# Surprise indexes and nowcasting: why do markets react to macroeconomic news?

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# Outline

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# Introduction

Macroeconomic news $\longrightarrow$ **market reactions**

Established result! Among the others see Andersen et al. (2003, 2007); Ehrmann and Fratzscher (2005); Gürkaynak et al. (2005); Faust et al. (2007); Gürkaynak and Wright (2013).

The effect is persistent and amplified at lower frequencies, explaining more than one third of the quarterly fluctuations of bond yields (Altavilla et al., 2017).

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I merge the two approaches and study the relationship between surprise indexes and nowcasting

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Other "hybrid" examples: Scotti (2016); Grover et al. (2016); Gilbert et al. (2017)

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$$News_{i,t} \equiv x_{i,t} - \mathbb{E}[(x_{i,t}|Info_{\nu})]$$

$$SI_t \equiv \sum_{s=t-win}^{t} \sum_{i \in I} W_{i,s} News_{i,s}$$

# Different types of surprise indexes

| | | **News** | |
|---|---|---|---|
| | | *Market* | *Model* |
| **Weights** | *Market* | Citi; Altavilla et al. | THIS PAPER |
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Model weights:

- Grover et al. (2016): weights from regressions of market news on GDP (predictive content)
- Scotti (2016): contributions of the variables in forecasting the factor
- Gilbert et al. (2017): regression coefficients of announcements multiplied by Kalman gain matrix

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# Nowcasting: model-based news and weights

Let $y_t^Q$ be the GDP at time $t$, and $\Omega_\nu$ the information set at time $\nu$, where $\nu$ is a vintage of data. The nowcast is the projection of $y_t^Q$ using the available data, $\mathbb{E}[y_t^Q|\Omega_\nu]$. At any release, the information set expands : $\Omega_\nu \subset \Omega_{\nu+1}$, and it is possible to decompose the new forecast in:

$$\underbrace{\mathbb{E}[y_t^Q|\Omega_{\nu+1}]}_{\text{new forecast}} = \underbrace{\mathbb{E}[y_t^Q|\Omega_\nu]}_{\text{old forecast}} + \underbrace{\mathbb{E}[y_t^Q|I_{\nu+1}]}_{\textit{revision}}$$

Where $I_{\nu+1}$ is the information in $\Omega_{\nu+1}$ orthogonal to $\Omega_\nu$. Express the revision as:

$$\underbrace{\mathbb{E}[y_t^Q|\Omega_{\nu+1}] - \mathbb{E}[y_t^Q|\Omega_\nu]}_{\textit{revision}} = \sum_{j \in J_{\nu+1}} w_{j,t,\nu+1} \underbrace{\left(x_{i_j,t_j} - \mathbb{E}[x_{i_j,t_j}|\Omega_\nu]\right)}_{\textit{news}}$$

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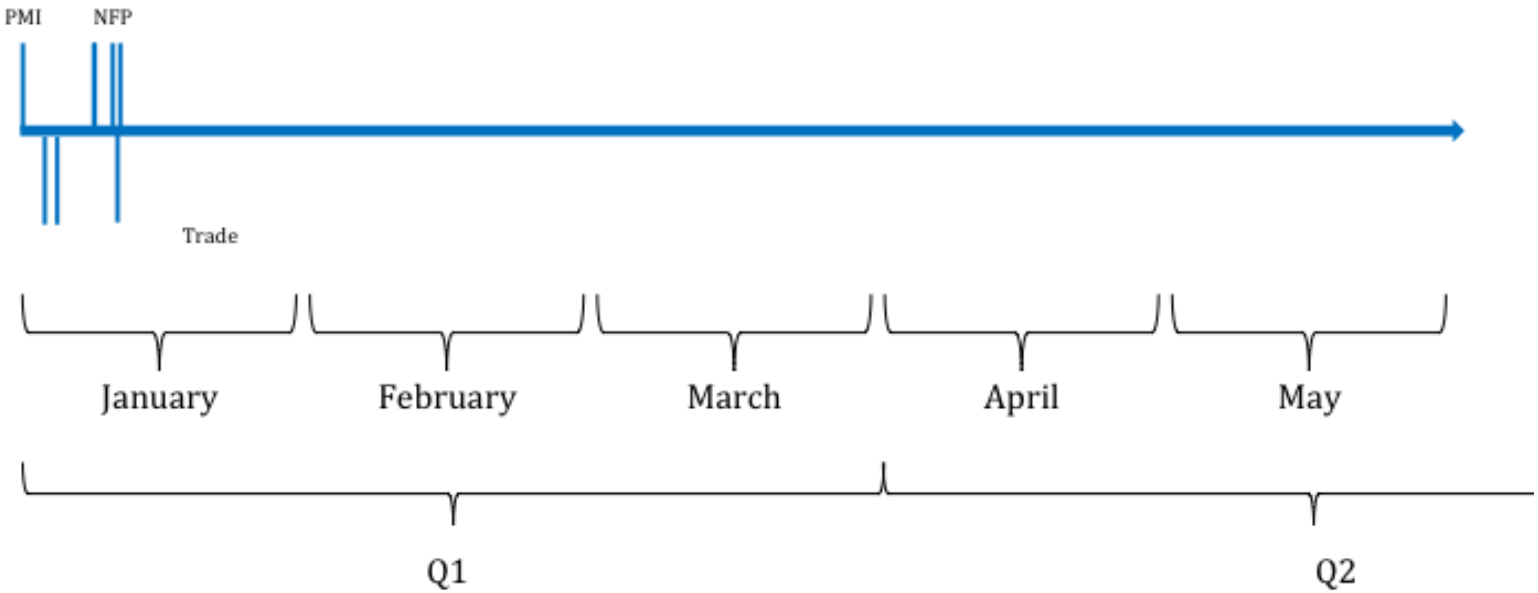
The weights represent the importance given by the model to a macro news in the update of the backcast-nowcast-forecast.

Nowcasting is a fixed event forecast and refers to GDP in a specific quarter: we should not use the nowcast directly!

I use a rolling window with a **consistent weighting scheme**.

# News Index construction: Weighting scheme



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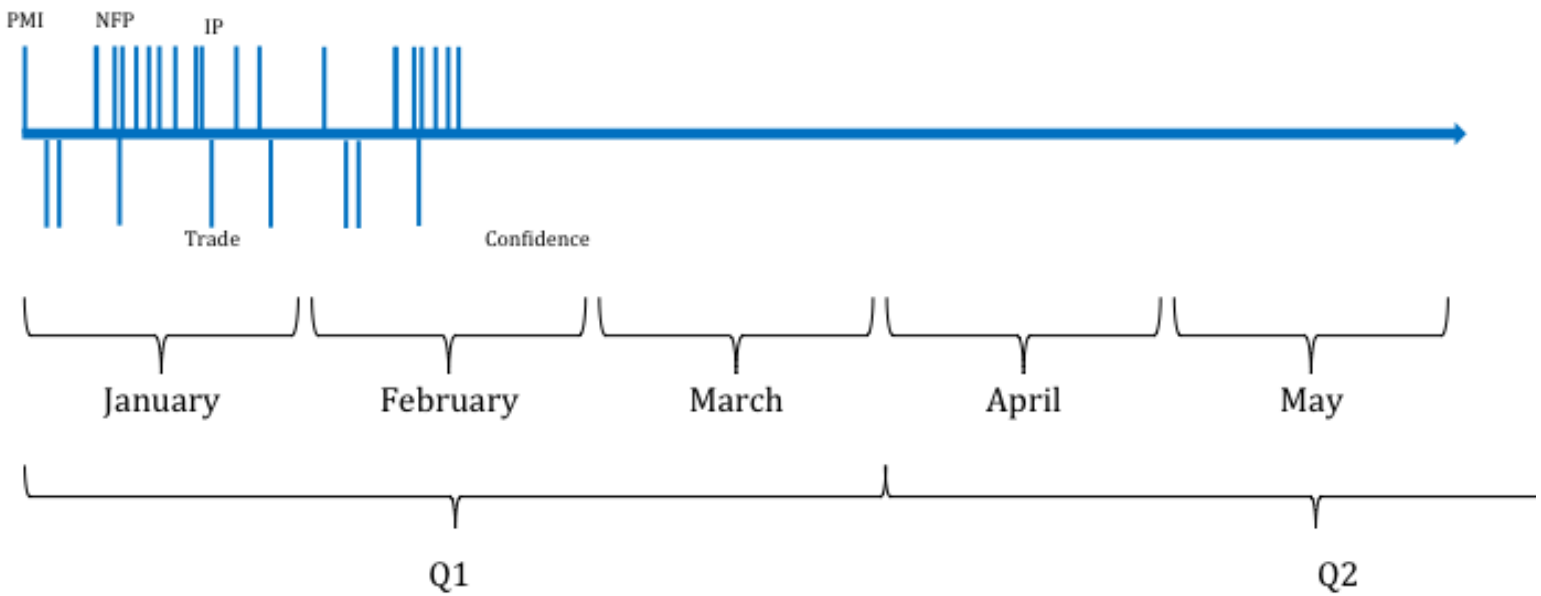

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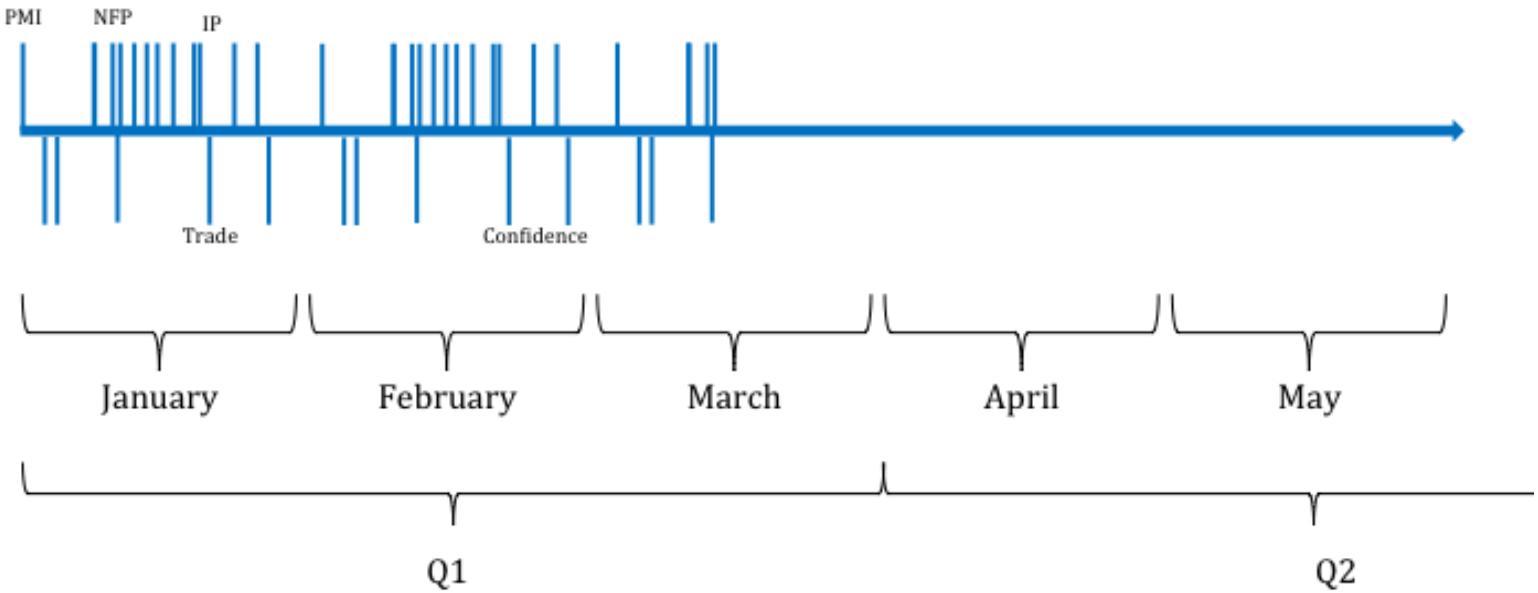

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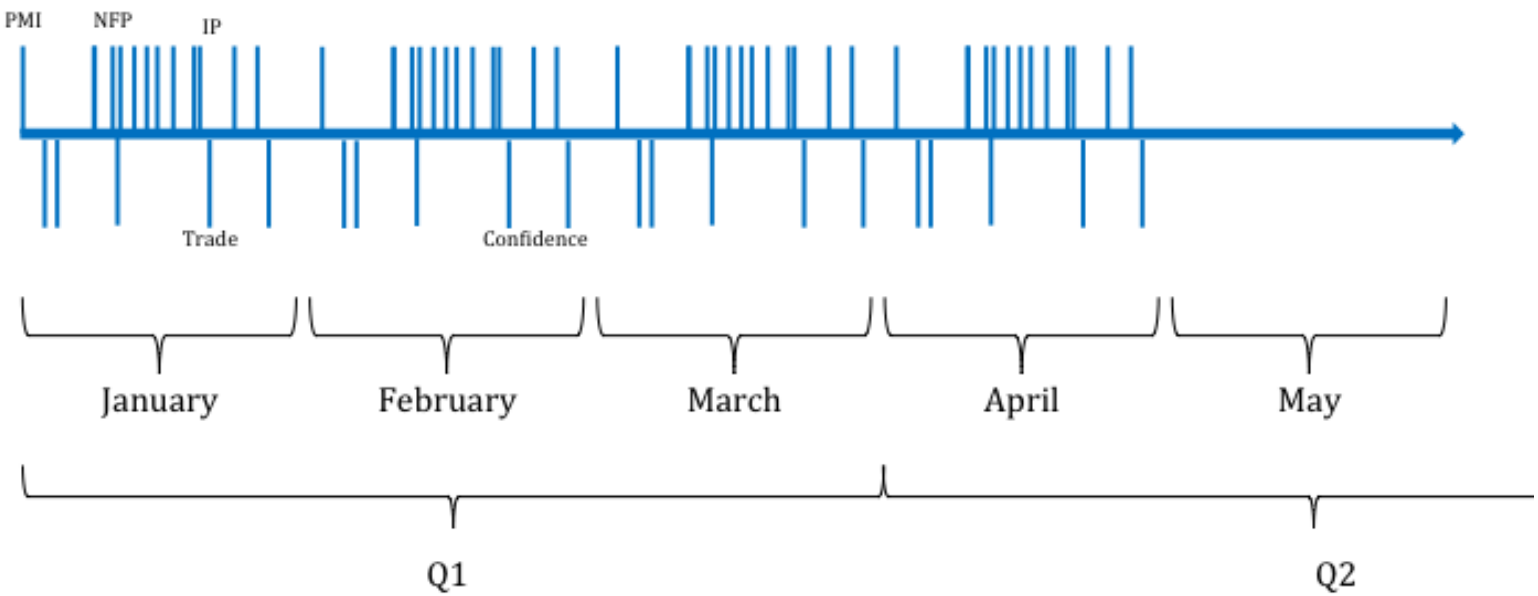

