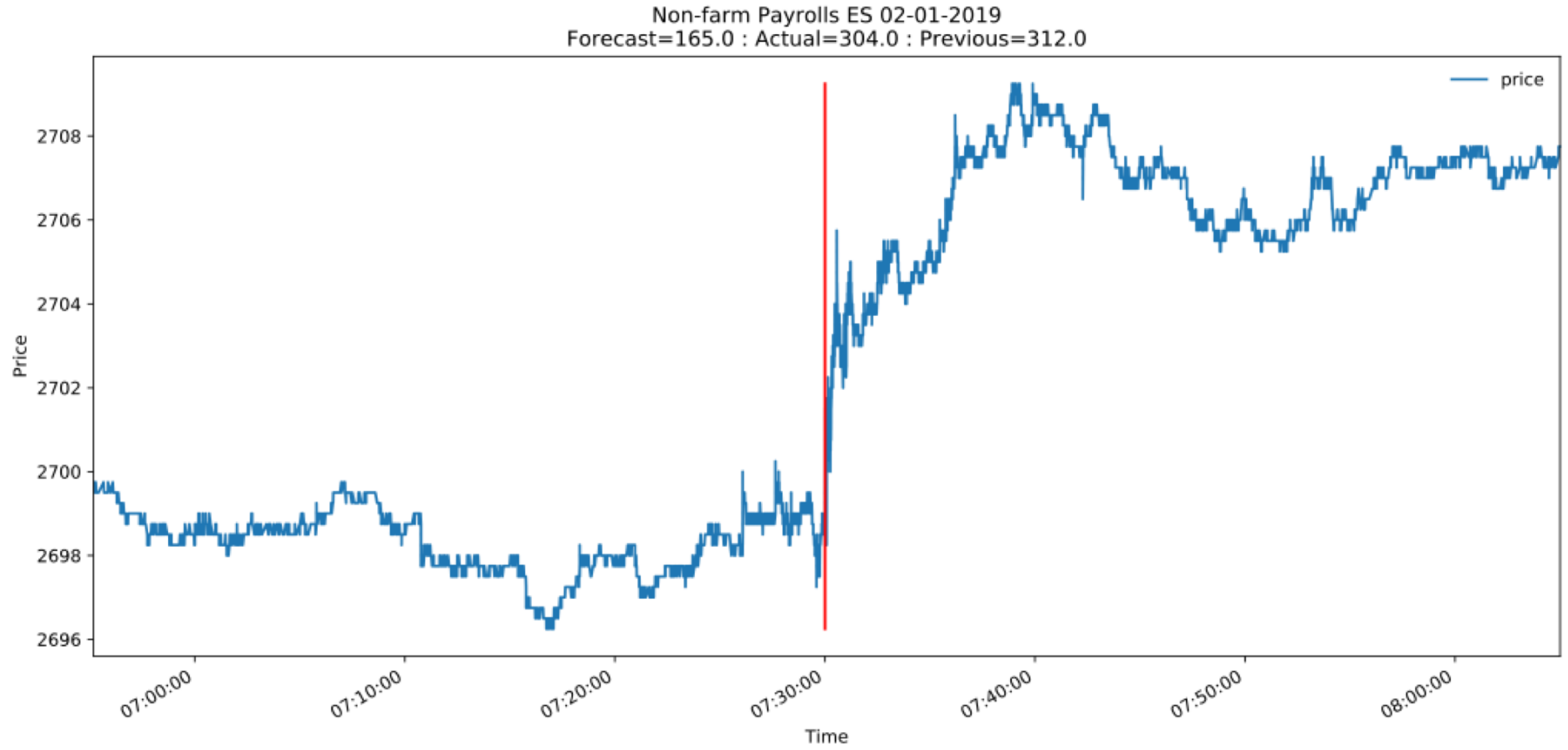
	Symbol	Contracts	Margin	PrePrice
Optimist	ES	79	497700	2698.000
	UB	-147	499800	161.500
Pessimist	ES	-79	497700	2698.000
	UB	147	499800	161.500
Corrupt	ES	79	497700	2698.000
	UB	-147	499800	161.500
Hedger	ES	79	497700	2698.000
	UB	147	499800	161.500

