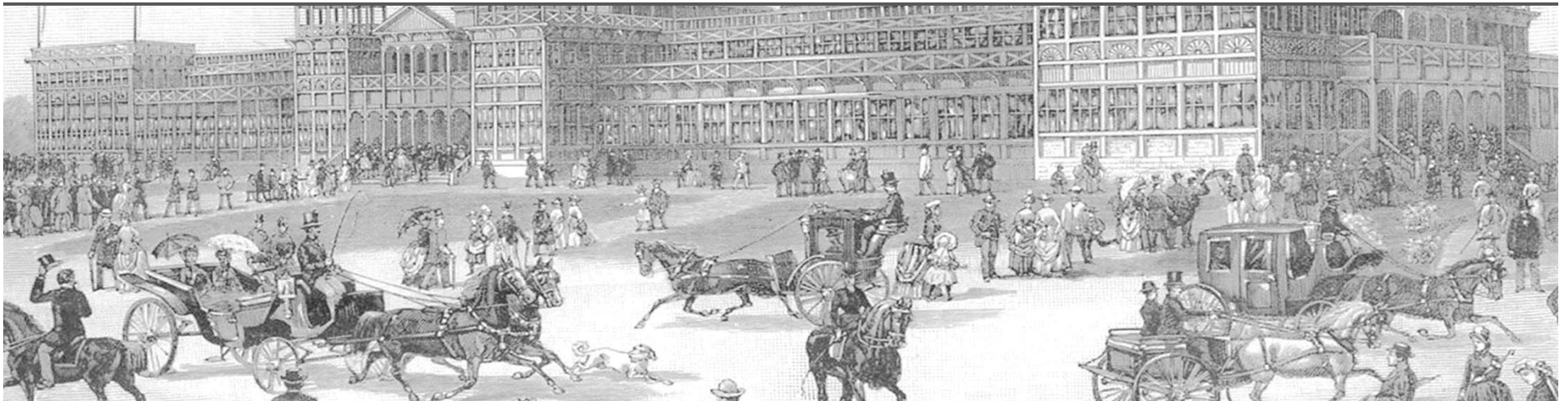# MONTAG

MONTAG Presentation 09.27.2018
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Roboadvisors: The trouble with algorithms

What *IS* a Roboadvisor?

- **A Roboadvisor is short for "robot" advisor**

- **Provides cost efficient portfolio management**

- **There is very little human intervention when using a Roboadvisor**

- **Trading decisions based on complex mathematical formulas...**

Easy Math…An Algorithm

$$\frac{D}{Dt}\overline{w'^i w'^j} + \overline{w'^i w'^\alpha}\nabla_\alpha \bar{u}^j + \overline{w'^j w'^\alpha}\nabla_\alpha \bar{u}^i - \alpha\left(g^{i\alpha}\overline{w'^j\frac{T'}{\bar{T}}} + g^{j\alpha}\overline{w'^i\frac{T'}{\bar{T}}}\right)\left(\nabla_\alpha \Phi + \frac{D\bar{u}_\alpha}{Dt}\right)$$

$$+ \frac{1}{\bar{\rho}}\nabla_\alpha[\overline{\bar{\rho}u'^\alpha w'^i w'^j} + \overline{(g^{i\alpha}w'^j + g^{j\alpha}w'^i)P'} - \overline{w'^i\sigma^{j\alpha}(u')} - \overline{w'^j\sigma^{i\alpha}(u')}]$$

$$+ \frac{1}{\bar{\rho}}\overline{w'^i w'^j\nabla_\alpha(\bar{\rho}u'^\alpha)} - \overline{P'(g^{i\alpha}\nabla_\alpha w'^j + g^{j\alpha}\nabla_\alpha w'^i)} = -\frac{1}{\bar{\rho}}[\overline{\sigma^{i\alpha}(u')\nabla_\alpha w'^j} + \overline{\sigma^{j\alpha}(u')\nabla_\alpha w'^i}] = -\epsilon_2^{ij}, \quad (30)$$

$$(1+e_4)\frac{D}{Dt}\overline{\left(\frac{T'}{\bar{T}}\right)^2} - 2f(t)\overline{\left(\frac{T'}{\bar{T}}\right)^2} - 2\overline{w'^\alpha\frac{T'}{\bar{T}}}D_\alpha + \frac{1}{(1+e_4)\bar{\rho}C_p^2}\nabla_\alpha\left[(1+e_4)^2 C_p^2\,\bar{\rho}\overline{w'^\alpha\left(\frac{T'}{\bar{T}}\right)^2}\right] + \frac{1+e_4}{\bar{\rho}}\overline{\left(\frac{T'}{\bar{T}}\right)^2\nabla_\alpha(\rho u'^\alpha)}$$

