Understanding the News that Moves Markets

EMNLP 2018
November 3, 2018

Gideon Mann
Head of Data Science, Office of the CTO
My journey: bad hair to no hair
What this talk is **not** about: How to make money on the stock market
What this talk **is** about:

Financial technology
The news that moves markets
Computer Things
BlocksWorld
Financial Technology
Financial Technology II
Financial Technology III
What is the finance ecosystem?

**Savers**
(Companies, charities, governments, individuals - me and you)

**Market:**
Stock exchanges

**Buy side**
- Wealth managers
- Sovereign Wealth Funds (Norway’s “Oil Fund”)
- Insurance companies
- Pension funds

**Sell side**
- Investment banks and other brokers (HSBC)

**Buy side**
- Investment Management firms (Vanguard, Azimut)

**Sell side**
- Sell side analysts
- Bloomberg
- Government and companies
- Credit rating agencies
- Central Banks
- Fund Rating agencies
- Investment consultants

Bloomberg
Bonds have more market value than equities

FX has the most daily notational volume

Vastly more structured products and derivatives than equities

News moves markets

100 Billion Messages per day

2008 Financial Crisis
Flash Crash
US Debt Ceiling Crisis/S&P Downgrade
Japan Earthquake & Tsunami
Stimulus Tapering Discussion
Not all channels are the same…

[Dredze et al. 2016]
[Osborne, Dredze 2014]
...not all sources are the same

First Bloomberg Headline

New York Times story

SEC Announcement

~12%
Broadcomm is said to explore deal to acquire chipmaker Qualcomm
Human Language Technology, not Renaissance Technologies
**Time is not a myth**

<table>
<thead>
<tr>
<th>Time Unit</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days &amp; Hours</td>
<td>Fundamental Investor</td>
</tr>
<tr>
<td>Minutes</td>
<td>Institutional Trader</td>
</tr>
<tr>
<td>Milliseconds</td>
<td>Event Driven Algorithmic Trader</td>
</tr>
<tr>
<td>Microseconds</td>
<td>High Frequency Trading</td>
</tr>
</tbody>
</table>
Detection
New text arrives

Extraction
Extract structured data from text

Interpretation
Relate new data to existing data

Presentation
Inform the user on what happened
### Document Ingest and Search

#### Top Ranked News

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Source</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engelhart Hires Former Sucden’s Donovan to Bolster Coffee Team</td>
<td>BN</td>
<td>12:10</td>
</tr>
<tr>
<td>2</td>
<td>SOFTS: Cocoa Advances on El Nino Concerns; Coffee, Sugar Climb</td>
<td>BFW</td>
<td>10/25</td>
</tr>
<tr>
<td>3</td>
<td>Tata Coffee Earnings Teleconference TCO IN</td>
<td>BT</td>
<td>05:19</td>
</tr>
</tbody>
</table>

#### Time Ordered News

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Source</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>*SEC Short Sale Rule 201 is in Effect : YGYI (NASDAQ)</td>
<td>BSS</td>
<td>12:10</td>
</tr>
<tr>
<td>5</td>
<td>Engelhart Hires Former Sucden’s Donovan to Bolster Coffee Team</td>
<td>BN</td>
<td>12:10</td>
</tr>
<tr>
<td>6</td>
<td>Mena Report: Tender For Sale Of Dried Coffee Berries.</td>
<td>NS8</td>
<td>11:36</td>
</tr>
<tr>
<td>7</td>
<td>Mena Report: Supply Of Coffee.</td>
<td>NS8</td>
<td>09:45</td>
</tr>
<tr>
<td>8</td>
<td>Mena Report: Coffee, Tea And Accompanying Products.</td>
<td>NS8</td>
<td>09:28</td>
</tr>
<tr>
<td>9</td>
<td>The Columbian: Food &amp; Drink: Kafiex celebrates global coffee village</td>
<td>NS1</td>
<td>09:09</td>
</tr>
<tr>
<td>10</td>
<td>Mena Report: Food, Beverages, Tobacco And Related Products (coffee</td>
<td>NS8</td>
<td>09:05</td>
</tr>
<tr>
<td></td>
<td>Beverage, ...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Stewart &amp; Mackertich Research WEEKLY Dossier 26-10-2018</td>
<td>SMK</td>
<td>08:46</td>
</tr>
<tr>
<td>12</td>
<td>Tuoi Tre: Tea-based drinks outplay coffee in caffeine-loving Vietnam:</td>
<td>NS6</td>
<td>08:18</td>
</tr>
<tr>
<td></td>
<td>report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Intl Coffee Org: Visit from Ambassador of Angola</td>
<td>ING</td>
<td>06:51</td>
</tr>
<tr>
<td>14</td>
<td>AGRICULTURE WEEKLY AGENDA: Sugar Ethanol; Bali; Soy Crush; Bunge</td>
<td>BFW</td>
<td>05:45</td>
</tr>
<tr>
<td>15</td>
<td>Asian News: GreenBrew all set to dominate Indian market with flavored</td>
<td>RF6</td>
<td>05:28</td>
</tr>
<tr>
<td></td>
<td>green coffee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Tata Coffee Earnings Teleconference TCO IN</td>
<td>BT</td>
<td>05:19</td>
</tr>
<tr>
<td>17</td>
<td>Commodity Online: India Coffee exports may fall as floods dent</td>
<td>NS1</td>
<td>04:19</td>
</tr>
<tr>
<td></td>
<td>production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>*SEC Short Sale Rule 201 Not In Effect : YGYI (NASDAQ)</td>
<td>BSS</td>
<td>03:58</td>
</tr>
<tr>
<td>19</td>
<td>Tata Coffee Earnings Q2 2019 Earnings Call Teleconference TCO IN</td>
<td>BT</td>
<td>02:38</td>
</tr>
</tbody>
</table>
Twitter: Ranking financial tweets