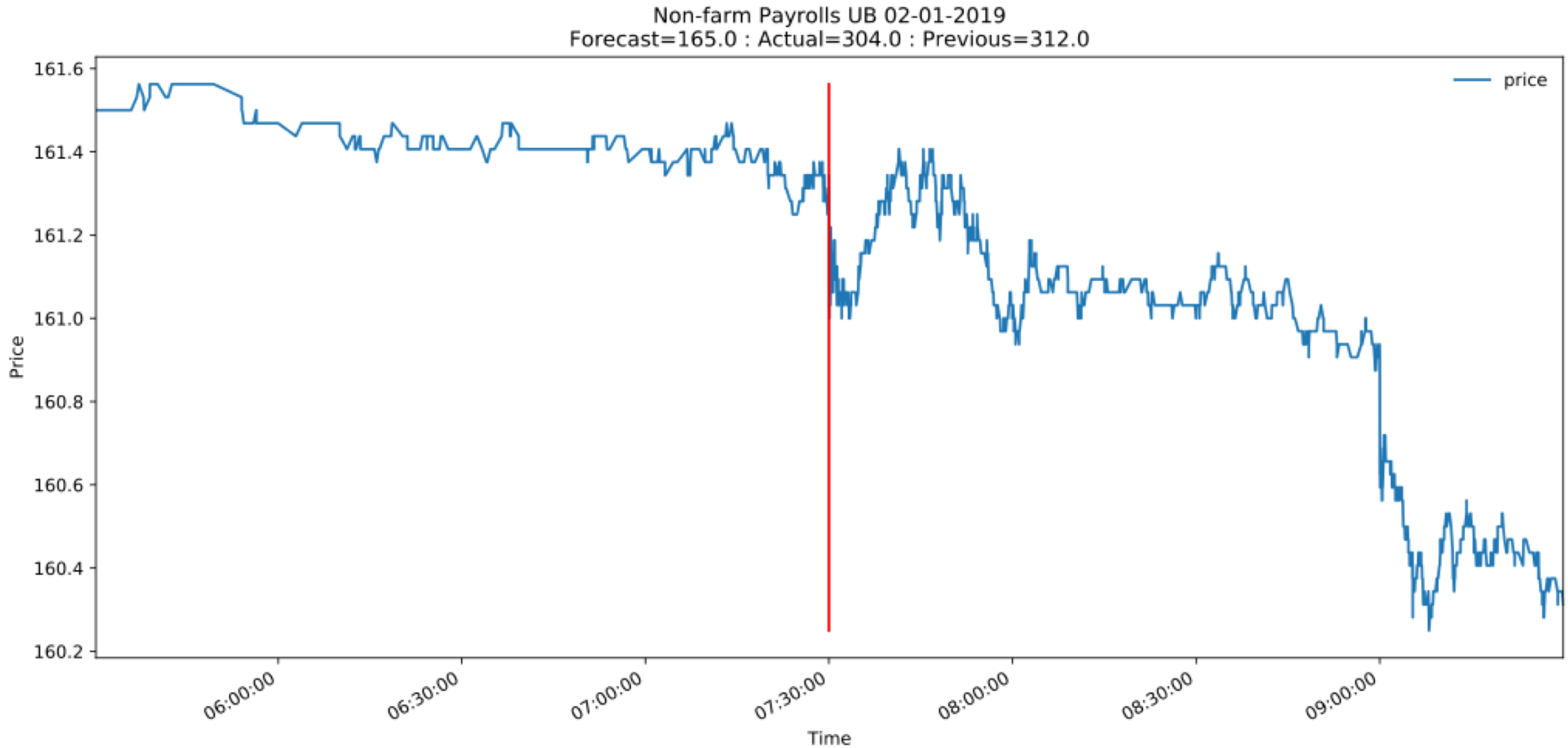
Our corrupt friend has information about the number rules of thumb

- Big win – Buy Equities / Short Bonds
- Bid miss – Short Equities Big Time/ Short Bonds

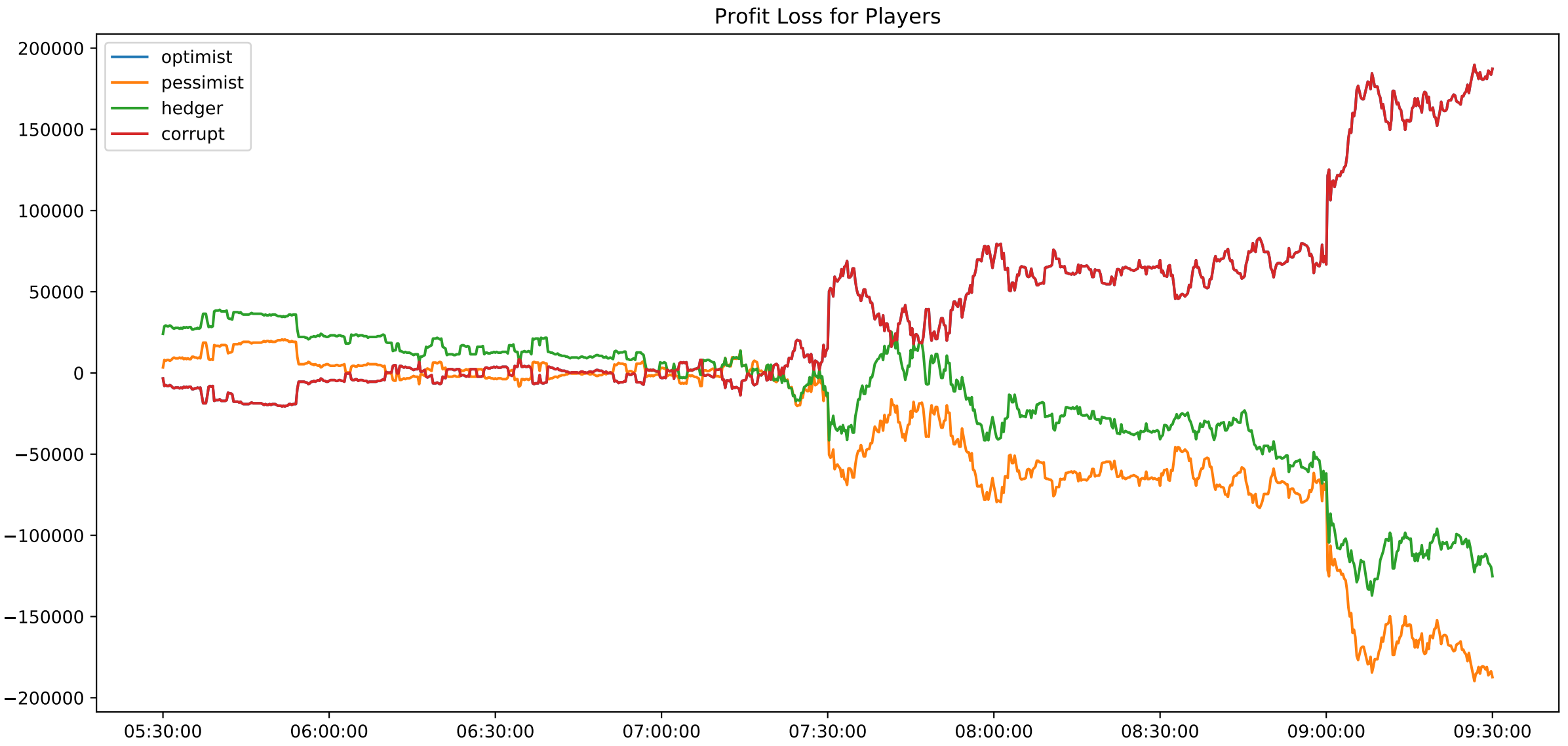
Market reaction to Non-farm Payrolls announcement