$$+ \frac{2}{\bar{\rho}\bar{T}C_p}\overline{\frac{T'}{\bar{T}}\left[P'\nabla_\alpha w'^\alpha - \nabla_\alpha(P'_g w'^\alpha) - \frac{DP'_g}{Dt}\right]} = \frac{2}{\bar{\rho}\bar{T}C_p}\overline{\frac{T'}{\bar{T}}[\sigma^{\alpha\beta}(u')\nabla_\alpha u'_\beta - \nabla_\alpha F_r'^\alpha]} = -\epsilon_2, \quad (31)$$

$$(1+e_4)\left[\frac{D}{Dt}\overline{\left(w'^i\frac{T'}{\bar{T}}\right)} + \overline{w'^\alpha\frac{T'}{\bar{T}}}\nabla_\alpha \bar{u}^i - \alpha\overline{\left(\frac{T'}{\bar{T}}\right)^2}g^{i\alpha}\left(\nabla_\alpha\Phi + \frac{D\bar{u}_\alpha}{Dt}\right)\right] - f(t)\overline{w'^i\frac{T'}{\bar{T}}} - \overline{w'^i w'^\alpha}D_\alpha$$

$$+ \frac{1}{\bar{\rho}C_p}\nabla_\alpha\left[(1+e_4)C_p\,\bar{\rho}\overline{w'^i w'^\alpha\frac{T'}{\bar{T}}}\right] + \frac{1+e_4}{\bar{\rho}}\overline{w'^i\frac{T'}{\bar{T}}\nabla_\alpha(\rho u'^\alpha)} + \frac{1}{\bar{\rho}\bar{T}C_p}\overline{w'^i\left[P'\nabla_\alpha w'^\alpha - \nabla_\alpha(P'_g w'^\alpha) - \frac{DP'_g}{Dt}\right]}$$

$$= \frac{1+e_4}{\bar{\rho}}\overline{\frac{T'}{\bar{T}}\nabla_\alpha\sigma^{i\alpha}(u')} + \frac{1}{\bar{\rho}\bar{T}C_p}\overline{w'^i[\sigma^{\alpha\beta}(u')\nabla_\alpha u'_\beta - \nabla_\alpha F_r'^\alpha]} = -\epsilon_2^i, \quad (32)$$

All Algorithms not created equal?

- **Roboadvisors were created when the market was doing THIS**
- **Algorithms created in a sustained bull market were undoubtedly backtested, but...**

Exogenous Shocks

- **Exogenous definition—Relating to or developing from external factors**

- **Examples of exogenous shocks**
  - **9/11**
  - **Fiscal Cliff**
  - **Tech bubble**
  - **The Big Short**

# The face of anguish then...

...and now

- **Trading is increasingly becoming a computer driven process**
- **Computers can make many more trades, and more efficiently, than a human can**