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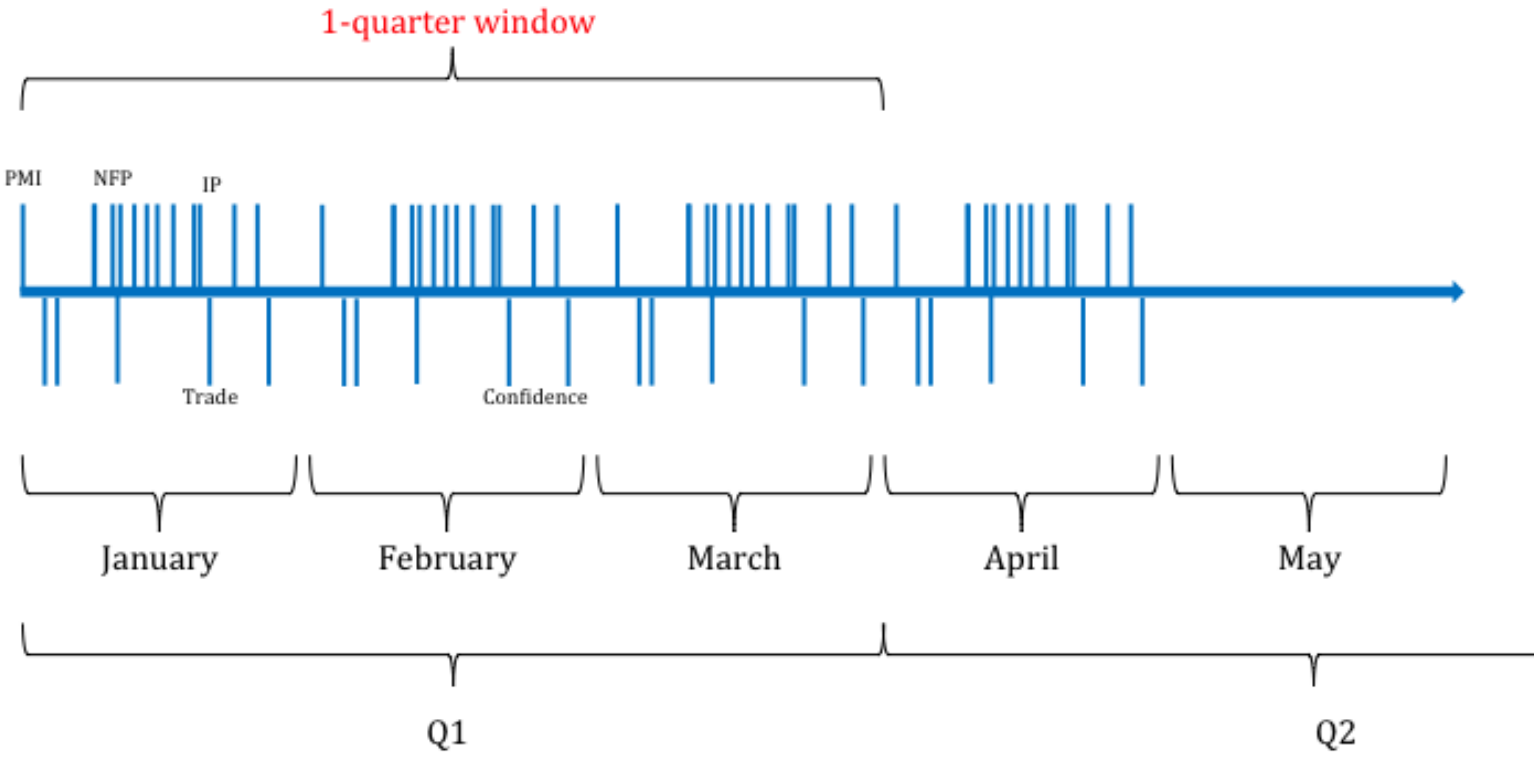

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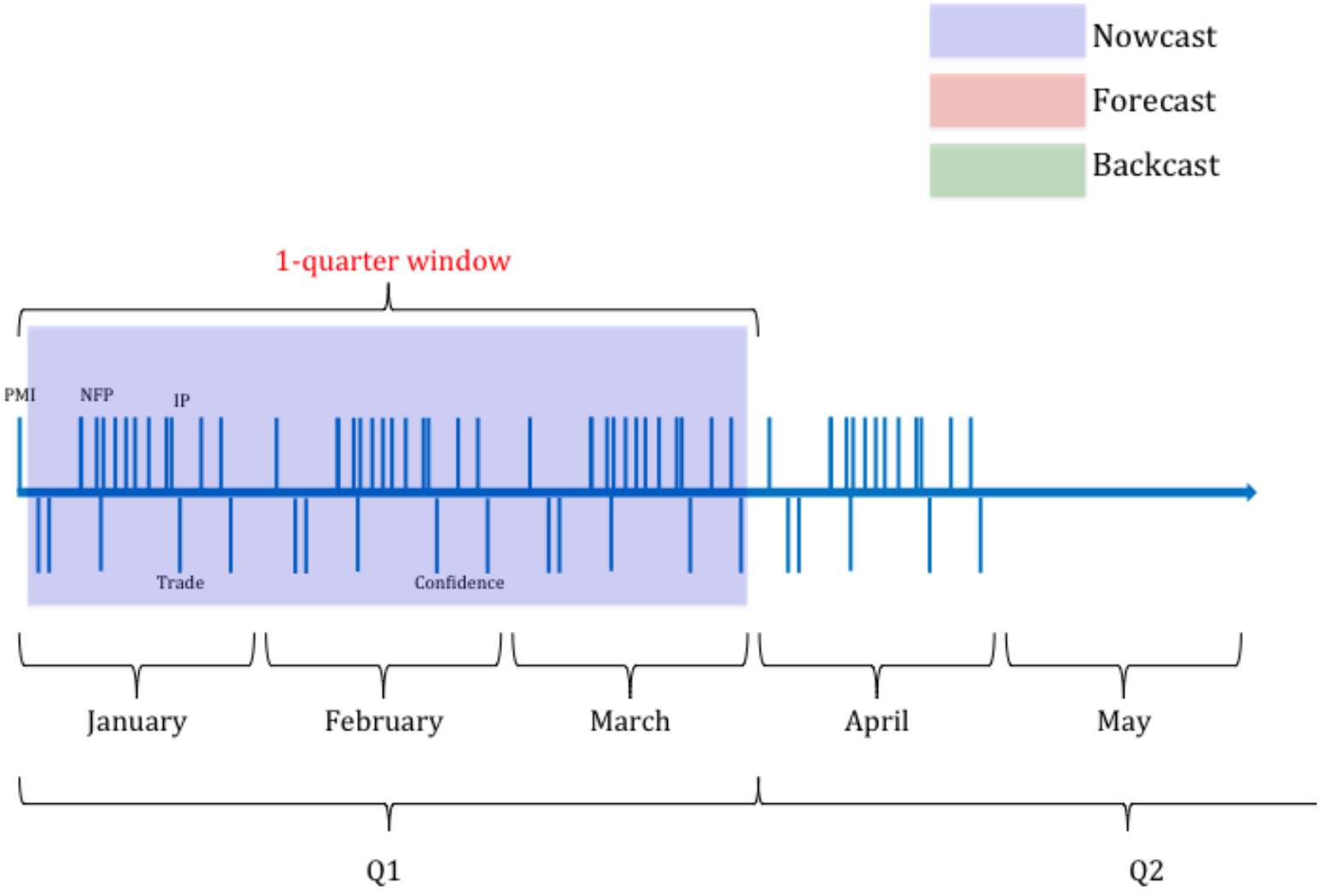

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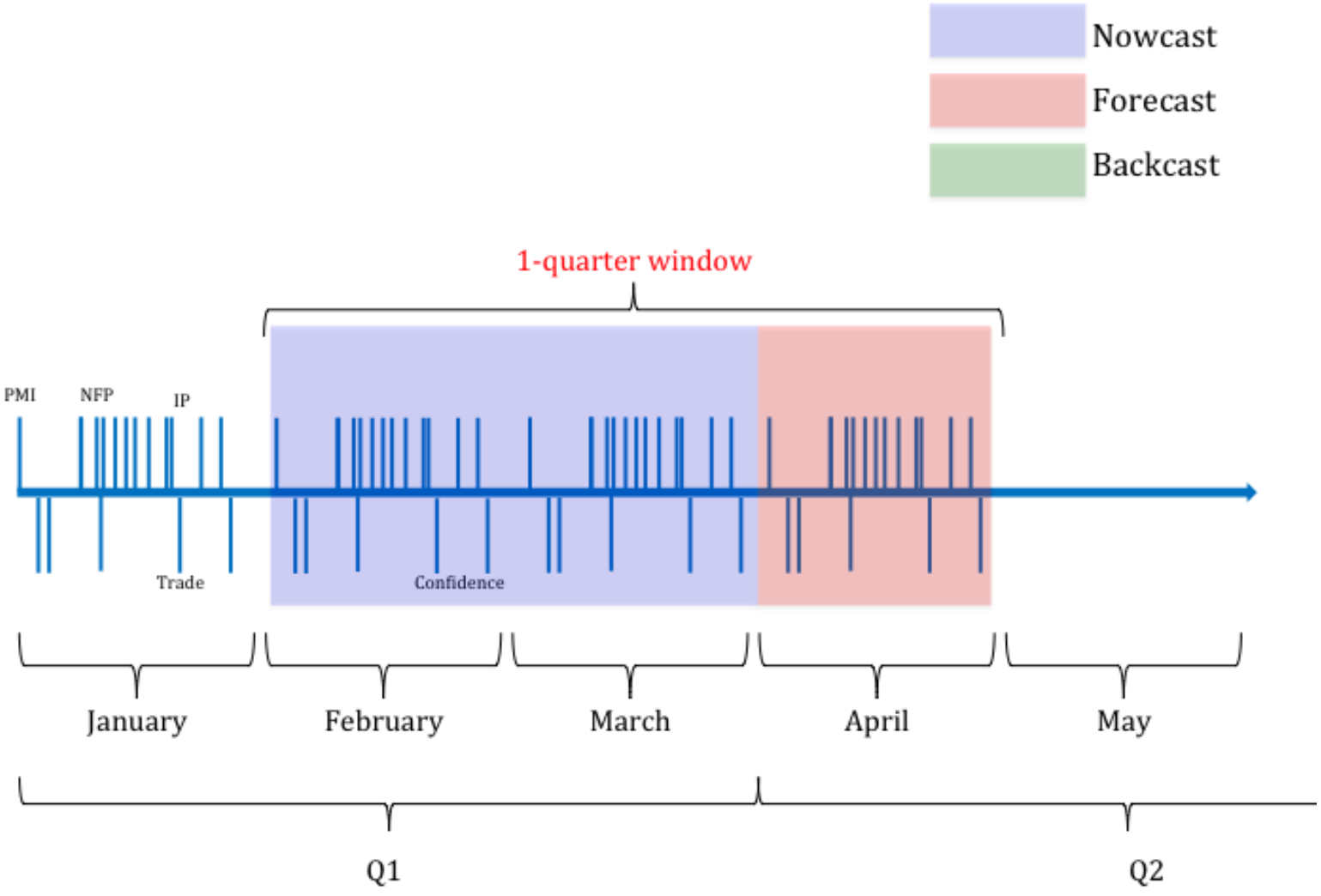