announcement at 7:30 am CST (8:30am EST) 2/1/2019




Non-farm Payrolls UB 02-01-2019
Forecast=165.0 : Actual=304.0 : Previous=312.0
price
Price
161.6
161.4
161.2
161.0
160.8
160.6
160.4
160.2
06:00:00
06:30:00
07:00:00
07:30:00
08:00:00
08:30:00
09:00:00
Time

PNL for NFP Feb 2019

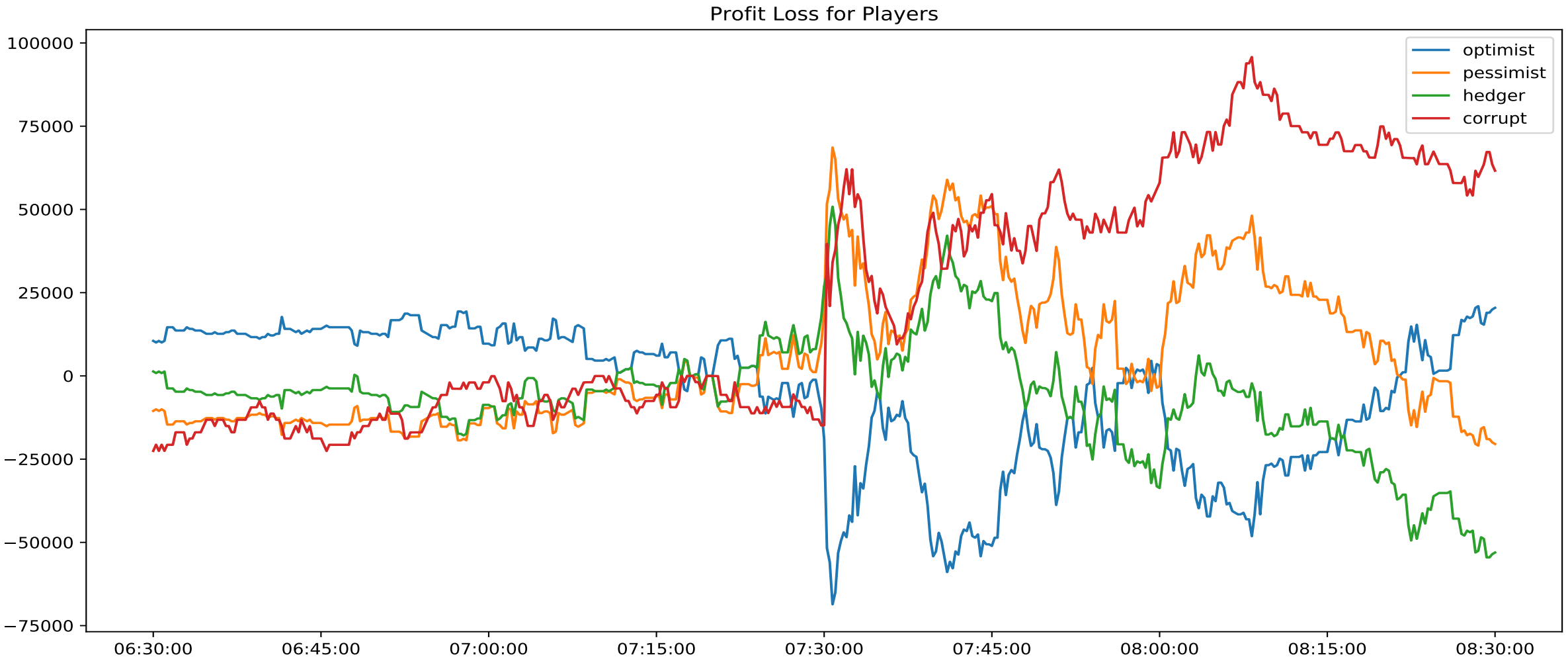


So what happened?

