

## #ChangePays

### There Were More Male CEOs Named John, than Female CEOs

#### Author

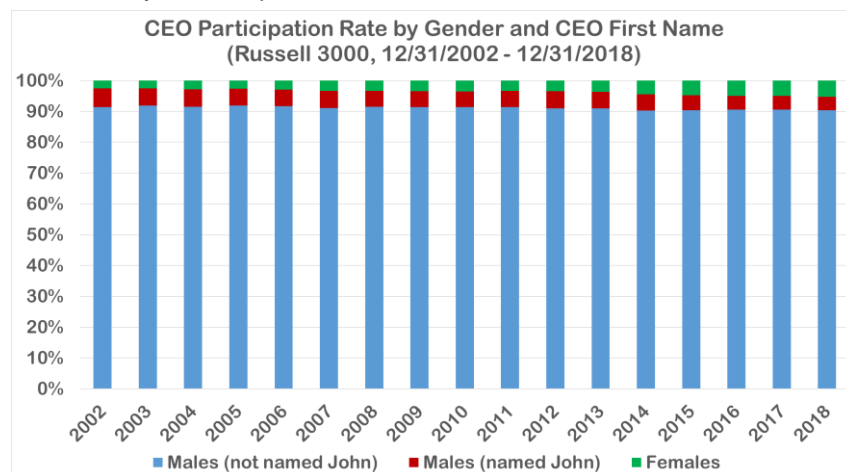
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#### Acknowledgements

A special thanks to the entire **Quantamental Research team** for their insights and guidance; and to the **Data Management Solutions** division for their content expertise and support.

The New York Times noted that “fewer large companies are run by women than by men named John”, in an article<sup>1</sup> published in 2015. “The Johns” were in second place by year-end 2016, but not by much (Figure 1). Although female executives remain grossly underrepresented in the C-suite, this small victory for gender inclusion underscores a changing dynamic. **Did this change pay?**

- The analysis presented herein<sup>2</sup> is one of the most comprehensive examinations, by breadth and time horizon, of gender diversity, to date.
- A male-to-female ratio of 19:1 for CEO and 6.5:1 for CFO, as of year-end 2018, exposes a persisting underrepresentation of females in key executive positions, despite recent advancements.
- Evidence of the outperformance of female executives, relative to their male peers, is offered. Female CEOs drove more value appreciation<sup>3</sup> and improved stock price momentum for their firms. Female CFOs drove more value appreciation, better defended profitability moats, and delivered excess risk-adjusted returns for their firms.
- An analysis of executives’ biographies suggests that the female executives who have been appointed to C-suite positions have attributes<sup>4</sup> consistent with the most successful male executives. One interpretation of this result is that female executives are held to a higher standard by the companies’ board of directors, than their male counterparts.



**Figure 1. Female Participation Rate for Chief Executive Officer Positions.** Relative percentage of companies in the Russell 3000 Index by gender. Males are subdivided by those named John versus not named John. Source: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019.

<sup>1</sup> Wolfers, J., 2015. “Fewer Women Run Big Companies Than Men Named John.” New York Times. <https://www.nytimes.com/2015/03/03/upshot/fewer-women-run-big-companies-than-men-named-john.html>

<sup>2</sup> Section 4 provides details on the dataset coverage, universe definition, and measurement time horizon.

<sup>3</sup> Value appreciation is defined as a decrease in the book-to-market multiple relative to the sector average. See section 4 for methodology details.

<sup>4</sup> The process of defining the dictionary of attributes is detailed in section 4.5.

## 1. Introduction

In 1986, Carol Hymowitz and Timothy Schelhardt coined the term ‘Glass Ceiling’ as a metaphor for the forces or circumstances which prevent female professionals from reaching senior management positions. In the thirty-three years since, the topic of gender<sup>5</sup> bias has received gradually increasing attention. Despite this focus, the female participation rate in senior management positions remains far from parity today. As of year-end 2018, there are approximately 19 male CEOs for every 1 female CEO and 6.5 male CFOs for every 1 female CFO, among companies within the Russell 3000 Index. The underrepresentation of females in key executive positions has raised a number of questions and inspired empirical research aimed at finding answers.

Unfortunately, the paucity of data (i.e. the limited number of female executives and the limited availability of structured, historical data<sup>6</sup> relevant to this topic) has limited the scope of previous research until recently. Early undertakings attempted to extract insights by evaluating as few as 25 diverse firms (Adler 2000) or considering a single date cross-section in the analysis (Carter, Simkins, Simpson 2002). More recent work has extended the time horizon (Hunt, Layton, Prince 2015) or made use of a market-representative index such as the S&P 1500 (Wolfers 2006), with caveats around data limitations.