1. StockCats (@StockCats)
   we haven't had a Twitter takeover rumor all year, so he's got to come up with something
   4:08 PM - 26 Jan 2017
   1 Retweet 14 Likes

2. zero hedge (@zerohedge)
   TWTR jumps 3.9% on rerun of Google acquisition rumor
   2:52 PM - 31 Aug 2016

[Ceccarelli, Nidito, Osborne 2016]
A disaster in the White House is huge

Over $136 billion was wiped out in minutes
Credibility
Twitter: Geolocation credibility

Firefighters are battling a fire on the 50th floor of Trump Tower in NYC

3:49 PM - 7 Apr 2018 from Highworth, England

3 Likes

[Preotiuc-Pietro, Guntuku, Ungar 2017]
[Preotiuc-Pietro, Liu, Hopkins, Ungar 2017]
[Giorgi, Preoțiuc-Pietro, Buffone, Rieman, Ungar, Schwartz 2018]
[Dredze, Osborne, Kambadur 2016]
### Starbucks Corporation

#### Consolidated Statements of Earnings (in millions, except per share data)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>$4,238</td>
<td>$414</td>
<td>$342</td>
<td>$373</td>
<td>$4,006</td>
<td>$646</td>
<td>$3,357</td>
<td>$1.71</td>
<td>$1.71</td>
</tr>
<tr>
<td>2018</td>
<td>$3,863</td>
<td>$394</td>
<td>$322</td>
<td>$346</td>
<td>$3,893</td>
<td>$510</td>
<td>$3,383</td>
<td>$1.60</td>
<td>$1.60</td>
</tr>
<tr>
<td>2017</td>
<td>$3,525</td>
<td>$370</td>
<td>$300</td>
<td>$290</td>
<td>$3,515</td>
<td>$967</td>
<td>$2,448</td>
<td>$1.27</td>
<td>$1.27</td>
</tr>
<tr>
<td>2016</td>
<td>$3,227</td>
<td>$351</td>
<td>$281</td>
<td>$283</td>
<td>$3,290</td>
<td>$957</td>
<td>$2,333</td>
<td>$1.25</td>
<td>$1.25</td>
</tr>
<tr>
<td>2015</td>
<td>$3,019</td>
<td>$329</td>
<td>$260</td>
<td>$262</td>
<td>$3,275</td>
<td>$752</td>
<td>$2,523</td>
<td>$1.22</td>
<td>$1.22</td>
</tr>
</tbody>
</table>

#### Notes to Financial Statements

- **Revenue, Adj:**
  - 2019: $4,238 million
  - 2018: $3,863 million
  - 2017: $3,525 million
  - 2016: $3,227 million
  - 2015: $3,019 million

- **EPS, Adj:**
  - 2019: $1.71
  - 2018: $1.60
  - 2017: $1.27
  - 2016: $1.25
  - 2015: $1.22

- **Enterprise Value:**
  - 2019: $22,386 million
Cats all the way down

### TABLE I — FINANCIAL INFORMATION

**Item 1. Financial Statements**

**STATISTICS CORPORATION**

**CONSOLIDATED STATEMENTS OF EARNINGS**

(All amounts, except per share data, in millions, except per share data)