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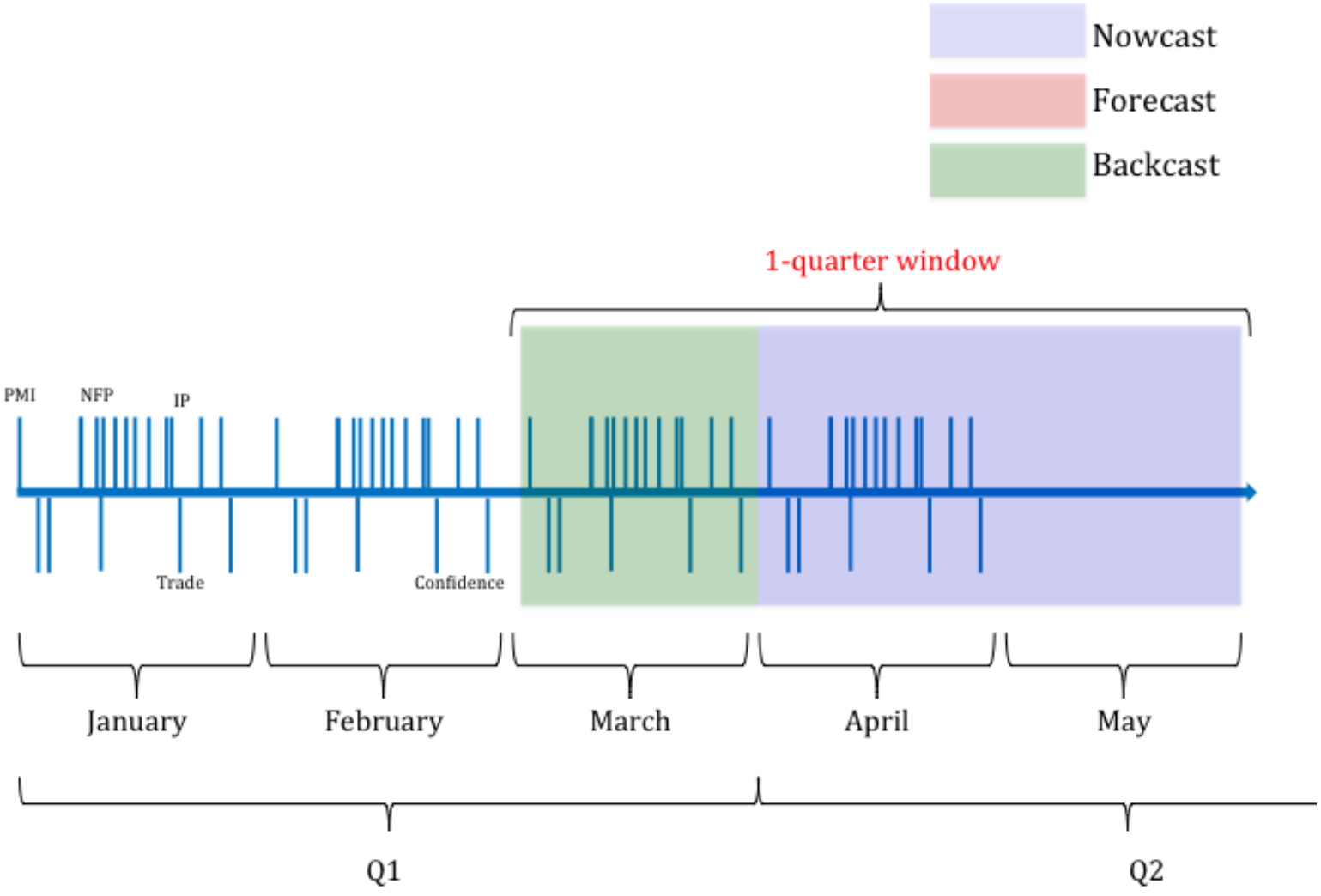

# News Index construction: Weighting the weights

Let $w_{i,t}^{BC}$, $w_{i,t}^{NC}$, $w_{i,t}^{FC}$ be the weights corresponding to the updates in the Backcast, Nowcast and Forecast.

Temporally weight them $\longrightarrow$ **coherent** weights. Call $d$ the distance from the beginning of the reference quarter.

$$\text{If } 0 \leq d \leq 33, \text{ then } W_{i,t} = \frac{33+d}{66} * w_{i,t}^{NC} + \frac{33-d}{66} * w_{i,t}^{BC}$$

$$\text{If } 33 \leq d \leq 66, \text{ then } W_{i,t} = \frac{99-d}{66} * w_{i,t}^{NC} + \frac{d-33}{66} * w_{i,t}^{FC}$$

This weighting scheme gives us the right "rolling assessment" of macro surprises.

# Why model-based?

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- model expectations are judgement-free, transparent, not prone to mood, herding and strategic behaviour
- it can be used for every country, also when market expectations are not available
- In this sample model expectations are more efficient. ▸ News analysis

# Outline

# Nowcasting model

Dynamic factor model, REAL TIME out-of-sample exercise (mixed frequency, exact calendar of macro releases) for US GDP QoQ growth rate.

I estimate with Maximum Likelihood within a Expectation-Maximization algorithm: it allows for autocorrelation of idio. and restrictions, consistent and feasible even in case of an approximate factor model.

▸ Model and estimation details

See Giannone et al. (2008); Doz et al. (2011, 2012); Banbura et al. (2013).

Estimation starts in 1991; evaluation period: 2005-2014; 1 factor, 2 lags (results are robust to changes in the specification).

# Data: 13 variables compatible with Bloomberg

| Name | Bloomberg | Transformation |
|---|---|---|
| Building Permits | ✓ | MoM |
| Capacity Utilization | ✓ | Diff |
| Civilian Unemployment Rate | ✓ | Diff |
| Conference Board: Consumer Confidence | ✓ | Level |
| Consumer Price Index | ✓ | MoM |
| Housing Starts | ✓ | MoM |
| Industrial Production | ✓ | MoM |
| ISM Mfg: PMI Composite Index | ✓ | Level |
| Producer Price Index | ✓ | MoM |
| Real Gross Domestic Product | ✓ | MoM |
| Total Nonfarm Employment | ✓ | Diff |
| Trade balance | ✓ | MoM |
| University of Michigan: Consumer Sentiment | ✓ | Level |

# Data: additional variables for robustness

| Name | Bloomberg | Transformation |
|---|---|---|
| Building Permits | ✓ | MoM |
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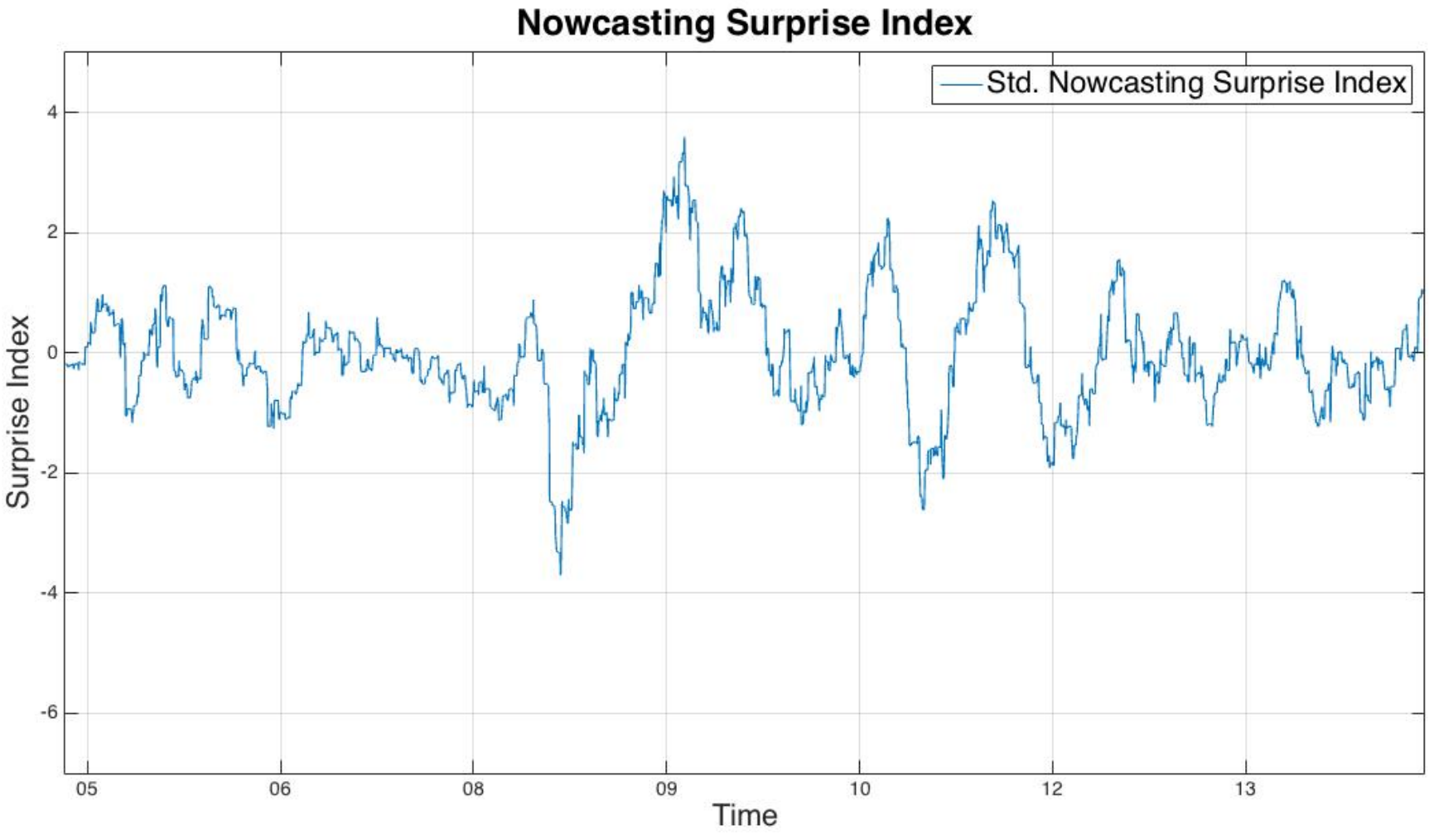
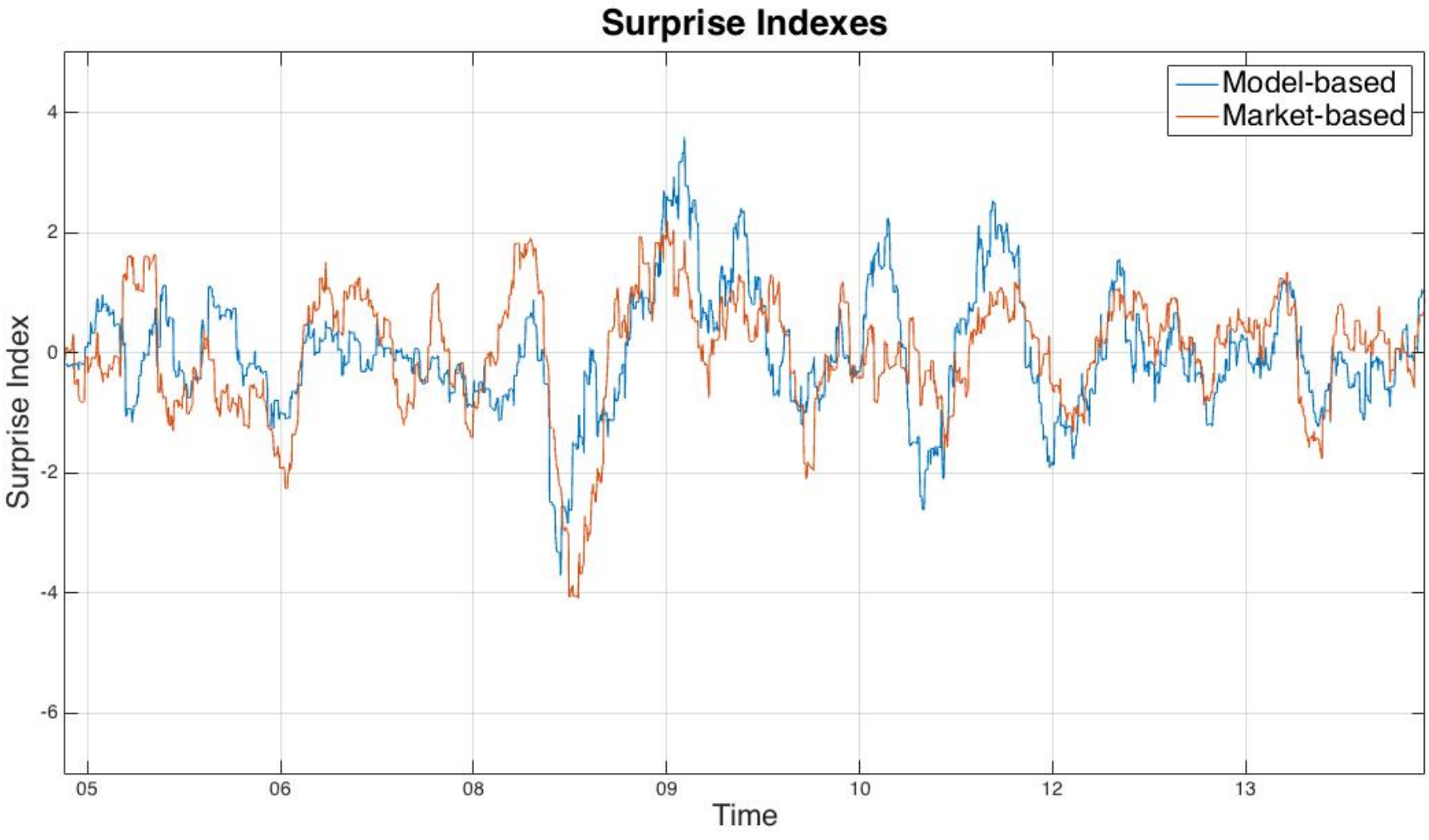
| 3-Month Treasury Bill | | Diff |
| 10-Year Treasury Constant Maturity Rate | | Diff |
| All Employees: Total Private Industries | | MoM |
| Average Weekly Hours Mfg | | MoM |
| Commercial and Industrial Loans | | MoM |
| Disposable Personal Income | | MoM |
| Inventories to Sales Ratio | | Diff |
| M2 Money Stock | | MoM |
| Mfg New Orders: Durable Goods | | MoM |
| Personal Consumption Expenditures | | MoM |
| Retail Sales | | MoM |
| Total Business Inventories | | MoM |