Algorithms = Rules

- **The algorithms serve as "trading rules" for the roboadvisors**

- **When market fundamental metrics change, algorithms trigger trades**

- **Continued selling during a market deterioration creates this…**

Market Shocks
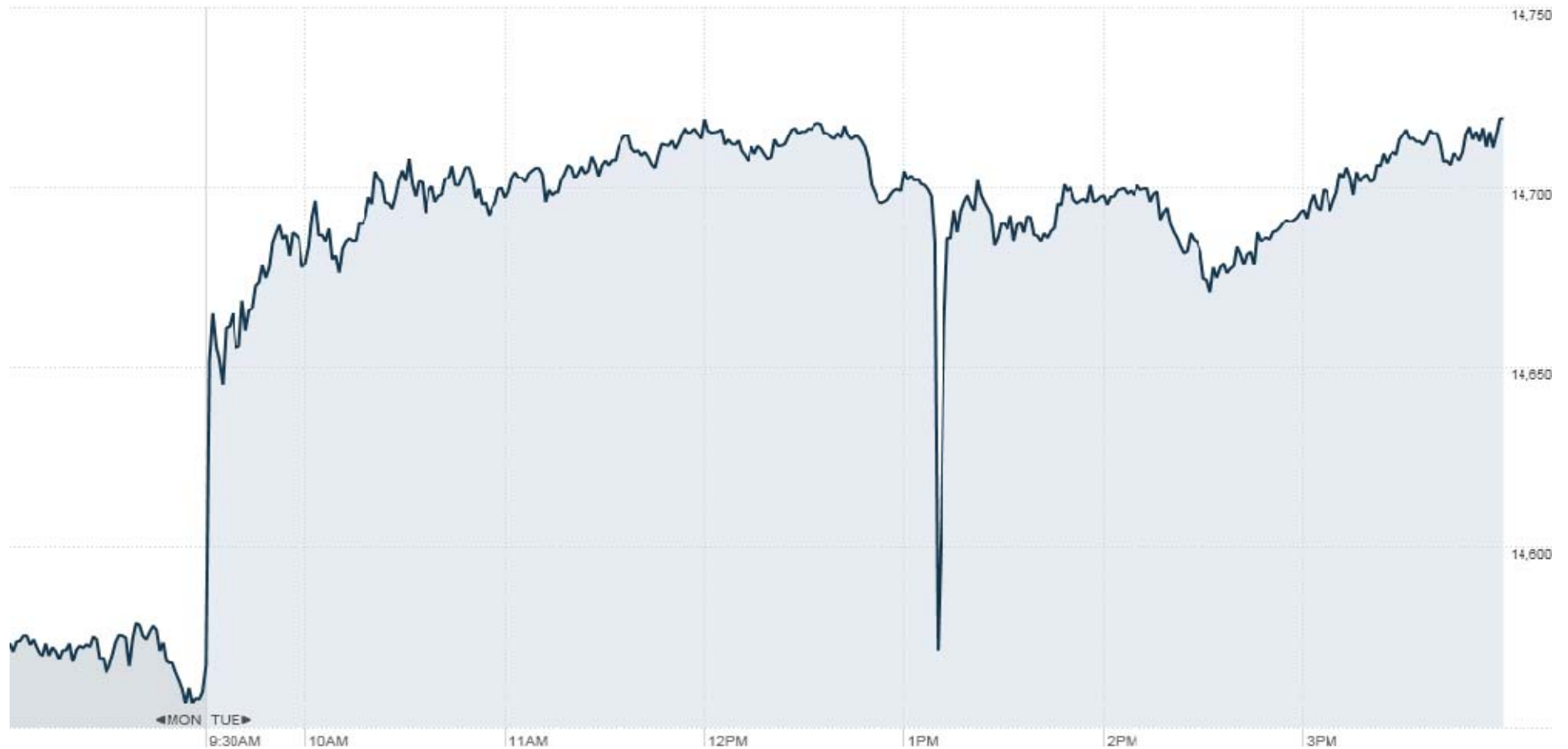
The result

What happened earlier this year?

- **Friday, February 2 = 666 point decline for Dow Jones Industrial Average**

- **Monday, February 5 = 1,175 point decline for Dow Jones Industrial Average**

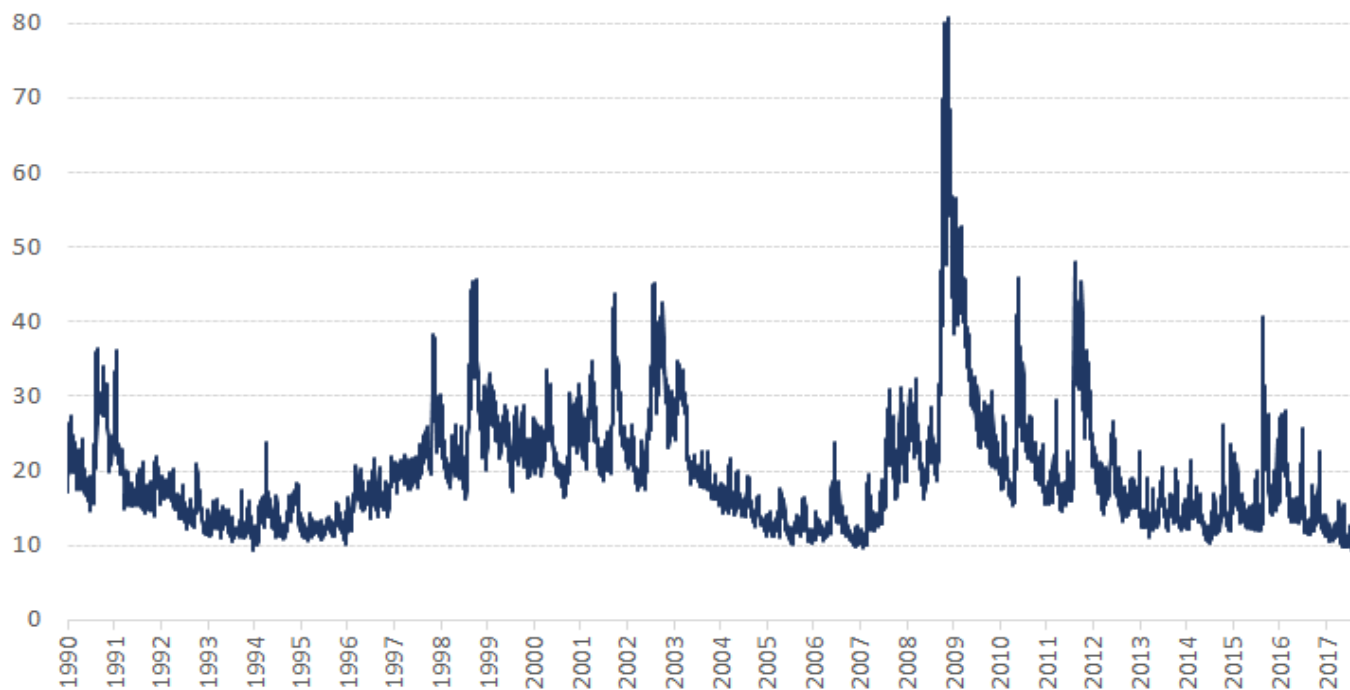- **BOTTOM LINE: Increased volatility rattled the stock markets...but what is volatility?**