**The analyses herein will evaluate the Russell 3000 universe over a 17-year period (December 31, 2002 through May 31, 2019); including 5,825 new executive appointments, of which 578 were female; making this study one of the most comprehensive contributions to the topic of gender inequality in the office of the CEO and CFO.** Despite the size of this study, we admonish the reader to interpret the results as a descriptive analysis, relevant from a governance standpoint, but not providing evidence of a predictive trading signal.

## 2. The Gender Effect

A modified event-study (MacKinlay 1997) approach is used throughout this paper and detailed in section 4. The “event” of consideration is the beginning of the tenure of a new executive in the CEO role (table 1, figure 2 left) or, in a separate analysis, to the CFO role (table 2, figure 2 right). The collection of events in which the new appointee is female (male) is termed the female (male) contingent. The tables summarize the characteristics<sup>7,8</sup> for firms on, and after, the appointment of a new executive. Averages are separately reported for the female and male contingents, as well as for the difference between the two contingents.

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<sup>5</sup> Our choice of diction regarding “gender” versus “sex”, used throughout the work, is discussed in more detail in Appendix 7.1.

<sup>6</sup> The interested reader is referred to section 4.1 of this paper for more detail on the S&P Global Professionals dataset, released in 2012, which made this research possible.

<sup>7</sup> A cross-sectional Z-score was calculated for all characteristics before averaging. Additional details are provided in section 4.4.

<sup>8</sup> Robustness checks for the tabulated calculations can be found in Appendices 7.2 and 7.3.

The female contingent was associated with a greater value appreciation, defined as a declining book to market ratio, in the 24-month period after a female CEO or CFO took office. Comparatively, the male contingent was statistically indistinguishable from its sector peer group. Weak statistical evidence supports that this value appreciation was associated with an increase in intermediate term price momentum for female CEO appointments. Consistent with results reported by Peltomäki and co-workers (Peltomäki, Swidler, Vähämaa 2018), firms which appointed a female CFO also had higher profitability. In the framework presented herein, we corroborate those results and also show the female contingent maintained profitability (average 2-year change was indistinguishable from 0) whereas the male CFO contingent saw a profitability erosion. **These observations are consistent with greater average skill among the female contingent than the male contingent.**

The data also support cultural differences between firms in the two contingents, similar to previous literature. However, our framework leads to a different interpretation than previous work. For example, Krishnan and Parsons (2008) attribute the correlation between firms with high gender diversity and high earnings quality<sup>9</sup> to the ways “women differ in their approach to money and investing”. We find that, while firms that appointed a female CEO had above average earnings quality (below average accruals) at the time the executive took office, accruals reverted to the mean (increased) in the 24-month period thereafter. Similarly, Peltomäki and co-workers (2018) explored the premise that “women try to avoid losses and are more cautious”,<sup>10</sup> showing that firms with female CFOs employ lower financial leverage<sup>11</sup> than their male counterparts as support. Again, our analyses find similar results with statistically lower financial leverage for the female contingent of both CEO and CFO positions when the executive takes office. However, the female contingent firms increased leverage in the 24 months following the CEO’s start date and maintained leverage in the 24 months following the CFO’s start date. Therefore, the causal relationship is questionable and possibly reversed. In other words, **our analysis supports that firms with higher earnings quality and lower leverage are firms with a culture conducive to making a female appointment, rather than the premise that stereotypical differences in the actions of the female executives, after their appointment, drive these differences.**

Firms that appointed a female CEO or CFO had a higher female participation rate on their board of directors compared to firms that made male appointments. Empirical evidence supports a growth in the female participation rate of the board over the first 24 months following the appointment of a female CEO. **These observations further support the idea that diversity and inclusion are features that gradually infuse into the culture of a firm.**

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<sup>9</sup> High earnings quality is defined as lower accruals relative to the sector average, as detailed in section 4.

<sup>10</sup> Peltomäki and coworkers present evidence to the contrary and ultimately conclude their empirical findings are ambiguous.

<sup>11</sup> Financial leverage, or leverage, is defined as debt to assets.