# Outline

# Nowcasting Surprise Index



# Surprise Indexes: market and model-based

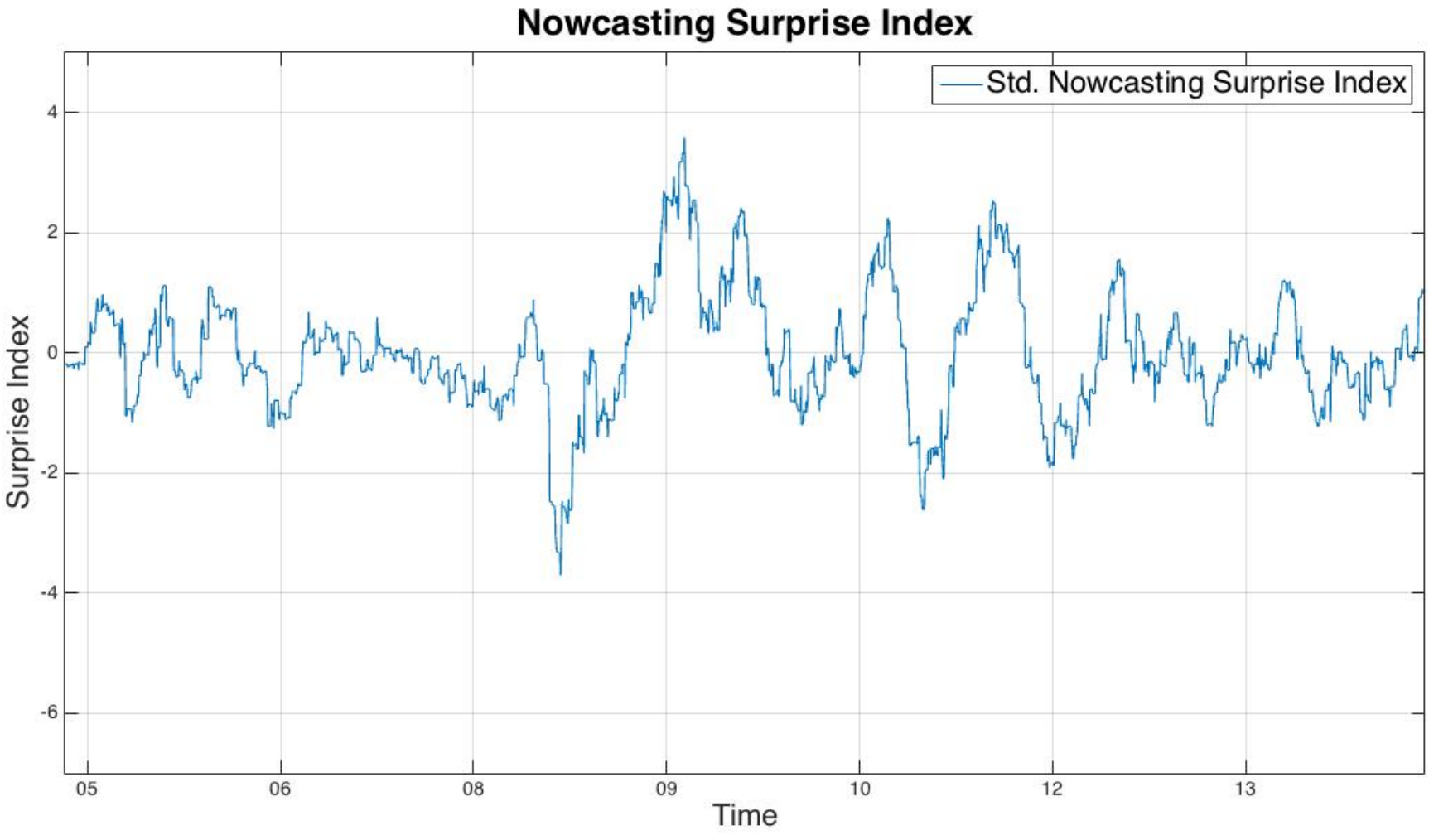


# Surprise Indexes: market and model-based

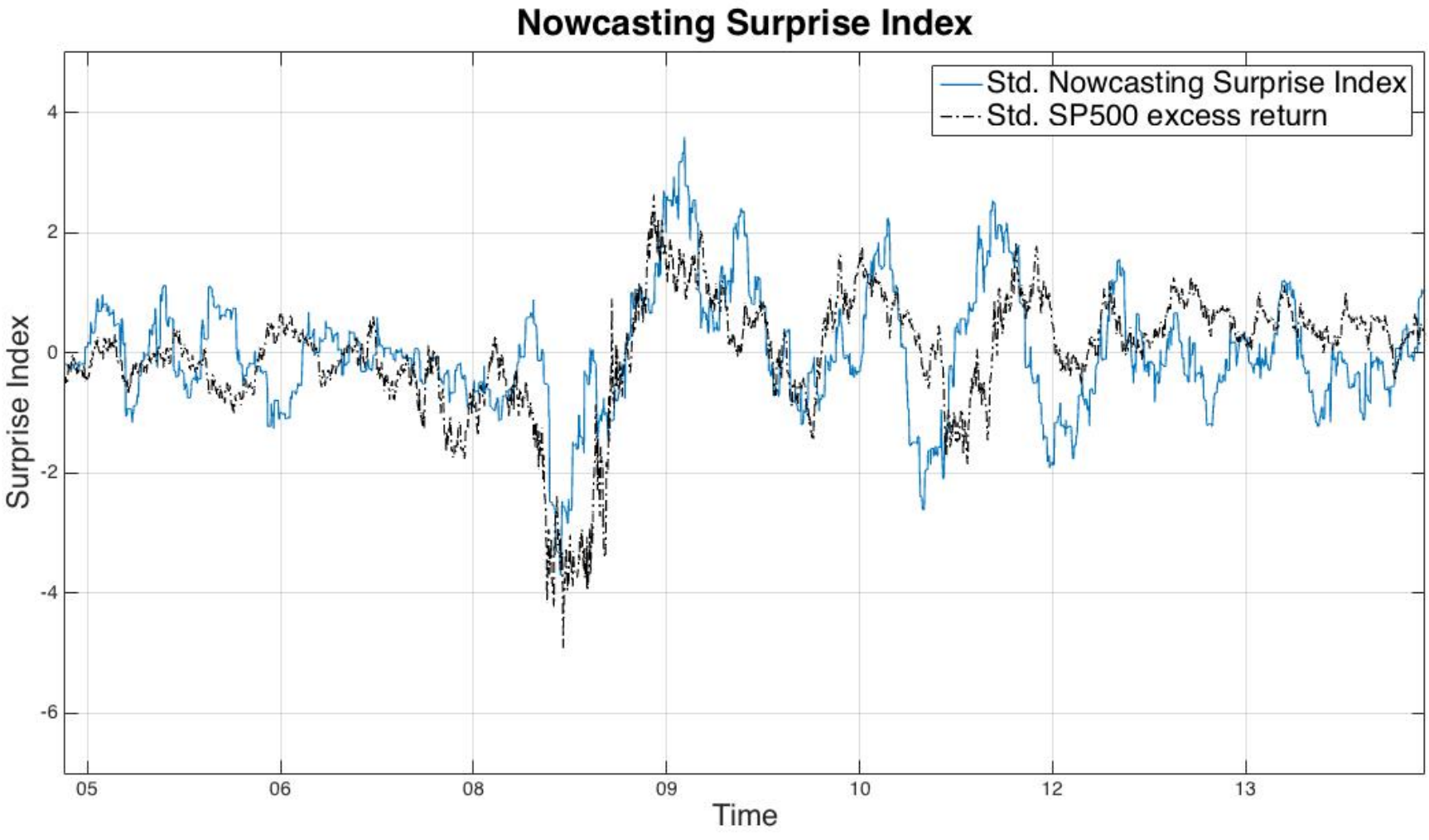
The indexes are very similar!

- Similar news: the model replicates market forecasts Detail
- Similar weights: market reaction is related to the impact of news in changing the assessing the state of the economy (and to its consequences, e.g. monetary policy?)

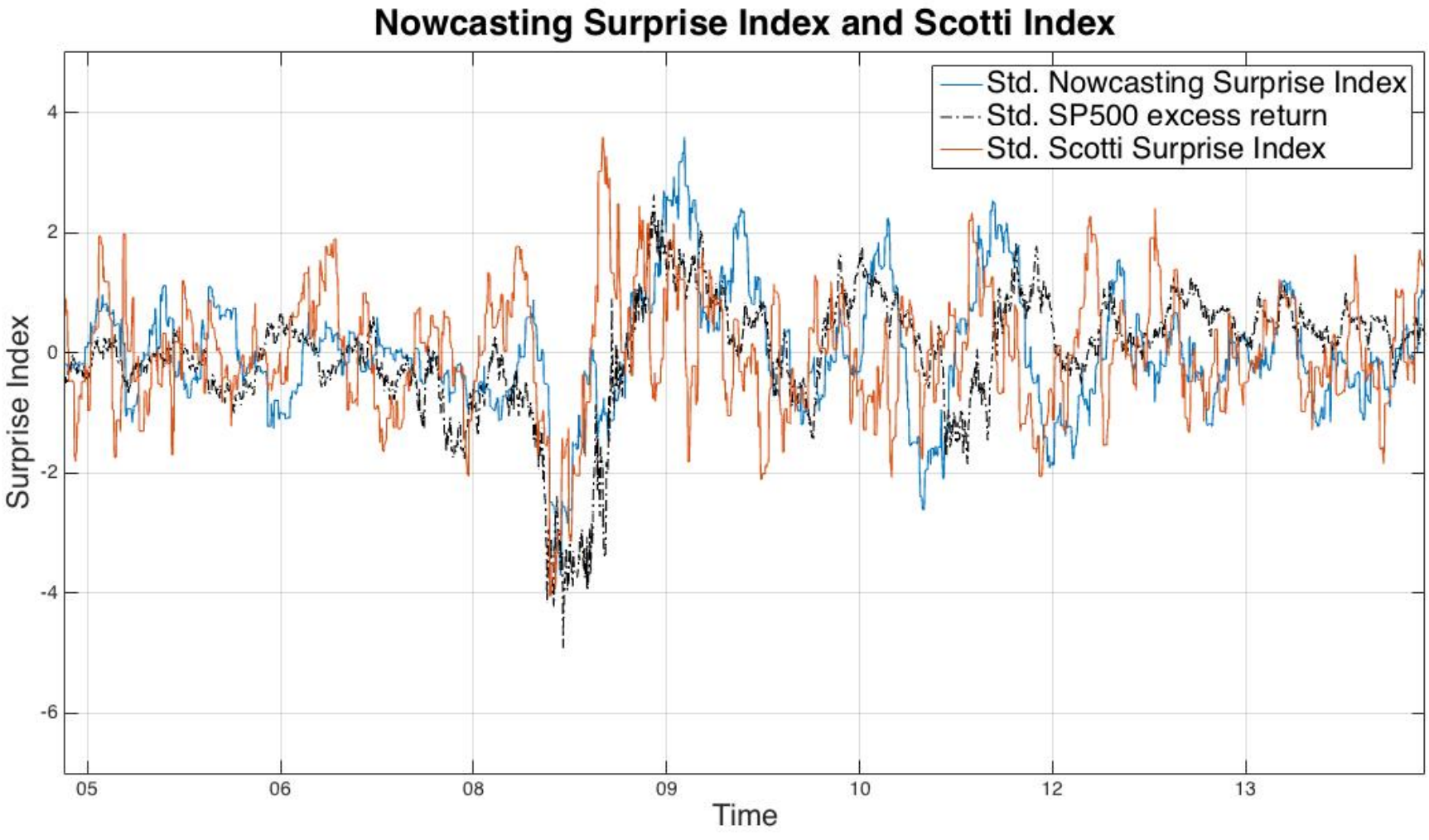
# Nowcasting Surprise Index



# Nowcasting Surprise Index and S&P 500 excess return



# Nowcasting Surprise Index, S&P 500 and Scotti Index



# Correlations - different frequencies

| | **Nowcasting Surprise Index** | | |
|---|---|---|---|
| *Correlations* | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.23 / 0.19* | 0.33 / 0.30* | 0.36 / 0.41* |
| S&P 500 excess returns | 0.23 / 0.23* | 0.37 / 0.36* | 0.42 / 0.45* |

| | **Market Surprise Index** | | |
|---|---|---|---|
| *Correlations* | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.33 | 0.40 | 0.45 |
| S&P 500 excess returns | 0.19 | 0.33 | 0.46 |

* Larger model with 26 variables

▸ Other benchmarks

# Regressions

I regress asset prices (change in 10y and S&P500 excess returns) on Surprise Indexes at different frequencies:

$$\Delta^w AssetPrices_{i,t} = \alpha + \beta_i(SurpriseIndex_t^w) + \epsilon_{i,t}$$

Where the $w$ can be 22, 44 or 66 working days.

For example, if $w = 22$, $\Delta^w AssetPrices_{i,t}$ is the monthly return of asset i and $SurpriseIndex_t^w$ is the index aggregated over a month.

# Regression - different frequencies

| | **Nowcasting Surprise Index** | | |
|---|---|---|---|
| *OLS* - $R^2$ | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.05 / 0.04* | 0.11 / 0.09* | 0.17 / 0.17* |
| S&P 500 excess return | 0.04 / 0.05* | 0.08 / 0.13* | 0.18 / 0.21* |

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| *OLS* - $R^2$ | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.11 | 0.16 | 0.21 |
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# Different kind of indexes and correlations

Recall, we started from here:

| | | **News** | |
|---|---|---|---|
| | | *Market* | *Model* |
| **Weights** | *Market* | Citi; Altavilla et al. | THIS PAPER |
| | *Model* | Grover et al.; Scotti; Gilbert et al. | THIS PAPER |

I compare the differences in correlation with S&P500 of indexes with model/market news and weights. Market weights: coefficients of the regression of news on asset prices (as in Altavilla et al., 2017).