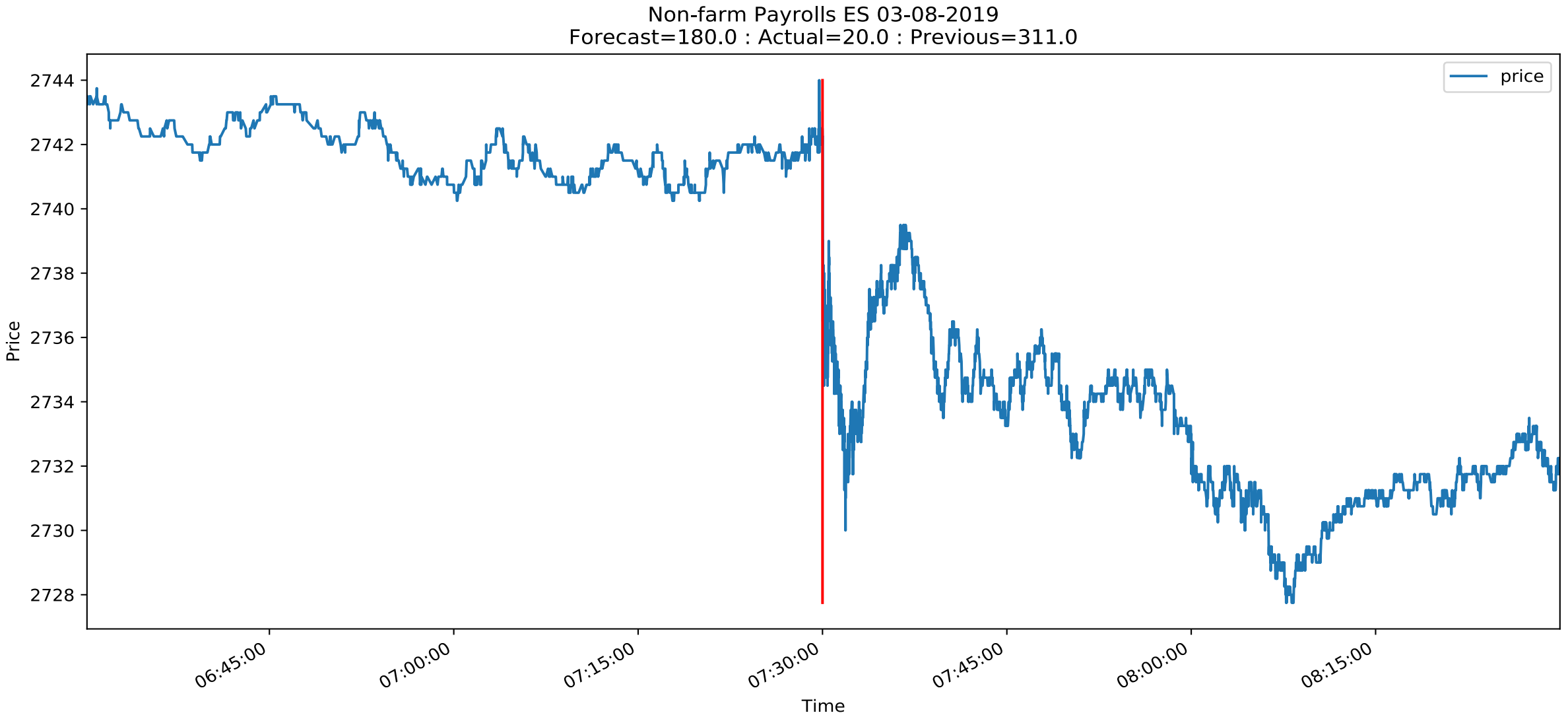
- The Non-farm Payroll number for Feb 2019 massively exceeded expectations! Job creation was almost 2x expected (304 v 165).
- What happened to our friends?
  - The optimist and corrupt both immediately saw approx. $60K gains on release of the number from their positions. Two hours later the gain was over $200k.
  - The pessimist was wrong and immediately lost -$60K

The next month … March 2019 NFP, Profit Loss

our corrupt friend knows it will be bad ES will sell hard so its pure short on ES



NFP Mar 2019 – Massive miss, market sells off



Initial thoughts

- Economic Announcements can move markets
- The information in the announcement is known to agents preparing the announcement before market participants know
- **Are the moves compelling enough in the announcements for market participants to attempt to seek the information before the announcement is made?**

Types of Announcements

- Non-farm Payrolls
- Federal Reserve Open Market Committee
- ISM (Institute for Supply Management) Survey (Manufacturing)
- Durable Goods
- CPI
- Retail Sales
- Consumer Confidence
- Company Earnings / IPO’s/ Management Changes/ Dividends etc.