<table>
<thead>
<tr>
<th>Item</th>
<th>Net Income</th>
<th>Share Data</th>
<th>Share Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apr.</td>
<td>Apr. %</td>
<td>Apr.</td>
</tr>
<tr>
<td>Sales</td>
<td>1,000.4</td>
<td>5.0%</td>
<td>1,000.0</td>
</tr>
<tr>
<td>Cost of goods sold</td>
<td>2,500.0</td>
<td>5.0%</td>
<td>2,500.0</td>
</tr>
<tr>
<td>Gross profit</td>
<td>750.0</td>
<td>5.0%</td>
<td>750.0</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>500.0</td>
<td>5.0%</td>
<td>500.0</td>
</tr>
<tr>
<td>Operating income</td>
<td>250.0</td>
<td>5.0%</td>
<td>250.0</td>
</tr>
<tr>
<td>Interest income</td>
<td>10.0</td>
<td>5.0%</td>
<td>10.0</td>
</tr>
<tr>
<td>Interest expense</td>
<td>5.0</td>
<td>5.0%</td>
<td>5.0</td>
</tr>
<tr>
<td>Income before income taxes</td>
<td>245.0</td>
<td>5.0%</td>
<td>245.0</td>
</tr>
<tr>
<td>Income tax expense</td>
<td>45.0</td>
<td>5.0%</td>
<td>45.0</td>
</tr>
<tr>
<td>Income after income taxes</td>
<td>200.0</td>
<td>5.0%</td>
<td>200.0</td>
</tr>
<tr>
<td>Net income</td>
<td>200.0</td>
<td>5.0%</td>
<td>200.0</td>
</tr>
<tr>
<td>Net income per share</td>
<td>0.40</td>
<td>5.0%</td>
<td>0.40</td>
</tr>
<tr>
<td>Diluted net income per share</td>
<td>0.40</td>
<td>5.0%</td>
<td>0.40</td>
</tr>
</tbody>
</table>

**Table of Common**

**Item 2. Condensed Consolidated Financial Statements.**

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**Statutory Corporation**

**CONSOLIDATED BALANCE SHEET**

(All amounts in millions, except per share data)

<table>
<thead>
<tr>
<th>Item</th>
<th>Apr.</th>
<th>Apr. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>1,000.4</td>
<td>5.0%</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>500.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Inventory</td>
<td>250.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>10.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total current assets</td>
<td>1,860.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Property, plant, and equipment</td>
<td>1,000.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Goodwill</td>
<td>500.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Intangible assets</td>
<td>250.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total assets</td>
<td>4,660.0</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Apr.</th>
<th>Apr. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounts payable</td>
<td>1,000.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Accrued expenses</td>
<td>500.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total current liabilities</td>
<td>1,500.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Long-term liabilities</td>
<td>1,000.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total liabilities</td>
<td>2,500.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Shareholders' equity</td>
<td>2,160.0</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Apr.</th>
<th>Apr. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net income</td>
<td>200.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total revenue</td>
<td>1,000.4</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total expenses</td>
<td>800.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Operating income</td>
<td>200.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Net income</td>
<td>200.0</td>
<td>5.0%</td>
</tr>
</tbody>
</table>
Scatteract

Old Faithful Geyser Eruptions

Wait Time Since Last Eruption (minutes)

Duration (minutes)

[Cliche, Rosenberg, Madeka, Yee 2017]
How Bill O’Reilly leaving Fox fired up O’Reilly Auto Parts stock

[Yang, Irsoy, Rahman 2018]
[Tsai, Roth 2018]
Financial named entity extraction

JPMorgan Chase & Co.

J.P. Morgan & Co.
(formerly: Morgan Guaranty Trust)
(merged 1959)

Banc One Corp.
(merged 1998)

First Chicago NBD
(merged 1995)

Bear Stearns
(est. 1923, acq. 2008)

Washington Mutual
(founded 1889)

Great Western Bank
(acq. 1997)

H.F. Ahmanson & Co.
(acq. 1998)

Bank of United of Texas
(acq. 2001)

Dime Bancorp, Inc.
(acq. 2002)

Providian Financial
(acq. 2005)

The Chemical Bank
of New York
(est. 1823)

Citizens National Bank
(est. 1851, acq. 1920)

Corn Exchange Bank
(est. 1852, acq. 1954)

New York Trust Company
(est. 1886, acq. 1986)

Texas Commerce Bank
(est. 1866, acq. 1990)

Hanover Bank
(est. 1873)

JPMorgan Chase & Co.
(merged 2000)

Bank One
(acq. 2000)

Chase Manhattan Bank
(merged 1996)

Chemical Bank
(merged 1991)

Manufacturers Hanover
(merged 1961)

Chemical Bank
(reorganized 1988)

Chase Manhattan Bank
(merged 1959)

Bank of the Manhattan Company
(est. 1799)

Chase National Bank
of the City of New York
(est. 1877)

Guaranty Trust Company
of New York
(est. 1866)

J.P. Morgan & Co.
(The House of Morgan)
(est. 1895)

Louisiana's First Commerce Corp.