▸ See market weights

# Correlations with S&P500: market and model

Quarterly correlation of model/market based indexes with S&P500.

| | | **News** | |
|---|---|---|---|
| | | *Market* | *Model* |
| **Weights** | *Market* | 0.46 | 0.17 |
| | *Model* | 0.40 | 0.42 / 0.25* |

* Nowcast (not rolling; no rolling weights)

# Markets and model: extracting the judgemental component

**Forecasts differences to be explored: How much and when?**
**(*work in progress*)**

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**Forecasts differences to be explored: How much and when?**
**(*work in progress*)**

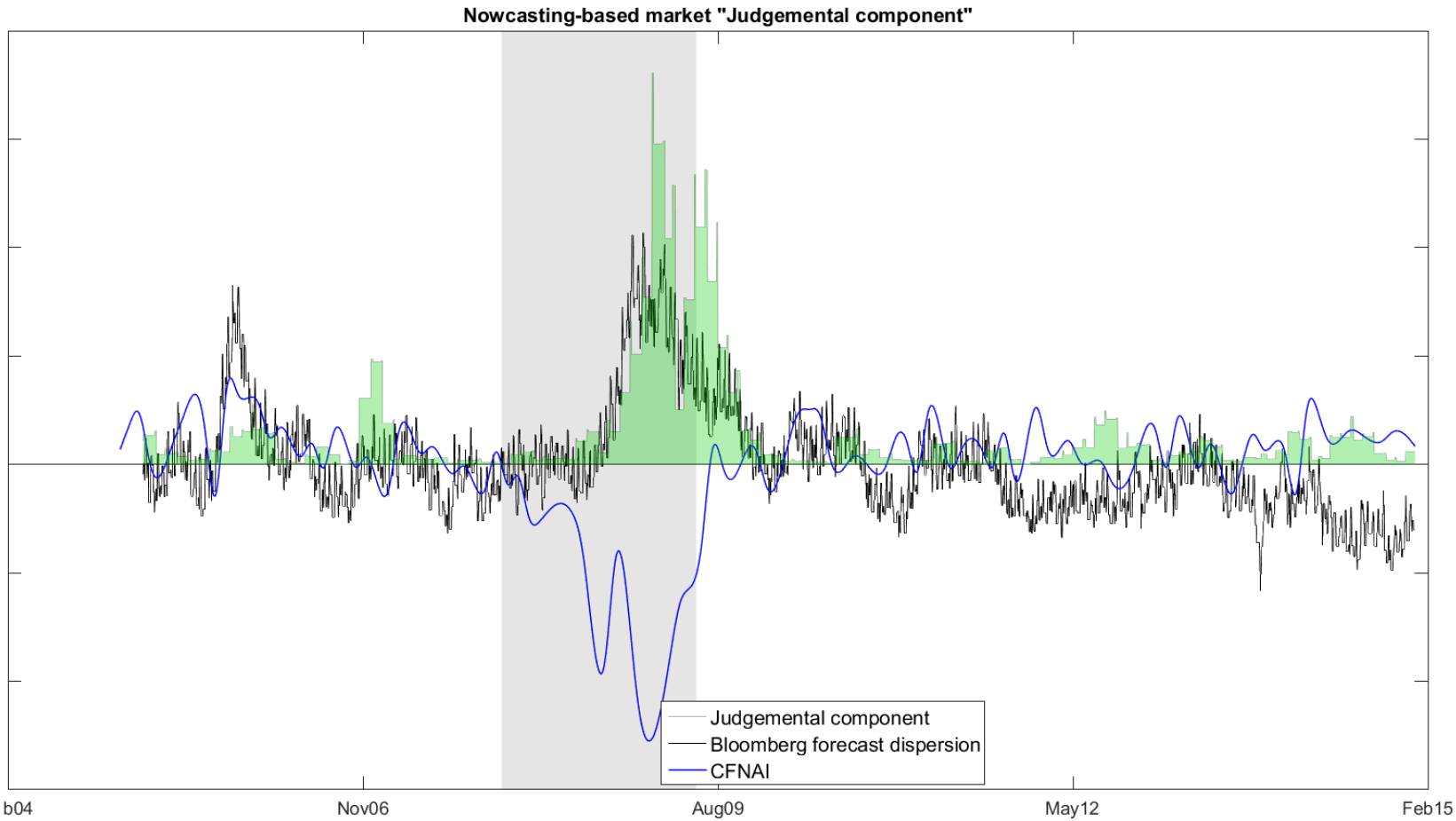
I define "judgemental component": the part of a survey forecast not implied by a nowcasting model:

$$JC_{i,t} = (BB_{i,t} - \mathbb{E}[x_{i,t}|\Omega_\nu])^2$$

$BB_{i_j,t_j}$ = median of Bloomberg surveys; $\mathbb{E}[(x_{i,t}|\Omega_\nu)]$ = model expectation

I aggregate the deviations between market/model forecast across the variables and smooth it: $JC$ follows disagreement and in specific episodes is more pronounced (non linearities, sentiment).

# News analysis - "judgemental" component and disagreement



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- Further research, in progress: predictive regressions; deviations between market/model forecasts in case of particular events.

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# Appendix: The model

$$x_t = \Lambda f_t + \epsilon_t$$

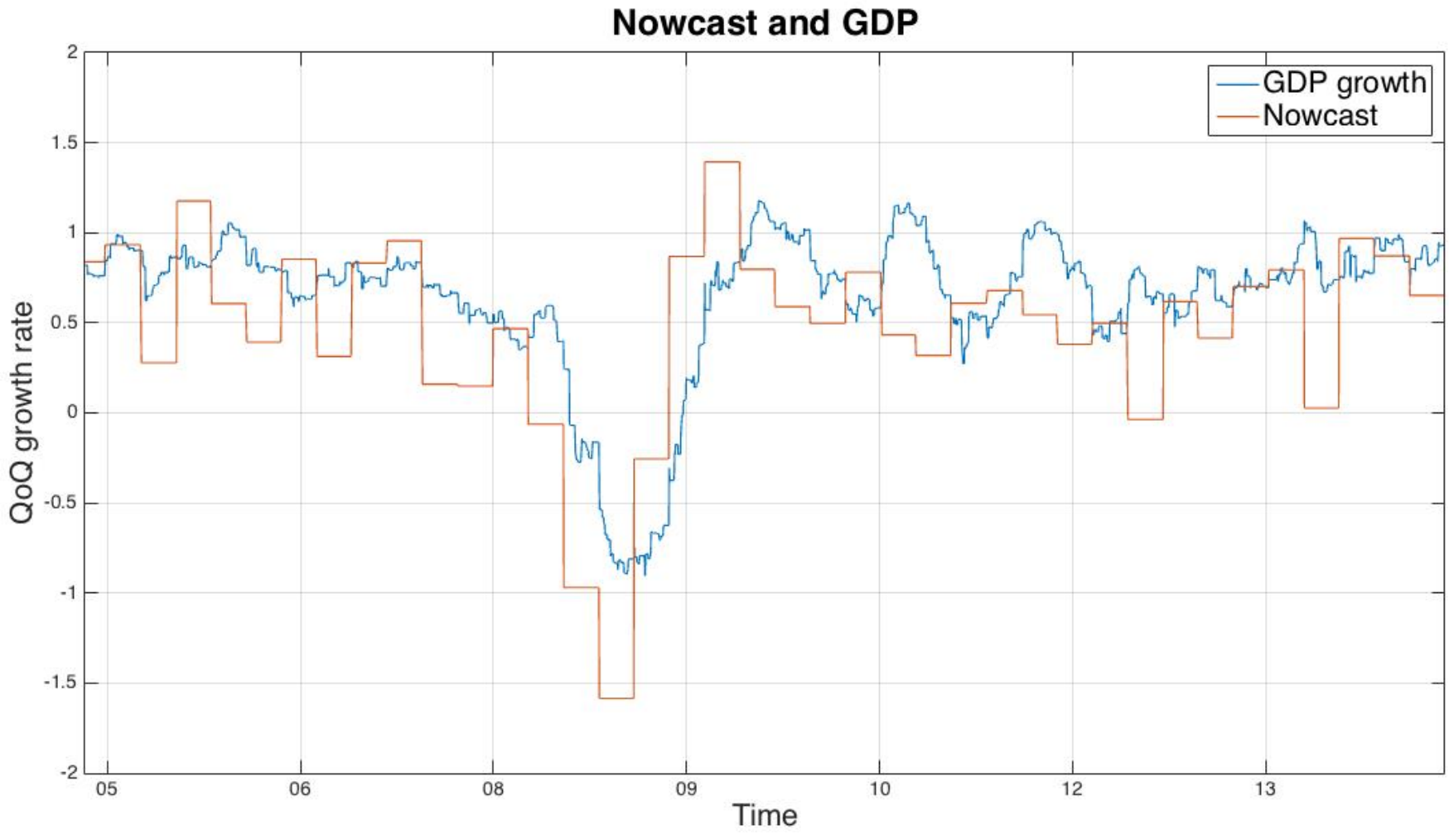
$$f_t = A_1 f_{t-1} + ... + A_p f_{t-p} + u_t;\ u_t\ i.i.d. \sim \mathcal{N}(0, Q)$$

- $x_t$: vector of standardized stationary monthly variables
- $f_t$: unobserved common factors following a $VAR(p)$
- $\Lambda$: factor loadings
- $\epsilon_t$: vector of idiosyncratic components following an $AR(1)$

Quarterly variables are modelled as monthly variables with periodically missing values; see the approximation of Mariano and Murasawa (2003).

Go back

# Real time out-of-sample - US GDP nowcast



# News analysis

Studies show that market-based forecast are not always efficient (Pierce and Roley, 1985; Balduzzi et al., 2001; Andersen et al., 2001; Scotti, 2016).

I test the efficiency of forecasts $F$ (Bloomberg survey or model-based forecast), testing for $\alpha_i = \beta_i = 0$ in the regression (coefficients jointly significant=not efficient):

$$News_{i,t} = \alpha_i + \beta_i F_{i,t} + \epsilon_{i,t} \tag{1}$$

# News analysis

## Bloomberg surveys

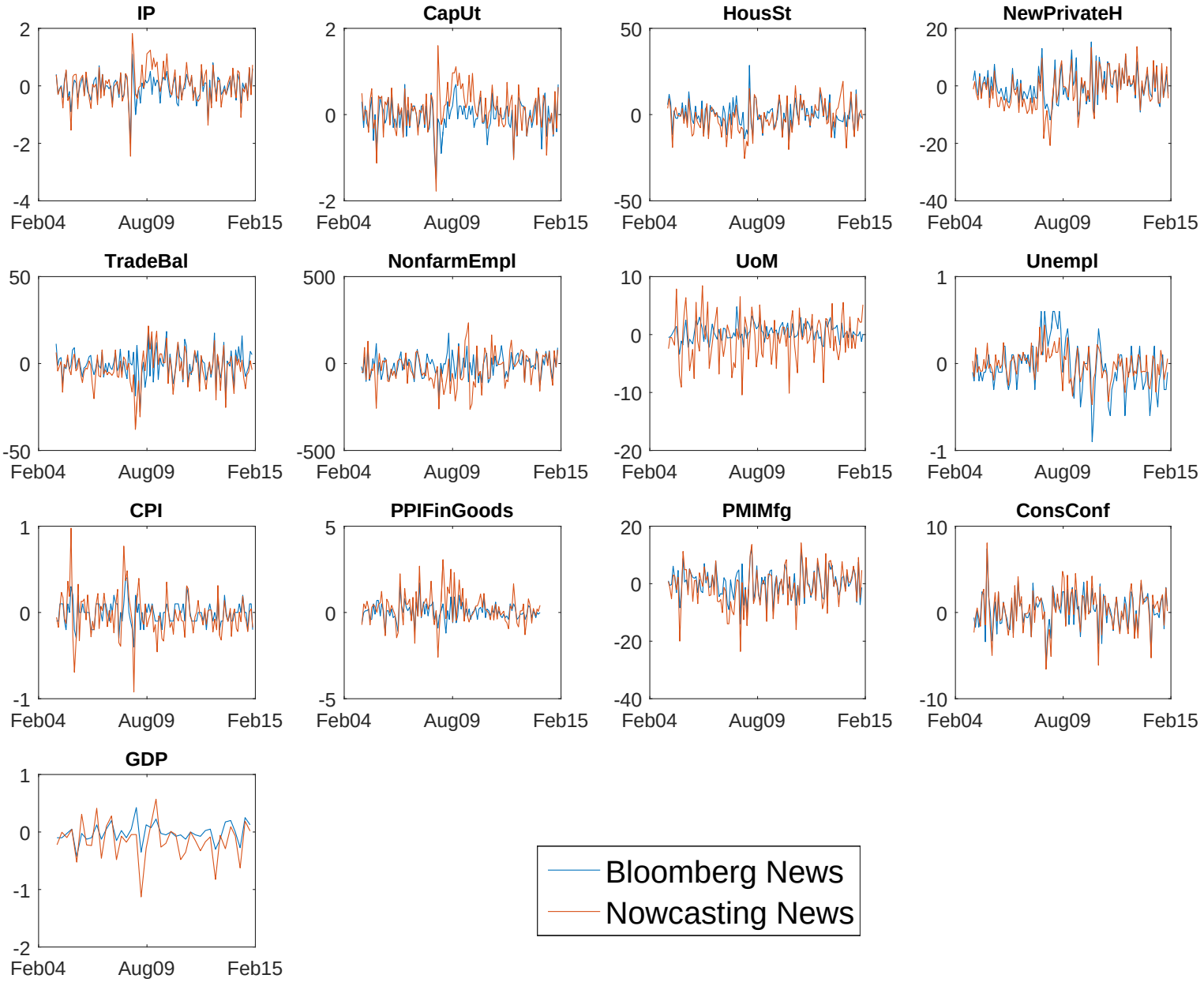
| | $\alpha$ | | $\beta$ | | F | | F-pvalue |
|---|---|---|---|---|---|---|---|
| Industrial Production | -0.300 | *** | 0.781 | *** | 13.849 | *** | 0.000 |
| Capacity Utilization | -0.182 | ** | 0.846 | *** | 15.943 | *** | 0.000 |
| Housing Starts | 0.019 | | 0.058 | *** | 8.047 | *** | 0.005 |
| Building Permits | 0.022 | | 0.042 | | 1.482 | | 0.226 |
| Trade Balance | 0.067 | | 0.000 | | 1.384 | | 0.242 |
| Change in Nonfarm Payrolls | -0.118 | | -0.001 | | 1.403 | | 0.239 |
| U. of Mich. Sentiment | 2.189 | *** | -0.024 | *** | 8.369 | *** | 0.005 |
| Unemployment Rate | -0.207 | ** | 2.581 | *** | 7.884 | *** | 0.006 |
| CPI | -0.313 | *** | 1.583 | *** | 32.469 | *** | 0.000 |
| PPI | -0.119 | | 0.862 | *** | 34.695 | *** | 0.000 |
| Consumer Confidence Index | -0.072 | | 0.001 | | 0.088 | | 0.767 |
| ISM Manufacturing | 1.276 | | -0.022 | | 1.575 | | 0.212 |
| GDP Annualized | -0.041 | | -0.024 | | 0.095 | | 0.759 |