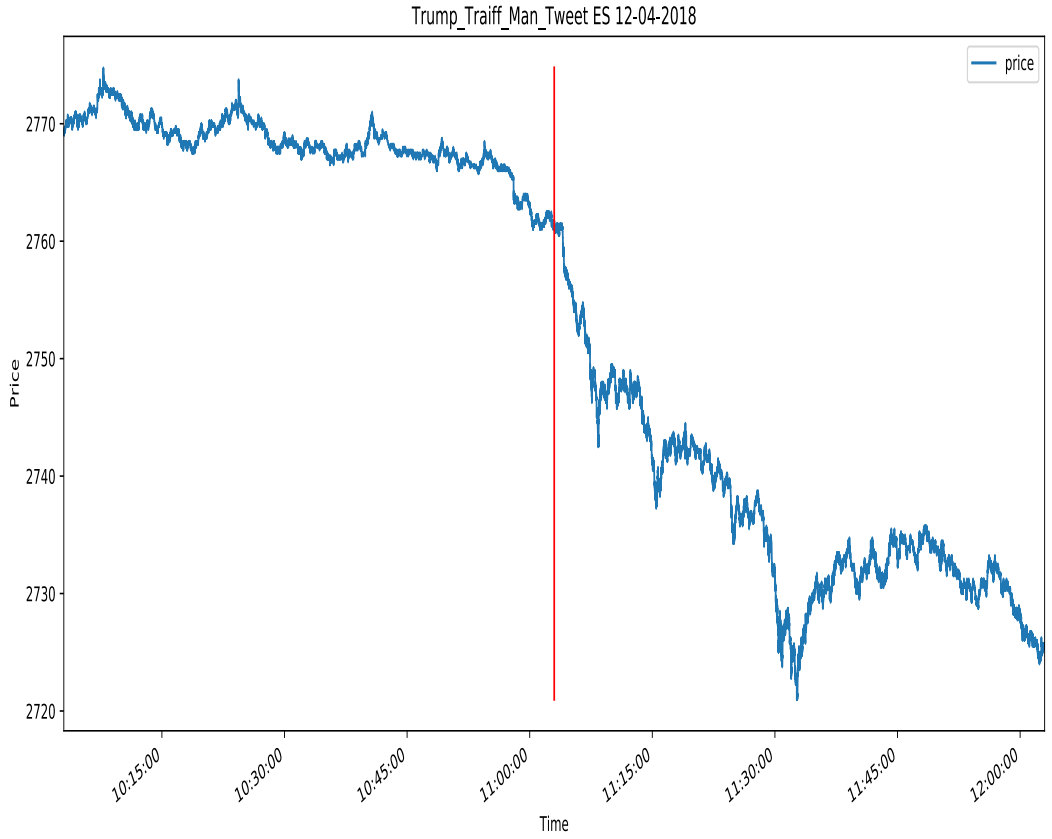
Approach

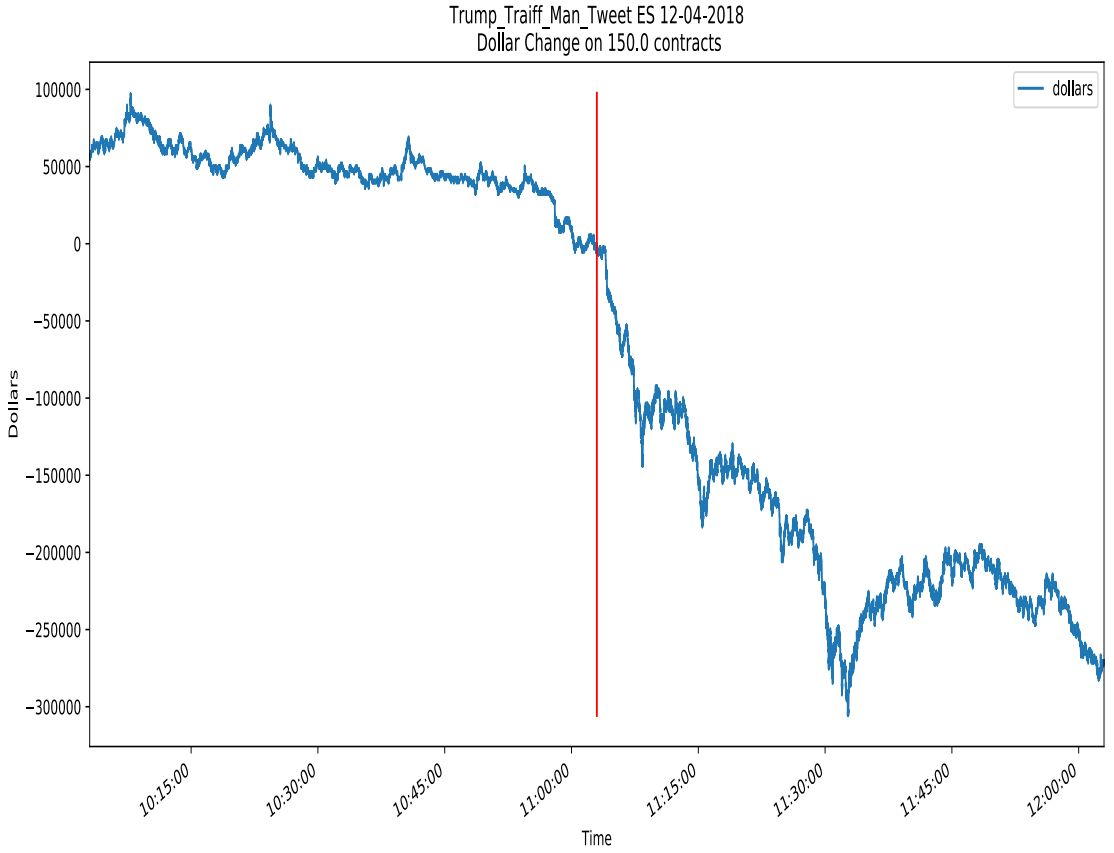
- Measure the market opportunity for announcements and compare to non-announcement periods
  - It may be the case that these moves aren't large enough to even care.
  - Maybe the market volume is worse
- Pick some time window before the announcement (start and duration) and see if pre-announcement returns offer any insight in to what happened ex-post.