NBD Bancorp.
(formerly: National Bank of Detroit)
(est. 1933)

Bank of United of Texas
(acq. 2001)

Providian Financial
(acq. 2005)

Providian Financial
(acq. 2005)

Washington Mutual
(founded 1889)

Bear Stearns
(est. 1923, acq. 2008)

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Bank of United of Texas
(acq. 2001)

Dime Bancorp, Inc.
(acq. 2002)

Providian Financial
(acq. 2005)

Providian Financial
(acq. 2005)
More data, more distant supervision for fact extraction

Starbucks reports 2017 fourth-quarter and three-month trailing results

Three-month trailing results
Three-month trailing net revenue of $16,688.53

[Meerkamp, Zhou, 2017]
Sanford Bernstein’s Toni Sacconaghi: “And so where specifically will you be in terms of capital requirements?”

Musk “Excuse me. Next. Boring, bonehead questions are not cool. Next?”
Constructing portfolio from a statistic: factor loading

- Home Depot 0.9
- Starbucks 0.87
- Yum Brands 0.1
- McDonalds 0.05

Long: Home Depot 0.9, Starbucks 0.87
Short: Yum Brands 0.1, McDonalds 0.05
Sentiment Alpha: Russell 2000
March 11, 2011: Earthquake in Japan

- Toyota Motor Tohoku Plant
- Cental Motor Miyagi Plant
- Kanto Auto Workers Iwate Plant
- Toyota Motor Hokkaido Plant
Explaining Knowledge Graph relationships

“In 1971, Siegl, Bowker and Baldwin established the Starbucks Coffee Company.”

[Stefanoni, Motik, Kostylev 2018]
[Abujabal, Roy, Yahya 2018]
[Voskarides, Meij, Reinanda, Khaitan, Osborne, Stefanoni, Kambadur, Rijke, 2018]
[Voskarides, Meij, Rijke 2017]
Automated news

**DEEP ECO: Starbucks Pressured, Industry Sales Slowest in 8 Yrs**

By Bloomberg Automation Feedback?

(Bloomberg) -- Starbucks Corp.'s revenue may be pressured after a U.S. Census Bureau report showed limited-service eating places nominal retail sales fell 0.1 percent in November, the first decrease in eight years.

- The monthly report may provide an indication of the performance of companies in the industry Bloomberg classifies as limited service restaurants; Starbucks gets 89 percent of its revenue from this industry.
- Analysts estimate the company's revenue will rise 8.2 percent in the current fiscal quarter.
- This retail sales index was up 1 percent in the first two months of the company's current fiscal quarter.
- In the past six years, Starbucks' revenue has had a 0.7 correlation with this index, according to data compiled by Bloomberg.

**Starbucks Shares Fall After Chain's U.S. Sales Disappoint Again**

By Leslie Patton

---

SBUX US Equity Graphic Dashboard

IM Imp Vol JH
28.07

Top Contacts
Bijan Segha.
Nimish Patel
Jojona FowL
Steven Wats.
Grego Frel.

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Smarsh Inc.
Software for traders
Smarsh is a registered Trademark
Copyright © 2017 Smarth inc.
Starbucks Jumps 2%, Outpaces S&P 500 Index Gains

Starbucks Corp. rose 2 percent as the S&P 500 Index advanced.

The shares increased to $57.86 from $56.75. Trading volume was almost the same as the 20-day average for this time of day. Starbucks's move compares with the 2 percent rise in the Russell 3000 Consumer Discretionary Index and the 1.9 percent gain in the S&P 500 Index.

In the past year, the stock had a similar or greater gain 10 times and was little changed the next day. It advanced four times for an average 1 percent and declined six times for an average 1.2 percent.

The stock rose 5.7 percent in the past month, compared with the 0.5 percent increase for the company's Bloomberg peers, the 4.8 percent loss in its industry index and the 3.5
NL QA / structured extraction from databases

[Arkoudas, Yahya 2018]
Detection
- News classification and ranking
- Topic identification
- Twitter user demographics
- Twitter geolocation

Extraction
- Natural document understanding
- Chart understanding
- Information extraction
- Distant supervision

Interpretation
- Event studies
- Signal construction
- Knowledge graph inference

Presentation
- Natural language generation
- NL interfaces to databases
Detection
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- Natural document understanding
- Chart understanding
- Information extraction
- Distant supervision

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- Event studies
- Signal construction
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- Natural language generation
- NL interfaces to databases

Speed

Precision
We’re not in BlocksWorld anymore
Lynette Hirschman on Reading comprehension

“A system has learned from a text if, by reading the text, it is able to answer questions it would not have been able to answer before having access to it.”
More Info:
https://www.TechAtBloomberg.com/NLP

Thank You!