# News analysis

## Nowcasting forecasts

| | $\alpha$ | $\beta$ | | F | | F-pvalue |
|---|---|---|---|---|---|---|
| Industrial Production | 0.086 | -0.610 | *** | 17.067 | *** | 0.000 |
| Capacity Utilization | -0.067 | -0.839 | *** | 15.679 | *** | 0.000 |
| Housing Starts | 0.020 | -0.035 | | 2.376 | | 0.126 |
| Building Permits | 0.018 | -0.102 | * | 3.228 | * | 0.075 |
| Trade Balance | 0.009 | 0.000 | | 0.187 | | 0.666 |
| Change in Nonfarm Payrolls | -0.052 | 0.001 | | 1.562 | | 0.214 |
| U. of Mich. Sentiment | 0.837 | -0.011 | | 1.331 | | 0.251 |
| Unemployment Rate | -0.018 | 1.294 | | 1.736 | | 0.190 |
| CPI | 0.085 | -0.442 | | 0.532 | | 0.467 |
| PPI | 0.099 | -0.670 | ** | 3.998 | ** | 0.048 |
| Consumer Confidence Index | 0.321 | -0.004 | | 1.071 | | 0.303 |
| ISM Manufacturing | 0.732 | -0.014 | | 0.590 | | 0.444 |
| GDP Annualized | 0.090 | -0.140 | | 0.146 | | 0.705 |

Go back


IP
CapUt
HousSt
NewPrivateH
TradeBal
NonfarmEmpl
UoM
Unempl
CPI
PPIFinGoods
PMIMfg
ConsConf
GDP
Feb04
Aug09
Feb15
Bloomberg News
Nowcasting News

# News analysis - forecasting professional forecasters

I forecast the median of the surveys conducted by Bloomberg at the moment of the release, using the model prediction updated up to the previous macroeconomic release.

| **RMSFE relative to random walk** | |
|---|---|
| Capacity Utilization | 0.81 |
| Housing Starts | 0.67 |
| Building Permits | 0.72 |
| Trade Balance | 1.21 |
| Change in Nonfarm Payrolls | 0.87 |
| U. of Mich. Sentiment | 0.75 |
| Unemployment Rate | 0.73 |
| CPI | 0.63 |
| PPI | 1.09 |
| Consumer Confidence Index | 0.62 |
| ISM Manufacturing | 0.44 |
| GDP | 1.27 |
| *real time out of sample, 2005-2014* | |

Go back

# Different kind of indexes and correlations

As market weights I take the coefficients of the regression of news on 10y bonds (as in Altavilla et al., 2017).

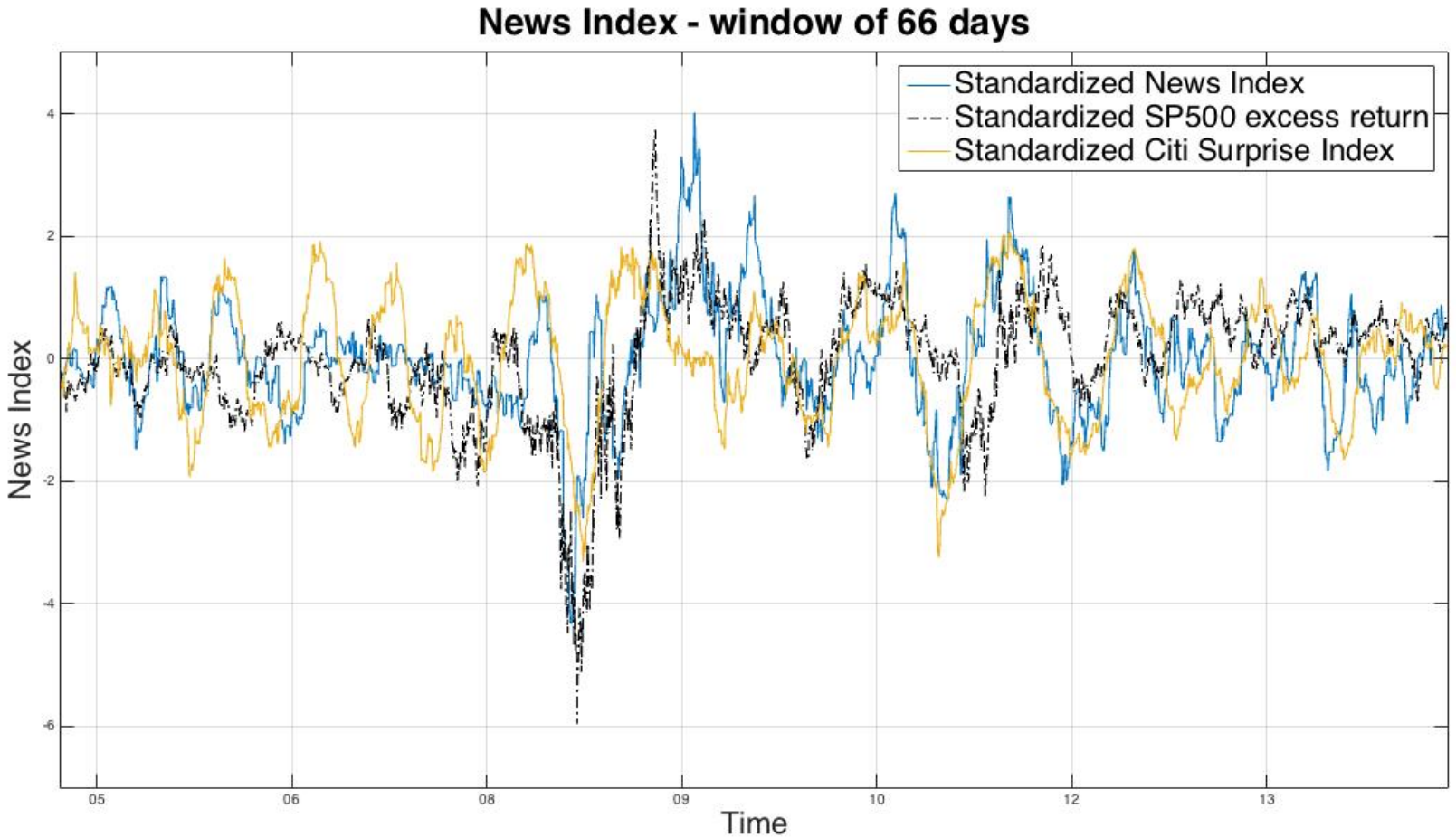
**Regression of News on daily difference of 10y bonds**

| | **Model-based** | **AGM (2017)** |
|---|---|---|
| Industrial Production | -0.983 | -0.57 |
| Capacity Utilization: Industry | 1.591 | 1.18 ** |
| Housing Starts | 0.842 | 0.27 |
| New Private Housing Units Authorized | 0.952 * | 0.65 |
| Trade Balance | 0.897 * | 1.03 ** |
| Total Nonfarm Employment | 1.110 | 3.59 ** |
| University of Michigan: Consumer Sentiment | 0.839 | 1.23 ** |
| Unemployment Rate | 0.001 | -0.21 |
| Consumer Price Index | 0.702 | 0.15 |
| Producer Price Index | 1.693 *** | -0.13 |
| Cons Conf | -0.211 | 0.89 ** |
| ISM Mfg: PMI | 2.417 *** | 2.62 ** |
| GDP | 0.150 | 1.70 ** |

NB Sample size: Model: 2004-14 / AGM: 2000-16. AGM do a regression with 41 variables.

Go back

# Nowcasting Surprise Index, S&P 500 and Citi Index



# Correlations - different frequencies

| | **Scotti Index** | | |
|---|---|---|---|
| *Correlations* | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.02 | -0.05 | 0.02 |
| S&P 500 excess returns | 0.06 | 0.16 | 0.21 |

| | **Citi Index** | | |
|---|---|---|---|
| *Correlations* | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.27 | 0.31 | 0.4 |
| S&P 500 excess returns | 0.15 | 0.19 | 0.22 |

Go back

# Regression - different frequencies

| | **Scotti Index** | | |
|---|---|---|---|
| *OLS* - $R^2$ | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0 | 0 | 0 |
| S&P 500 excess return | 0 | 0.02 | 0.04 |

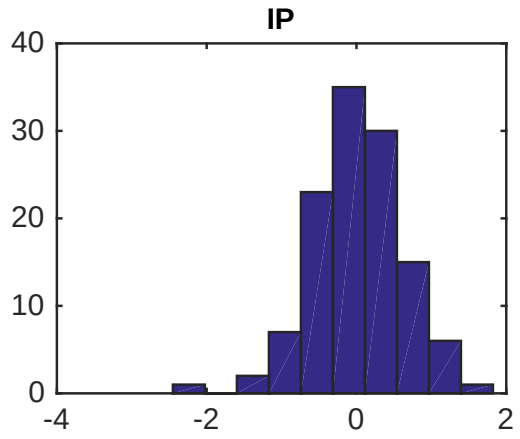
| | **Citi Index** | | |
|---|---|---|---|
| *OLS* - $R^2$ | 1-month | 2-months | Quarterly |
| Change in 10y yields | 0.07 | 0.1 | 0.16 |
| S&P 500 excess return | 0.02 | 0.03 | 0.05 |

▸ Go back

# News Analysis: Now-Casting news

**Data description: Histograms**

**I start from Now-Casting news**


IP
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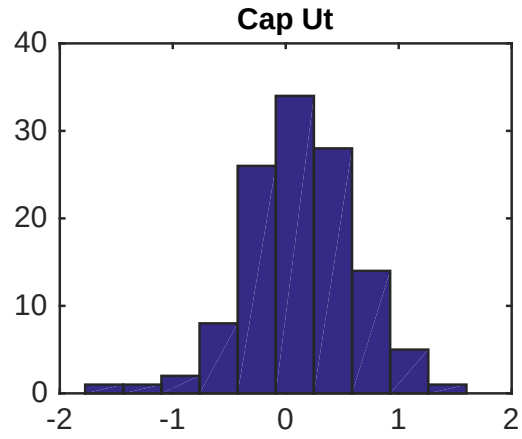
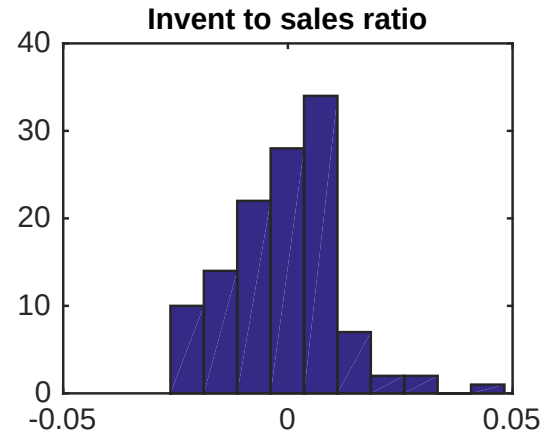
30
20
10
0
-4
-2
0
2


Cap Ut
40
30
20
10
0
-2
-1
0
1
2


Invent to sales ratio
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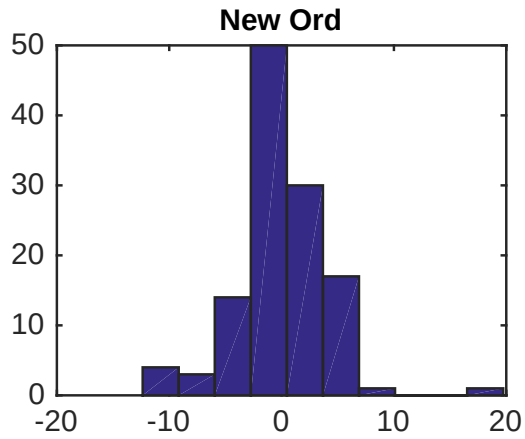
30
20
10
0
-0.05
0
0.05


New Ord
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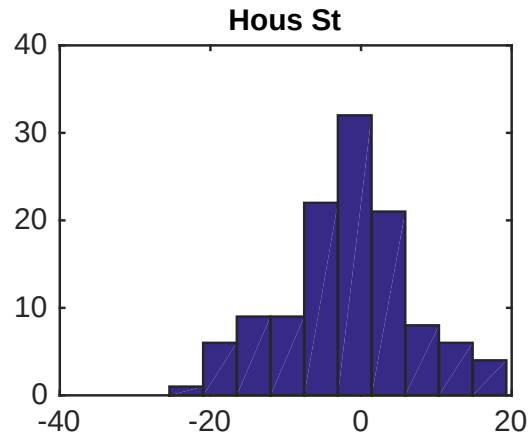
40
30
20
10
0
-20
-10
0
10
20


Hous St
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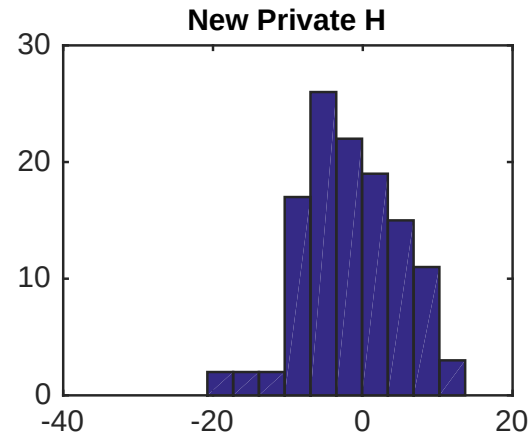
30
20
10
0
-40
-20
0
20


New Private H
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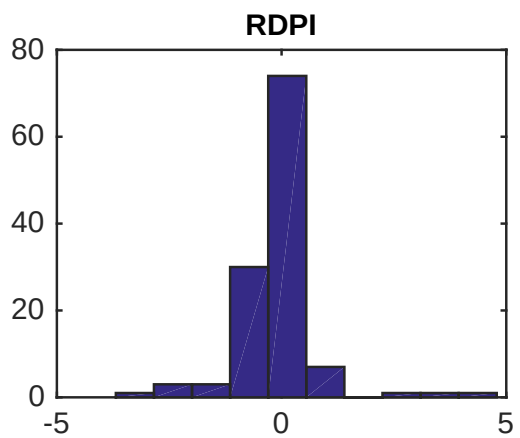
20
10
0
-40
-20
0
20