Software developed

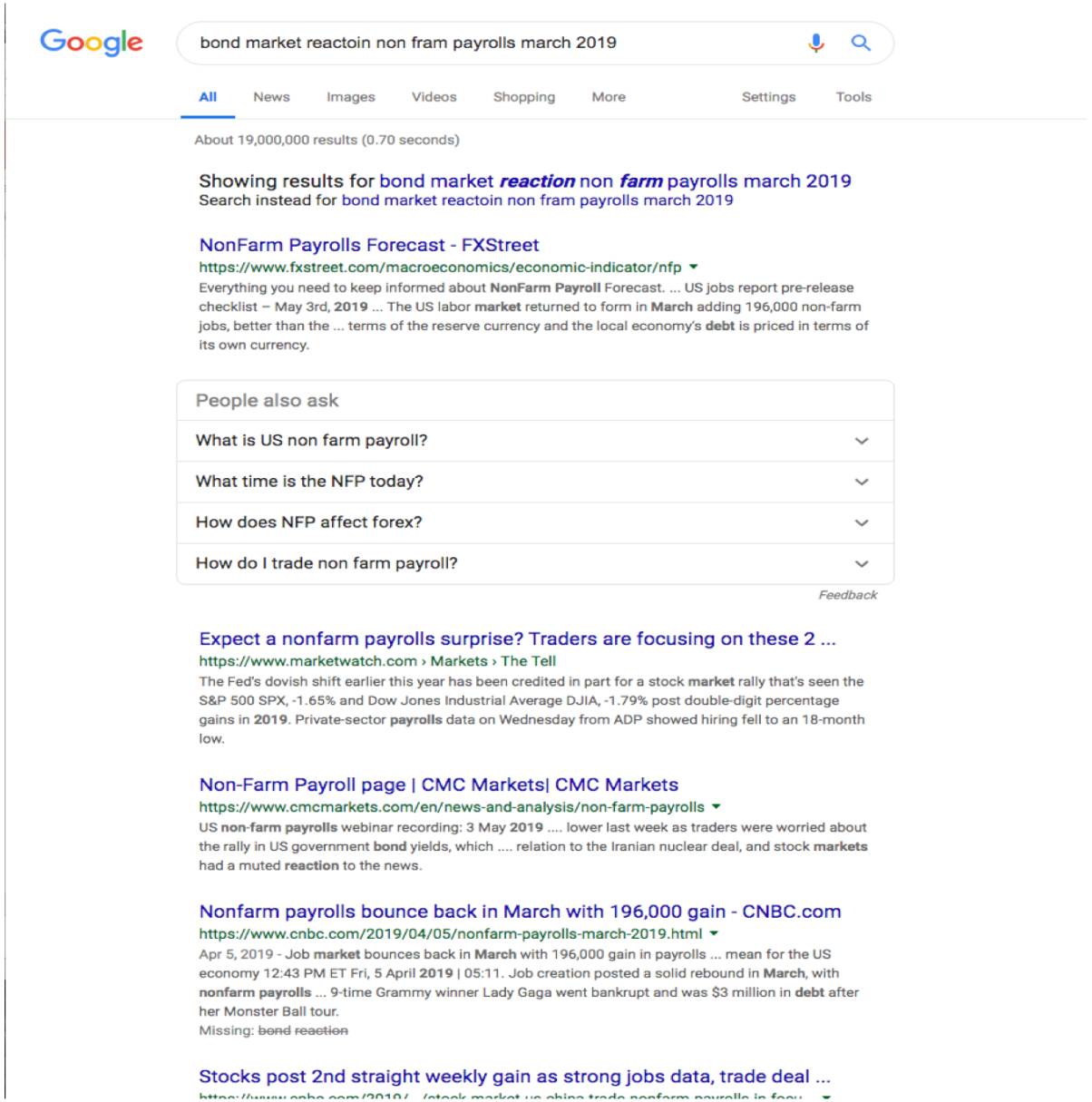
- We developed software that would map market reactions to economic events with accurate timing of event to reaction.
- For this project we have tied events to Equity and Fixed Income Futures.
- The software ties in for pre-planned events the expectations of the event (forecast), the actual event and the tick plot of the futures contract price.
- The software aligns time zones or prices and forecasts.
- The software can also look at any window given the times.

Tariff Man … a non-planned event





Aside – Its not easy to find the market reaction



Study will focus on the Futures Markets

in particular Equities (ES-mini), Short Term Rates(2 Year TU) , long Term Rates (Ultra-Bond UB)

- **Why Futures**
  - Most liquid of all markets
  - Leverage: Futures are leveraged products
  - Trade around the clock from Sunday Night
    - (6pm EST) to Friday Night (1 hour close at 5pm EST for switch over)
  - Easiest to express short position (just sell contract)
    - No special behavior to go short a market
    - Short = Sell contracts, betting price of contract will fall
    - Long = Buy contracts, betting price of contract will rise
  - Contracts across all markets
    - Equities (ES-S&P 500, NQ – Nasdaq 100, YM- Dow)
    - Bond Futures (TU, FV, TY, ZB, UB) (2, 5, 10, 15 30 yr)
    - Oil, Gasoline, Natural Gas(CL, RB, NG)
    - Agriculture (Wheat, Corn, Soybeans)
    - F/X (Euro, Yen, CAD, Swiss, Pound, ADU, NZD, Peso)
    - Metals (Gold, Sliver , Copper)

Data Source

- Publicly available **events calendar**
- Futures **tick trade data** from CME
- **Twitter** for President Trump’s communications

Hypothesis Testing

Questions that need to be examined

1. Do announcements present opportunity?

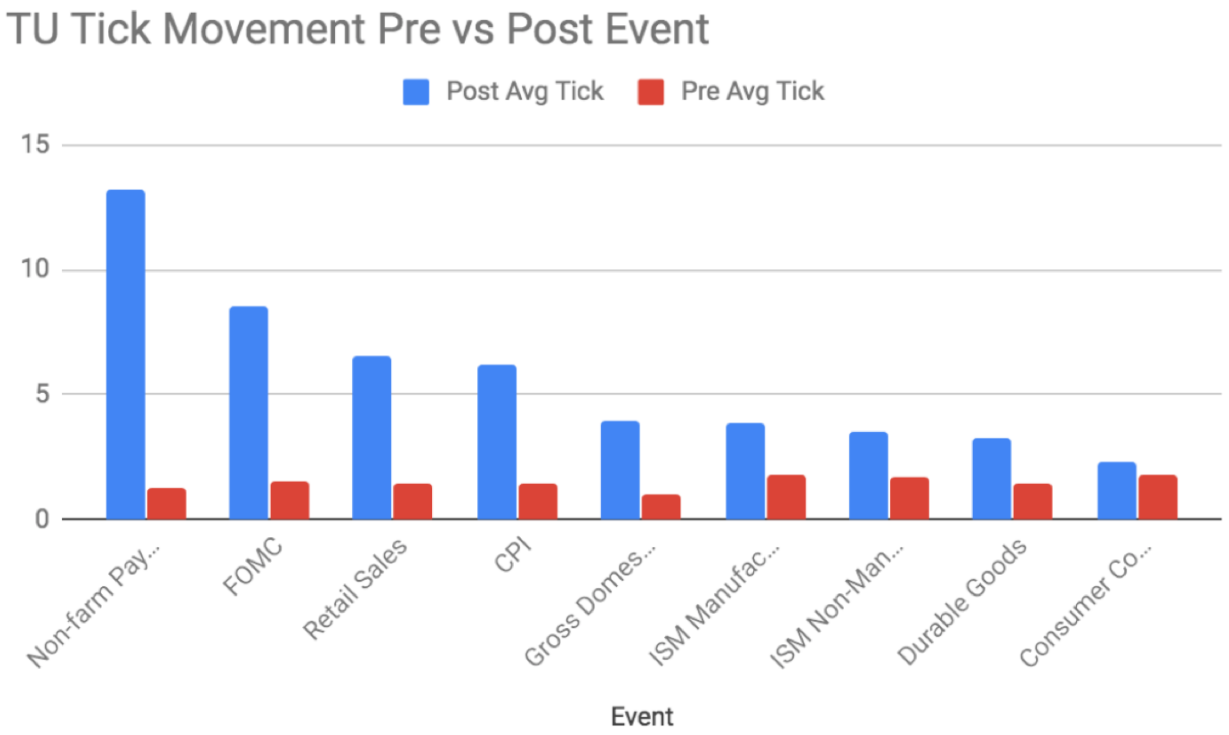
2. Can pre market movements help in predicting the direction of an event?