**Table 1: Firm Characteristics Associated with CEO Appointments by Gender  
(Russell 3000, 12/31/2002 – 5/31/2019)**

	On Appointment Date			2Y Change Post Appointment Date		
	Male	Female	F-M	Male	Female	F-M
Market Beta	-0.02% (-0.01)	-2.06% (-0.93)	-2.04% (-0.61)	-2.11% (-0.92)	-7.69%** (-2.29)	-5.59% (-1.38)
Size (Log MCap)	26.63%*** (13.84)	27.92%*** (3.68)	1.28% (0.16)	-1.17%* (-1.77)	-2.72% (-1.21)	-1.55% (-0.66)
Value (Book / Market)	1.93% (1.22)	4.96% (0.98)	3.03% (0.57)	1.87% (1.16)	-10.68%** (-2.02)	-12.55%** (-2.28)
Investment (CAPEX / Sales)	-3.38%** (-2.51)	-6.22% (-1.44)	-2.84% (-0.63)	0.15% (0.09)	3.15% (0.87)	3.00% (0.76)
Profitability (Gross Profit / Assets)	2.54% (1.32)	4.97% (0.59)	2.43% (0.28)	-2.75% (-1.35)	-2.75% (-0.61)	-0.75% (-0.16)
Profitability (EBITDA / Assets)	13.27%*** (7.94)	4.28% (0.75)	-8.99% (-1.51)	-0.35% (-0.25)	0.69% (0.17)	1.05% (0.24)
Momentum (12M-1M)	-3.48%* (-1.86)	1.82% (0.24)	5.30% (0.67)	-1.81% (-0.74)	6.80% (0.81)	8.61% (0.98)
Momentum (6M)	-1.19% (-0.65)	-5.70% (-0.70)	-4.50% (-0.54)	-1.62% (-0.60)	18.35%* (1.67)	19.96%* (1.77)
Accruals	1.65% (1.07)	-13.96%*** (-2.73)	-15.61%*** (-2.92)	-2.20% (-1.30)	8.21%* (1.87)	10.41%*** (2.21)
Leverage (Debt / Assets)	-1.14% (-0.63)	19.73%*** (-3.22)	-18.59%*** (-2.91)	1.26% (1.08)	12.68%** (2.45)	11.41%*** (2.16)
Board Size	10.42	10.95	0.52* (1.94)	-0.13	0.02	0.15 (0.79)
Board Female Participation	10.61%	22.63%	12.01%*** (13.99)	1.51%	3.05%	1.54%* (1.94)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% level

For each value in the table except Board Size and Board Female Participation, an average Z-score is reported with corresponding test statistic in parentheses. Z-scores are presented as a percent of one standard deviation.

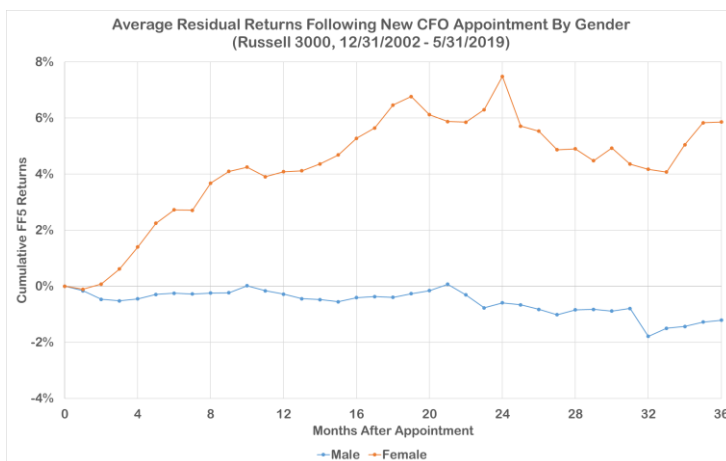
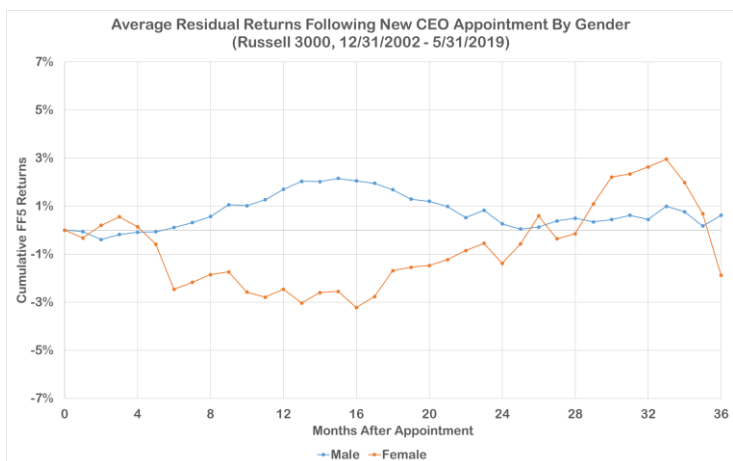
**Table 2: Firm Characteristics Associated with CFO Appointments by Gender  
(Russell 3000, 12/31/2002 – 5/31/2019)**