RDPI
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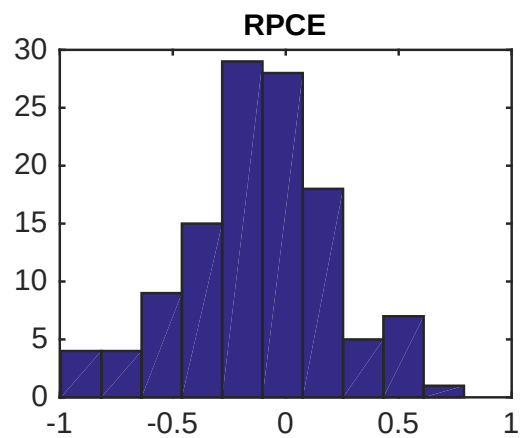
60
40
20
0
-5
0
5


RPCE
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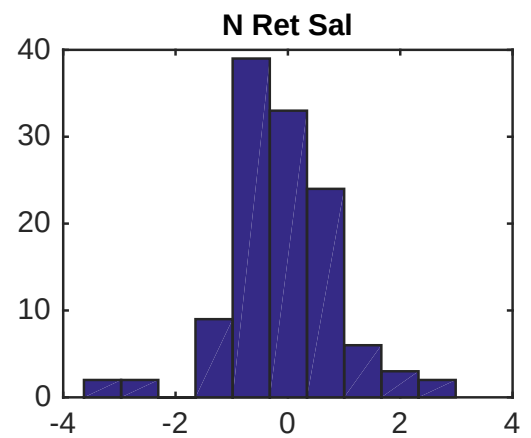
25
20
15
10
5
0
-1
-0.5
0
0.5
1


N Ret Sal
40
30
20
10
0
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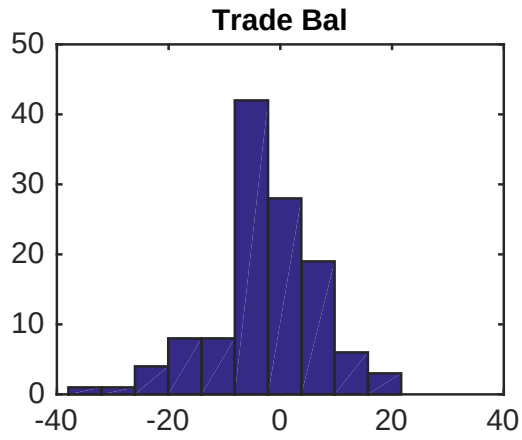
-2
0
2
4


Trade Bal
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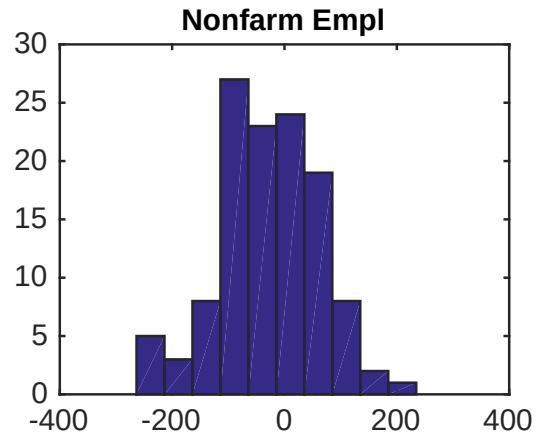
0
20
40


Nonfarm Empl
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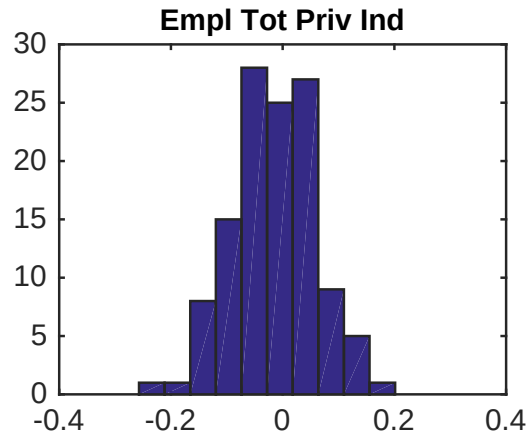
25
20
15
10
5
0
-400
-200
0
200
400


Empl Tot Priv Ind
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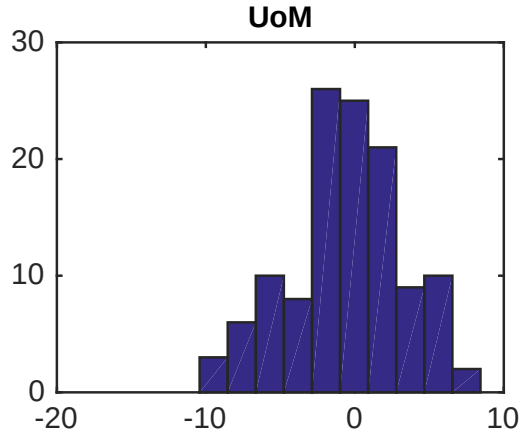
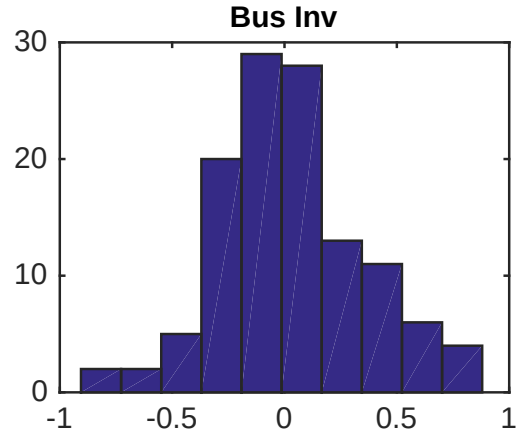
25
20
15
10
5
0
-0.4
-0.2
0
0.2
0.4


UoM
30
20
10
0
-20
-10
0
10


Bus Inv
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20
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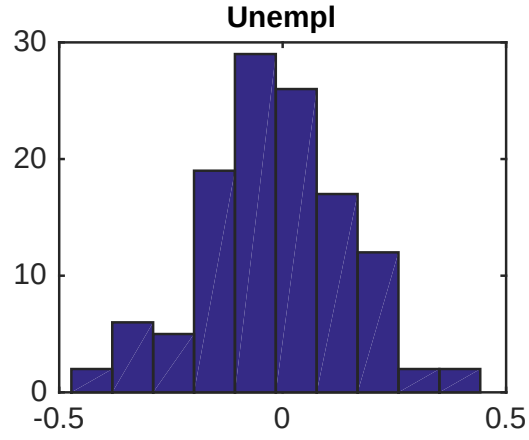
0
-1
-0.5
0
0.5
1


Unempl
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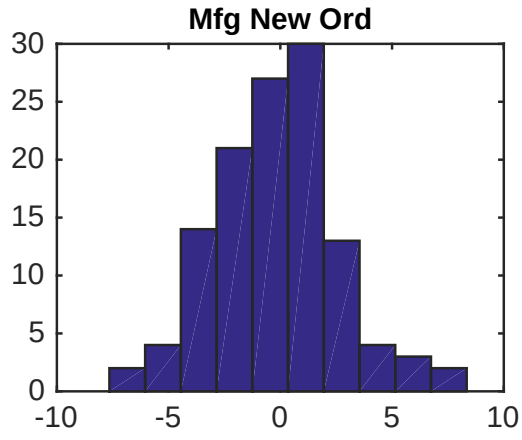
Mfg New Ord
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0
5
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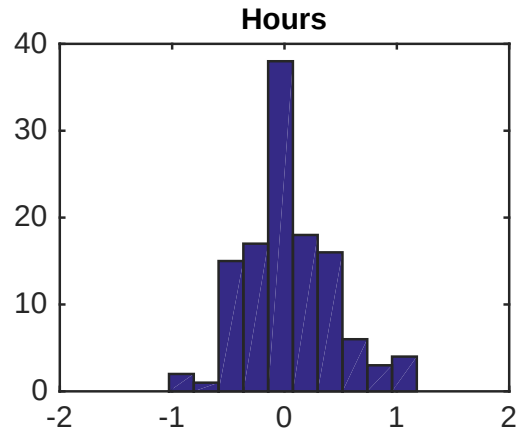
Hours
40
30
20
10
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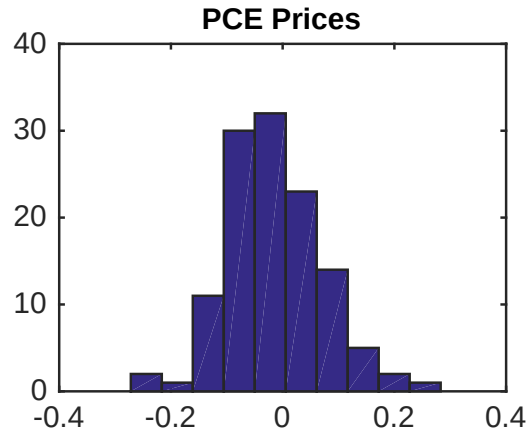
-2
-1
0
1
2


PCE Prices
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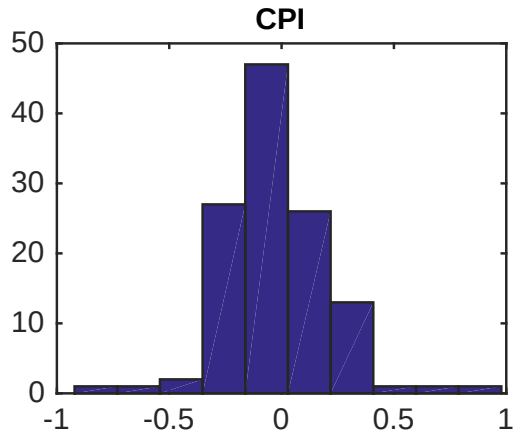
30
20
10
0
-0.4
-0.2
0
0.2
0.4


CPI
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40
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20
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0
0.5
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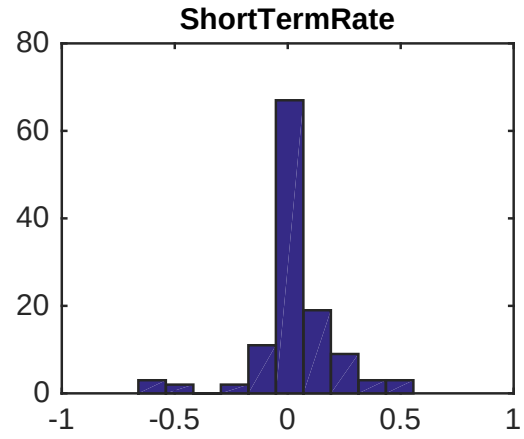
ShortTermRate
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-1
-0.5
0
0.5
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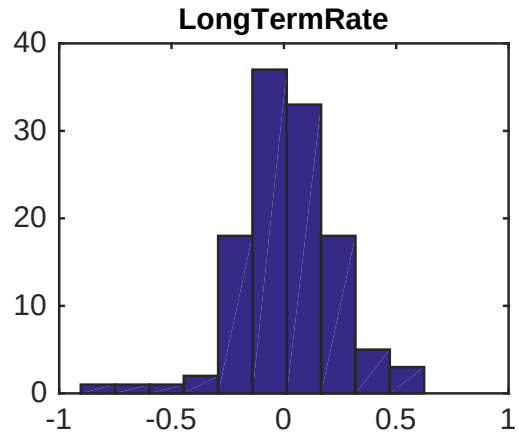
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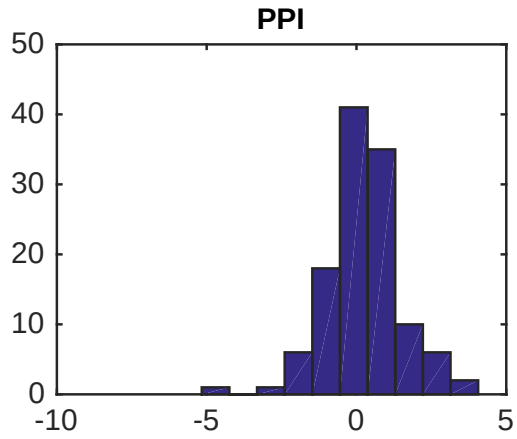
PPI
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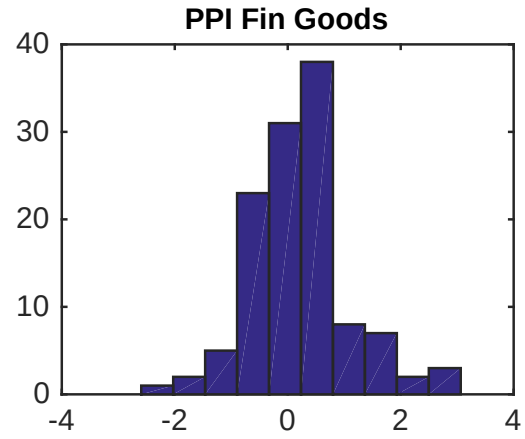
PPI Fin Goods
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2
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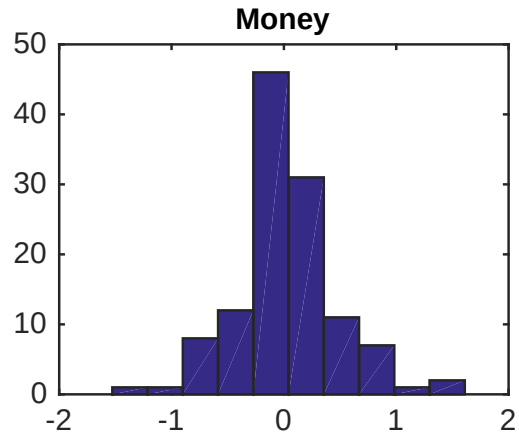
Money
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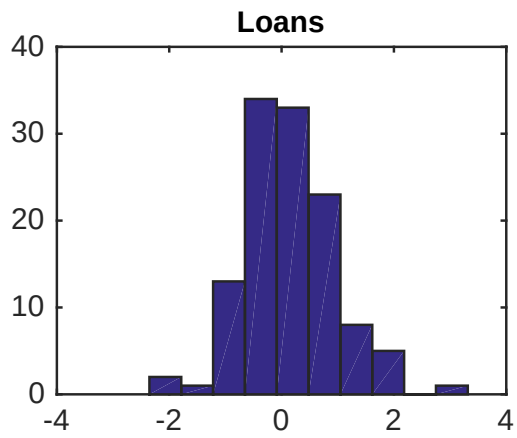
1
2