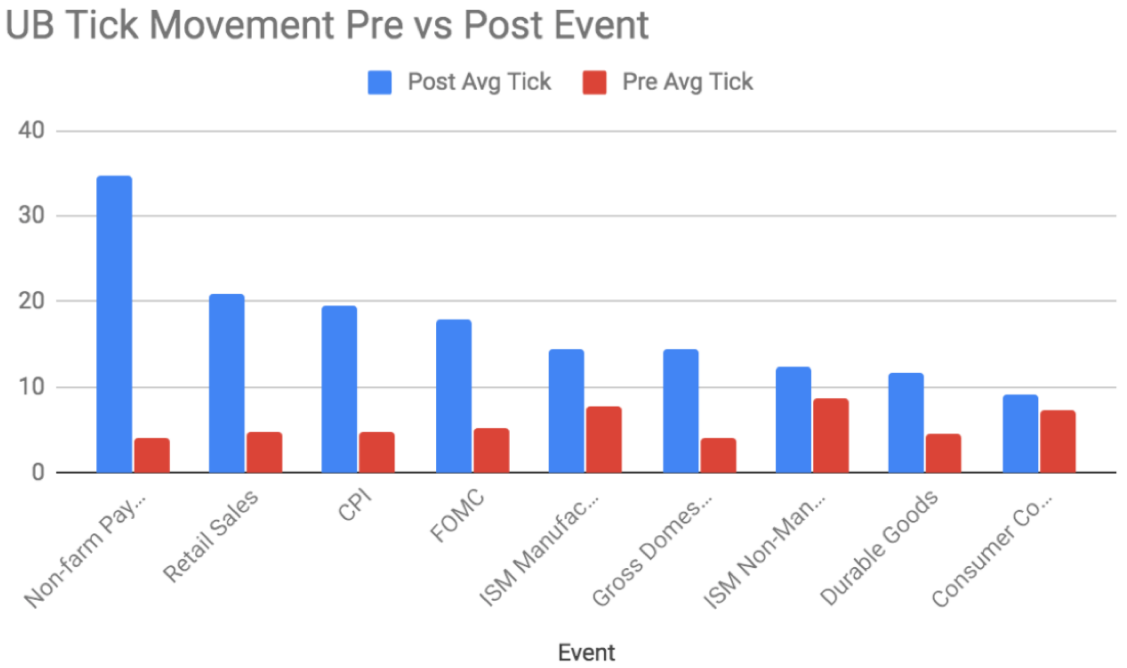
Do announcements present opportunity?

We will start with the premise that there can be no crime without opportunity.

To determine “opportunity” we will compare the magnitude of the market movement **pre-event** compared to **post-event** ten minute window.

Charts comparing pre-event and post-event window
for 9 most important economic announcement





Tables comparing pre-event and post-event window for 9 most important economic announcement

Symbol	Event	N	Event Max	Even Mean	No Event	Vol Ratio
UB	Non-farm Payrolls	58	80	35	4	16.4
UB	Retail Sales	58	46	21	5	8.5
UB	CPI	58	44	20	5	8.0
UB	Gross Domestic Product	46	29	14	4	5.9
UB	FOMC	54	45	18	5	3.6
UB	Durable Goods	56	29	12	5	4.2
UB	ISM Manufacturing	57	31	14	8	2.1
UB	ISM Non-Manufacturing	55	43	12	9	1.7
UB	Consumer Confidence	53	32	9	7	1.4

Symbol	Event	N	Event Max	Mean	No Event	VolumeR
TU	Non-farm Payrolls	58	35	13	1	17.1
TU	FOMC	54	45	9	2	5.4
TU	Retail Sales	58	14	7	1	9.0
TU	CPI	58	13	6	1	8.5
TU	Gross Domestic Product	46	10	4	1	6.7
TU	Durable Goods	56	8	3	1	4.4
TU	ISM Manufacturing	57	10	4	2	2.7
TU	ISM Non-Manufacturing	55	12	3	2	2.1
TU	Consumer Confidence	53	12	2	2	1.8

Result

Do announcements present opportunity?

Events present extremely outsized opportunities. It's possible to make short term trades and gain outsized profits given the time period. The average tick movement across all events is approximately 3.5x larger than the average tick movement in prices across a similar time window without and event while the **trading volume is on average 6.5x larger and can be over 20x larger.**

Can pre market movements help in predicting the direction of an event?

To test this premise we examine a few different models to determine **how much pre-event returns can help in predicting post event returns.** We evaluated the prediction of post-event return using two models and condition on different criteria, all pre-event returns and pre-event returns that were 1 standard deviation greater than the mean pre-event move.

The first model predicts the post event return using a standard linear regression, the second model is a classification model to just predict the post move direction (up or down). We choose support vector machine because it has stricter criteria than a simple logistic regression.

