**CONCLUSION**

Today we are launching on a new proprietary behavioral finance metric called Media Derived Price (MDP) with actionable ideas coming when stock prices deviate away from their Media Derived Price (MDP). We have found that when price deviates away from MDP it generally sets up a mean reversion process which typically plays out over 4-8 weeks. Our MDP is a synthesis of historical media data paired with Generalized Autoregressive Score (GAS) models to explain price action. Over the past 390 weeks MDP has an average correlation of .85 with these stocks past price movements. The predictive ability of each signal is measured via Weight of Evidence (WoE) and Information Value (IV) which can simplistically be thought of as "# of correct estimates / # of wrong estimates" (WoE and IV calculations as defined by Information Theory are on page 2 in the "Stock Chart Guide").

**Media Derived Price (MDP).** MDP is a new behavioral finance metric created by the Piper Jaffray Alternative Data & Intelligence Team which quantifies the estimated value of publicity gained through digital media and investor attention. For instance Tesla TV News mentions has a fairly strong relationship (.71 correlation) with the price of Tesla. Going beyond TV News, MDP is a distillation of investor attention from sources: Archive.org, Google, Factset, and Twitter.

**Weight of Evidence (WoE).** WoE are calculated cutoff boundaries where evidence suggests a good risk-reward situation based on our signal (Media Derived Price - Price) / Price.

**Information Value (IV).** IV is the summation of WoE to evaluate predictive strength. Information Value greater than 0.5 suggests cautiously very strong predictive power (Information Value evaluation and sample calculations are on page 2 in the "Stock Chart Guide" for further context). In depth reading on Weight of Evidence and Information Value can be found [here](#).

**History of Media Derived Price.** Our Alternative Data & Intelligence Team (A.D.I.) started developing Media Derived Price in 2015 based on the observation of partial co-integration between media and stocks. After successfully testing this relationship in personal portfolios using a handful of companies we were compelled to expand the analysis to include more media sources and more companies.

**Correlation Does Not Mean Causation:** It's important to note that the number of news mentions doesn't necessarily cause the price to rise or fall. There are many other factors at play and to figure out factor importance further testing needs to be done. One such test would be the Granger causality test which is defined as a statistical hypothesis test for determining whether one time series is useful in forecasting another.

**Limitations Of Media Derived Price.** Just like any other system, there are limitations to the Media Derived Price. The MDP doesn't provide any clarity around earnings price movements or other fundamental moves higher or lower.
Stock Charts Guide

Price vs. AAPL Price

- Price
- Media Derived Price
- MDP - Price / Price

WoE Boundaries: IV = 0.66
- <= 0.0449
- <= -0.0023

Price is below red line (lower WoE boundary)

Information Value (IV):
- <= 0.02: Insignificant Predictive Power
- 0.02 - 0.1: Weak Predictive Power
- 0.1 - 0.3: Medium Predictive Power
- 0.3 - 0.5: Strong Predictive Power
- > 0.5: Cautiously Very Strong

Defining Accuracy:
In order to assess our signal, via Weight of Evidence and Information Value, we need to categorize future returns into binary outcomes (positive or negative return over 6 weeks).

Hypothetical WoE and IV Calculations for lower WoE boundary:

Distribution Negative Return (DN):
The lower boundary captured 15 negative returns w/ a possible 25 total negative outcomes
15/25 = 0.60 DN

Distribution Positive Return (DP):
The lower boundary captured 5 positive returns w/ a possible 20 total positive outcomes
5/20 = 0.25 DP

\[ \text{Info(DN / DP)} = \text{Weight of Evidence} \]

\[ \text{Info(DN / DP)} = \frac{0.60 - 0.25}{0.60 - 0.25} = 1.5 \]

Insight by Alternative Data & Intelligence

Sources: Archive.org, Investopedia, Factset, Google, and Twitter

- represents the price is above the green line (above the upper WoE boundary line)
- represents the price is below the red line (below the lower WoE boundary line)
- represents the price is between the WoE boundary lines
Sources: Archive.org, Investopedia, Factset, Google, and Twitter
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Sources: Archive.org, Investopedia, Factset, Google, and Twitter
**Media Derived Price vs. DAL Price**

- **Price**
- **Media Derived Price**
- **(MDP - Price) / Price**

**MDP Residuals & Weight of Evidence Boundaries**

WoE Boundaries: IV = 0.54

- > 0.0616
- <= 0.0053

<table>
<thead>
<tr>
<th>Ticker</th>
<th>Company</th>
<th>Sector</th>
<th>Market Cap</th>
<th>PE Ratio</th>
<th>EV / EBITDA</th>
<th>Next Earnings</th>
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</thead>
<tbody>
<tr>
<td>DAL</td>
<td>Delta Air Lines, Inc</td>
<td>Industrials</td>
<td>$32,985 MM</td>
<td>8.80</td>
<td>5.61</td>
<td>01/23/2020</td>
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Sources: Archive.org, Investopedia, Factset, Google, and Twitter
Media Derived Price vs. VMW Price