Volatility

- **Volatility is defined as a statistical measure of the dispersion of returns for a given security OR MARKET INDEX**
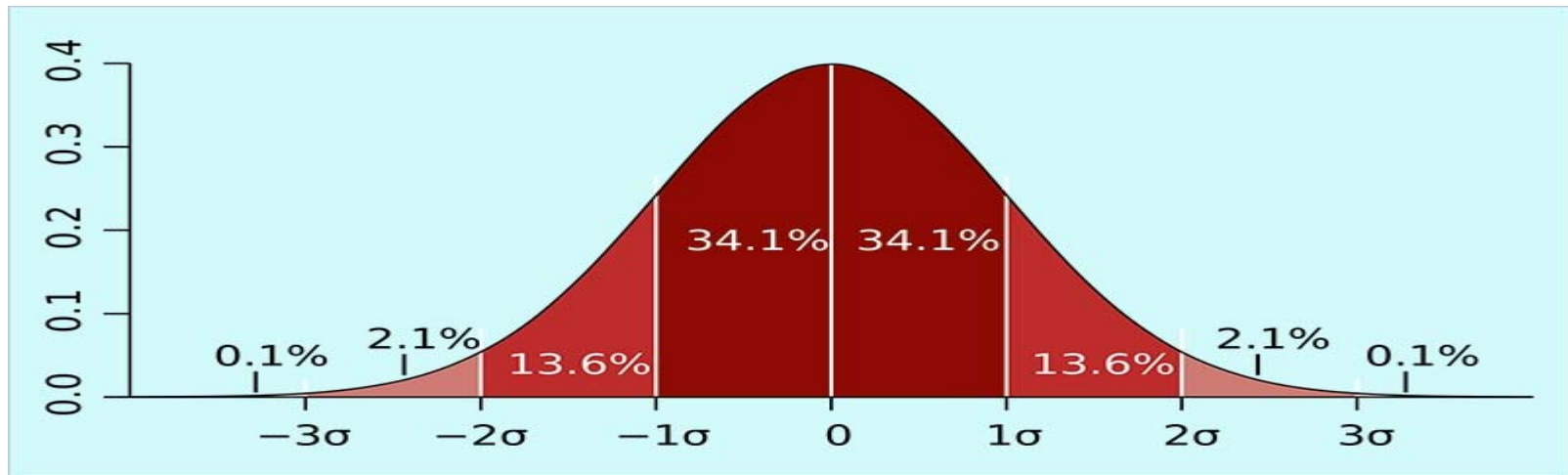
The Volatility Index (VIX)

CBOE Volatility Index (VIX) 1990-2017

Data source: CBOE - www.cboe.com

Increased volatility, investors panic

- **Many traders were "short" on VIX because it had been so low for so long**

- **VIX spikes 115% on February 5**

- **All the traders that were "short" VIX had to cover their short trade**

- **This covering of the short trades actually created MORE volatility**

Roboadvisors = Gas on the Fire?

- **When market fundamental metrics change, algorithms trigger trades**

- **Every time a Roboadvisor made a trade, it was trading into a market that was going down...and fast**

- **This triggered Roboadvisors to make more trades, faster, to unwind positions and tactically position portfolios**

Conclusions

- **Roboadvisors, good for some, not for others**
- **The HUMAN element**
- **Opportunities?**

QUESTIONS?