Models used for Analysis

Model 1: linear regression of post-event return on pre-event return

$$R_t = \beta R_{t-1} + \epsilon_t$$

Model 2: support vector machine logistic regression of post-event direction using pre-event return

$$D_t = \sigma(\beta R_{t-1}) + \epsilon_t$$

Tables comparing the two scenarios

Scenario 1:
What is the relation of post event market move based on the pre-market move.

	E[R|dP]			E[D|dP]		
	TU	UB	ES	TU	UB	ES
Consumer Confidence	0.00	0.01	0.10	0.51	0.62	0.51
CPI	0.00	0.02	0.00	0.57	0.50	0.57
Durable Goods	0.00	0.00	0.10	0.66	0.55	0.66
FOMC	0.01	0.02	0.07	0.65	0.52	0.65
GDP	0.01	0.00	0.01	0.57	0.52	0.57
ISM Manufacturing	0.04	0.00	0.02	0.56	0.54	0.56
ISM Non-Manufacturing	0.01	0.00	0.00	0.71	0.60	0.71
Non-farm Payrolls	0.08	0.02	0.00	0.5	0.62	0.50

Scenario 2:
What is the relation on larger pre-market moves?

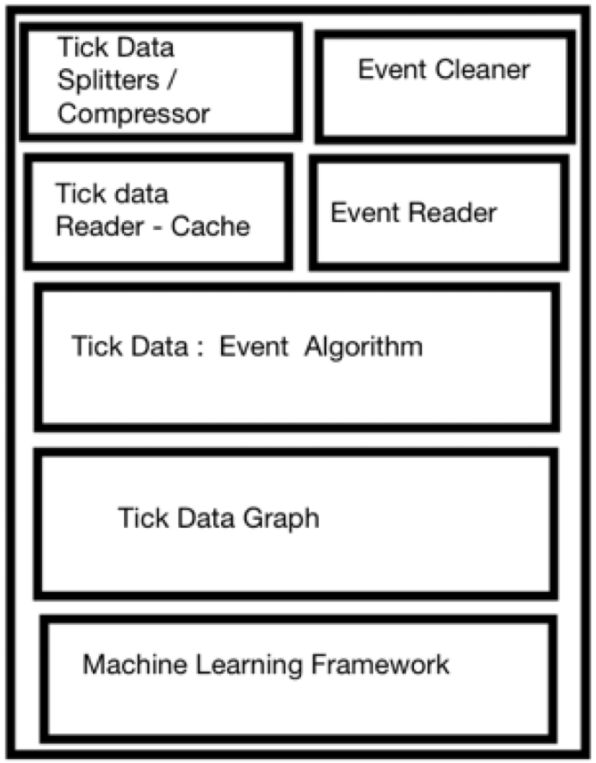
	E[RIdP > s]			E[DIdp > s]		
	TU	UB	ES	TU	UB	ES
Consumer Confidence	1.00	0.13	0.17	0.5	0.75	0.65
CPI	0.01	0.26	0.05	0.7	0.75	0.75
Durable Goods	0.03	0.25	0.06	0.6	0.63	0.71
FOMC	0.25	0.03	0.62	0.83	0.67	0.75
GDP	0.01	0.03	0.03	0.57	0.57	0.78
ISM Manufacturing	0.35	0.07	0.02	0.67	0.70	0.56
ISM Non-Manufacturing	0.00	0.16	0.05	0.67	0.67	0.67
Non-farm Payrolls	0.64	0.10	0.47	0.71	0.78	0.6

Result

Do pre market movements help in predicting the direction of an event?

We were surprised to find that when the pre-event market move is greater than 1 standard deviation from the mean pre-event market move, the predictive power of the pre-market move is significantly better compared to all market moves. **A speculator has much better odds of making a profit when the pre-event movement is larger than usual!** This was actually surprising to find. Also the ability to predict post market returns from pre-market returns using all data for each event was close to zero, while the ability to predict post even direction fared better.

Product Tech Stack



Software Stack

The diagram represents the software stack developed for this analysis which could turn into a product to lease to middle-tier financial firms. Many firms we have encountered do not have any in house capability to split, compress, cache and then deliver tick data to a client program for analysis. The software takes in several GB of raw trade tick data from the CME, splits and compresses it so it can be quickly looked up via data time in a client analysis tool via the cache reader or used as input to simple machine learning framework developed for this project.

Product Features

The software developed has the following features:

- Create compressed Tick Trade Archive from Raw Exchange Data
- Take exchange tick trade data make it fast to load for any particular date across a range of contracts.
- Create Events Repository with Event , Event Date, Market Expectation and Actual Number
- Locate event based on a close date, map the market reaction and expectations and plot
- Show the profit loss of speculators taking long/short positions in contracts
- Compare Events based on Tick Movements
- Apply Machine Learning
    - Assess pre-market moves of post event moves,
    - Assess market expectations vs actual on market moves

Applications to Other Markets

While we focused on US Futures Markets and Macroeconomic Events, the software stack developed can be applied to any exchange traded markets around the world. For instance we could use the methodology on earnings announcements on US Equities, international central banks announcements on their impact currency valuation and general foreign economic reporting and its impact on local equities and fixed income markets.

Conclusion

We have shown that **economic announcements** present **outsized opportunity** in terms of market volatility and trading volume compared to non-event market periods. We have shown that higher than average **pre-event market moves** are better predictors of the post event price direction and returns compared to the average pre-event return. This lends some credence to the adage that “someone knows something.” The software developed for this problem, stumbled on the problem of the difficulty in using search engines to answer things from an historical context.and starts to address the issue of its not really easy to use search engines to find things in a historical context. In addition we have created the genesis of a product that can be used to analyze historical events impact on the markets.

We also discovered in doing the course of this work there are no real good sources that map historical events to market reactions and they are not easy to find.