Loans
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30
20
10
0
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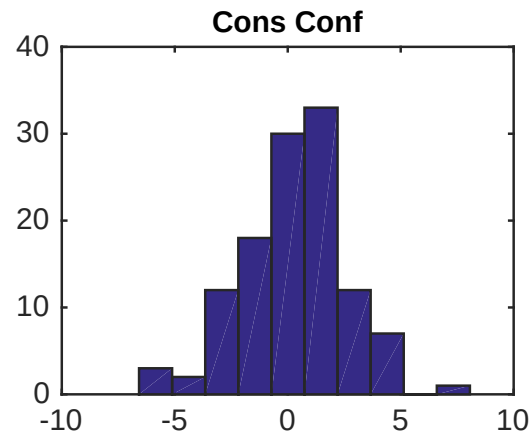
-2
0
2
4


Cons Conf
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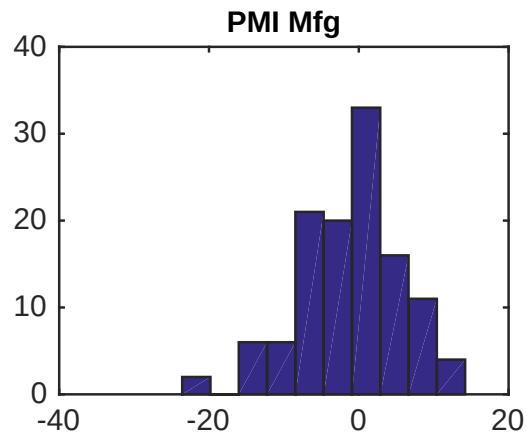
30
20
10
0
-10
-5
0
5
10


PMI Mfg
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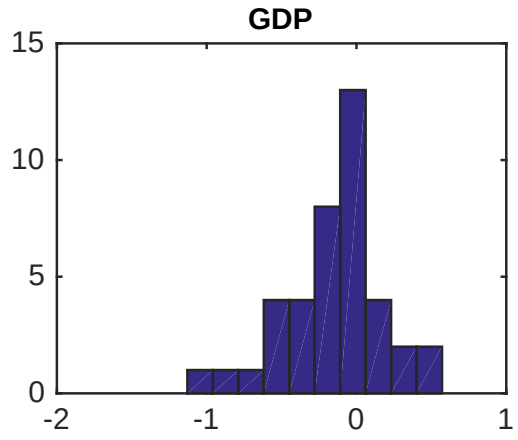
30
20
10
0
-40
-20
0
20


GDP
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5
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-2
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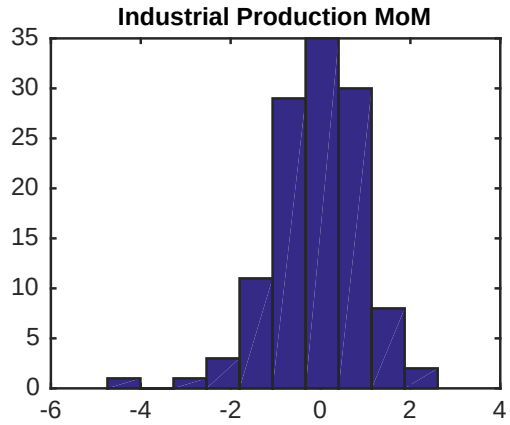
1

# News Analysis: Now-Casting news

**Data description: Histograms**

**Bloomberg news**


Industrial Production MoM
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25
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15
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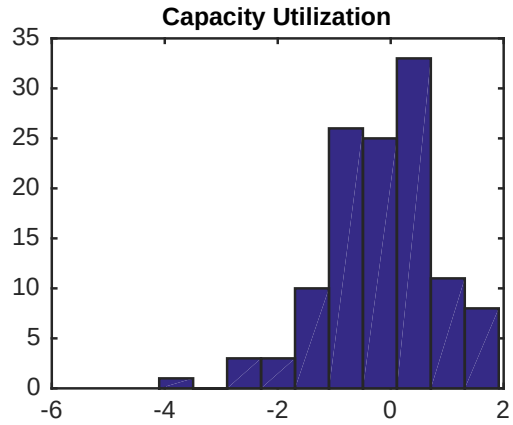
5
0
-6
-4
-2
0
2
4


Capacity Utilization
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30
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20
15
10
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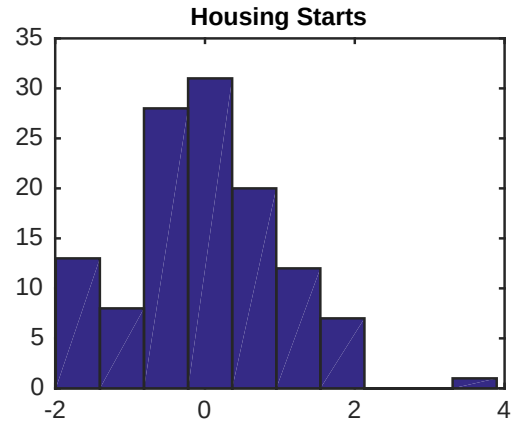
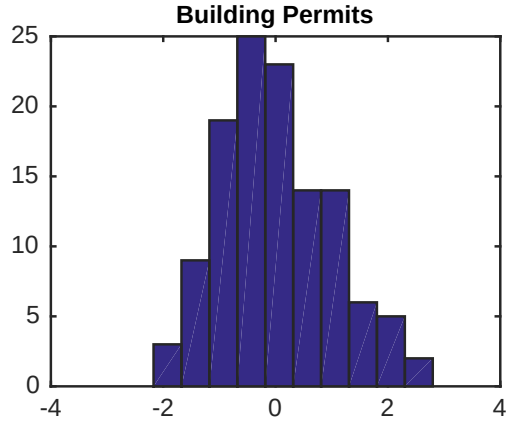
-4
-2
0
2


Housing Starts
35
30
25
20
15
10
5
0
-2
0
2
4


Building Permits
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20
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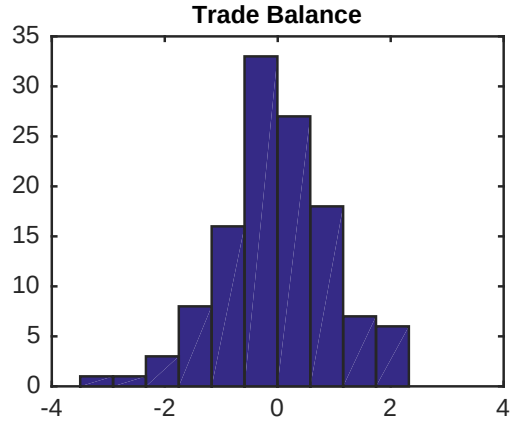
10
5
0
-4
-2
0
2
4


Trade Balance
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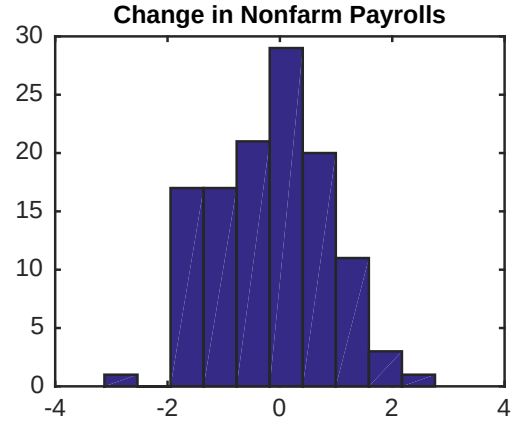
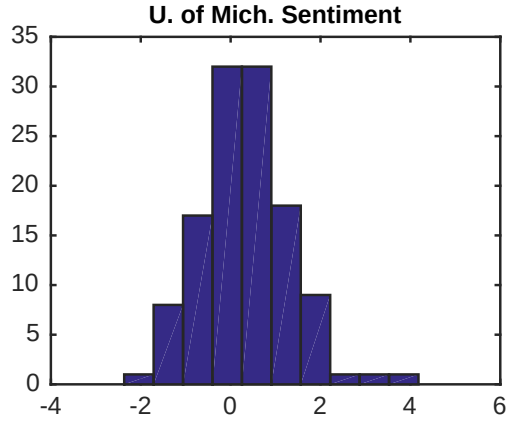
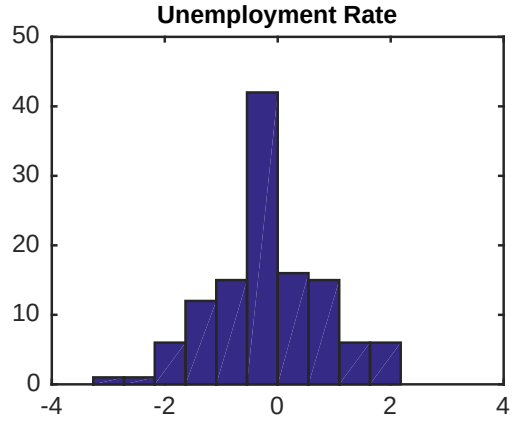
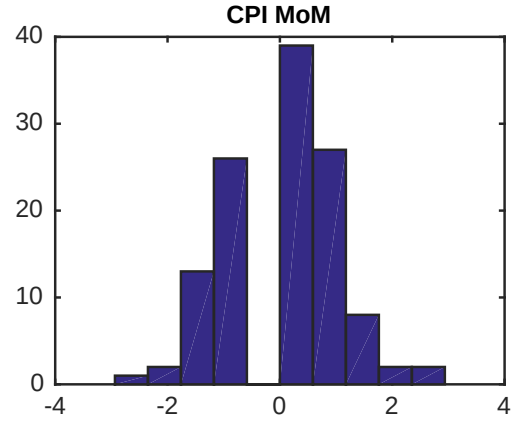
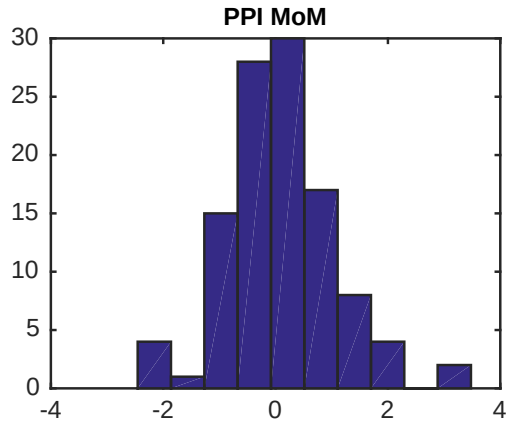
30
25
20
15
10
5
0
-4
-2
0
2
4

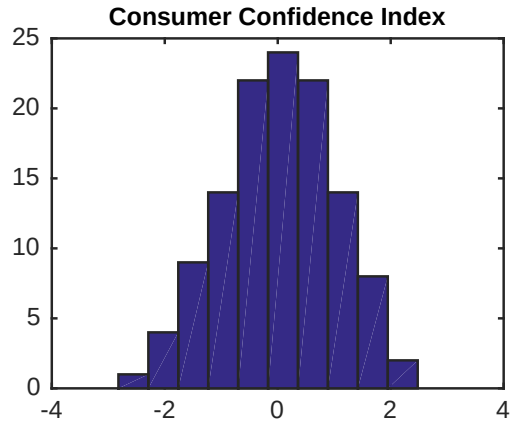

Change in Nonfarm Payrolls
30
25
20
15
10
5
0
-4
-2
0
2
4

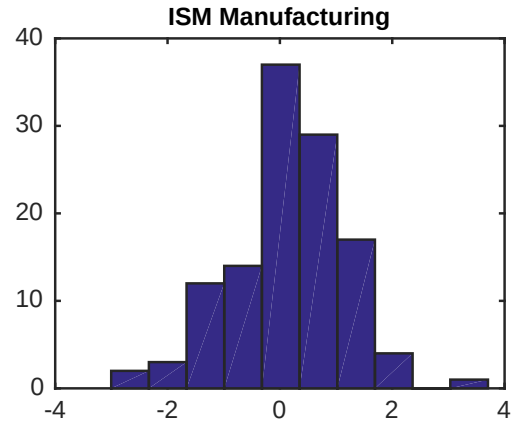

U. of Mich. Sentiment
35
30
25
20
15
10
5
0
-4
-2
0
2
4
6

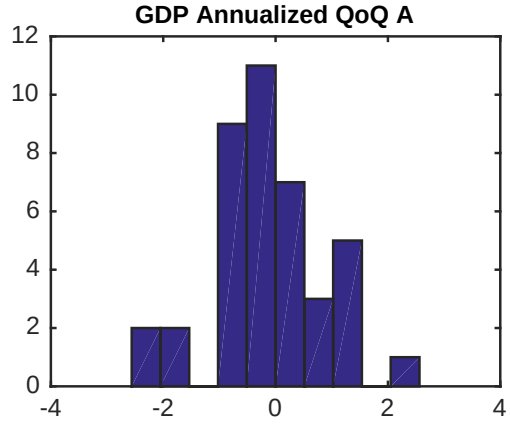

Unemployment Rate
50
40
30
20
10
0
-4
-2
0
2
4


CPI MoM
40
30
20
10
0
-4
-2
0
2
4


PPI MoM
30
25
20
15
10
5
0
-4
-2
0
2
4


Consumer Confidence Index
25
20
15
10
5
0
-4
-2
0
2
4


ISM Manufacturing
40
30
20
10
0
-4
-2
0
2
4


GDP Annualized QoQ A
12
10
8
6
4
2
0
-4
-2
0
2
4