MDP Residuals & Weight of Evidence Boundries

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<tr>
<td>VMW</td>
<td>VMware, Inc. Class A</td>
<td>Information Technology</td>
<td>$16,227 MM</td>
<td>88.93</td>
<td>20.52</td>
<td>02/28/2019</td>
</tr>
</tbody>
</table>

Sources: Archive.org, Investopedia, Factset, Google, and Twitter
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Media Derived Price vs. JWN Price

MDP Residuals & Weight of Evidence Boundaries

Sources: Archive.org, Investopedia, Factset, Google, and Twitter
Sources: Archive.org, Investopedia, Factset, Google, and Twitter
Media Derived Price vs. RL Price

MDP Residuals & Weight of Evidence Boundaries

**Sources:** Archive.org, Investopedia, Factset, Google, and Twitter

**Ticker** | **Company** | **Sector** | **Market Cap** | **PE Ratio** | **EV / EBITDA** | **Next Earnings**
--- | --- | --- | --- | --- | --- | ---
RL | Ralph Lauren Corporation Class A | Consumer Discretionary | $6,087 MM | 56.66 | 8.40 | 05/23/2019
MediaDerived Price vs. DIS Price

MDP Residuals & Weight of Evidence Boundaries

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<th>Next Earnings</th>
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<tr>
<td>DIS</td>
<td>Walt Disney Company</td>
<td>Communication Services</td>
<td>$165,525 MM</td>
<td>13.99</td>
<td>11.05</td>
<td>11/08/2019</td>
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</table>

Sources: Archive.org, Investopedia, Factset, Google, and Twitter
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Media Derived Price vs. SBUX Price

MDP Residuals & Weight of Evidence Boundaries

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<th>EV / EBITDA</th>
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<tr>
<td>SBUX</td>
<td>Starbucks Corporation</td>
<td>Consumer Discretionary</td>
<td>$80,267 MM</td>
<td>17.54</td>
<td>15.46</td>
<td>11/04/2019</td>
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WoE Boundaries: IV = 0.33

(MDP - Price) / Price

> 0.0641

<= 0.0128
Sources: Archive.org, Investopedia, Factset, Google, and Twitter
MDP Residuals & Weight of Evidence Boundaries

Sources: Archive.org, Investopedia, Factset, Google, and Twitter
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<th>Next Earnings</th>
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<tr>
<td>PG</td>
<td>Procter &amp; Gamble Company</td>
<td>Consumer Staples</td>
<td>$227,765 MM</td>
<td>21.27</td>
<td>12.96</td>
<td>08/01/2019</td>
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</table>

WoE Boundries: IV = 0.52

-0.0146

<= -0.0472
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Notes: The boxes on the Rating and Price Target History chart above indicate the date of the fundamental Equity Research Note, the rating and the price target. Each box represents a date on which an analyst made a change to a rating or price target, except for the first box, which may only represent the first Note written during the past three years.

Legend:
I: Initiating Coverage
R: Resuming Coverage
T: Transferring Coverage
D: Discontinuing Coverage
S: Suspending Coverage
OW: Overweight
N: Neutral
UW: Underweight
NA: Not Available
UR: Under Review

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<tr>
<th>Rating</th>
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<th>Percent</th>
<th>Count</th>
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<td>419</td>
<td>64.76</td>
<td>117</td>
<td>27.92</td>
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<tr>
<td>HOLD [N]</td>
<td>216</td>
<td>33.38</td>
<td>18</td>
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<td>SELL [UW]</td>
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<td>1.85</td>
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<td>0.00</td>
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Note: Distribution of Ratings/IB Services shows the number of companies currently covered by fundamental equity research in each rating category from which Piper Jaffray and its affiliates received compensation for investment banking services within the past 12 months. FINRA rules require disclosure of which ratings most closely correspond with "buy," "hold," and "sell" recommendations. Piper Jaffray ratings are not the equivalent of buy, hold or sell, but instead represent recommended relative weightings. Nevertheless, Overweight corresponds most closely with buy, Neutral with hold and Underweight with sell. See Stock Rating definitions below.

**Analyst Certification — Travis S. Jakel, Analytics Specialist**

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Time of dissemination: 22 January 2019 16:01EST.
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Neutral (N): Anticipated to perform in line relative to the median of the group of stocks covered by the analyst.

Underweight (UW): Anticipated to underperform relative to the median of the group of stocks covered by the analyst.

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