	On Appointment Date			2Y Change Post Appointment Date		
	Male	Female	F-M	Male	Female	F-M
Market Beta	-0.28% (-0.14)	1.38% (0.31)	1.66% (0.34)	-2.99% (-1.57)	1.85% (0.42)	4.84% (1.00)
Size (Log MCap)	25.65%*** (15.52)	24.22%*** (5.28)	-1.43% (-0.29)	-0.62% (-1.01)	1.52% (0.98)	2.14% (1.29)
Value (Book / Market)	-3.81%*** (-2.96)	-2.91% (-0.76)	0.90% (0.22)	8.05%*** (5.11)	-1.62% (-0.44)	-9.67%** (-2.43)
Investment (CAPEX / Sales)	-0.67% (-0.44)	-7.17%*** (-3.21)	-6.50%** (-2.42)	-1.59% (-0.86)	4.15% (1.05)	5.74% (1.32)
Profitability (Gross Profit / Assets)	0.39% (0.24)	10.55%** (2.34)	10.16%** (2.12)	-1.64% (-1.57)	2.30% (0.92)	3.94% (1.46)
Profitability (EBITDA / Assets)	11.59%*** (7.88)	19.08%*** (4.67)	7.50%* (1.73)	-4.06%*** (-3.19)	2.15% (0.72)	6.21%* (1.92)
Momentum (12M-1M)	2.76%* (1.67)	0.44% (0.11)	-2.32% (-0.53)	-8.74%*** (-3.90)	-9.63%* (-1.69)	-0.89% (-0.15)
Momentum (6M)	2.45% (1.53)	2.66% (0.61)	0.21% (0.05)	-4.01%* (-1.78)	-2.89% (-0.46)	1.12% (0.17)
Accruals	2.55% (1.64)	-2.49% (-0.79)	-5.04% (-1.44)	-3.56%* (-1.68)	-11.66%** (-2.15)	-8.10% (-1.39)
Leverage (Debt / Assets)	2.39% (1.42)	-7.89%* (-1.87)	-10.28%** (-2.27)	2.77%*** (2.77)	0.02% (0.01)	-2.75% (-1.07)
Board Size	10.07	10.32	0.244 (1.51)	-0.05	-0.15	-0.10 (-0.98)
Board Female Participation	11.17%	13.80%	2.62%*** (5.07)	1.15%	0.72%	-0.43% (-1.33)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

For each value in the table except Board Size and Board Female Participation, an average Z-score is reported with corresponding test statistic in parentheses. Z-scores are presented as a percent of one standard deviation.

Source for Tables 1 and 2: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019. Indices are unmanaged, statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities they represent. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not a guarantee of future results.



\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

**Figure 2. Fama-French 5 (FF5) Factor Adjusted Returns.** The average FF5 residual return demeaned at the sector level is reported for the male and female contingent in the 36-months following appointment of a new CEO (left) and CFO (right).

**Table 3: Adjusted Returns Following New Executive Appointments by Gender (Russell 3000, 12/31/2002 – 5/31/2019)**

Time Horizon	CEO			CFO		
	Male (N=2317)	Female (N=143)	F-M	Male (N=2930)	Female (N=435)	F-M
12 Month	1.70%** (2.37)	-2.46% (-0.88)	-4.16% (-1.44)	-0.28% (-0.46)	4.09%** (2.49)	4.37%** (2.49)
24 Month	0.26% (0.25)	-1.38% (-0.34)	-1.64% (-0.40)	-0.59% (-0.60)	7.48%*** (2.61)	8.08%*** (2.66)
36 Month	0.61% (0.39)	-1.88% (-0.33)	-2.49% (-0.42)	-1.21% (-0.85)	5.86% (1.61)	7.07%* (1.81)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

Source for Figure 2 and Table 3: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019. Indices are unmanaged, statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities they represent. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not a guarantee of future results.

After adjusting for differences in firm characteristics (Fama, French 2015) and sector performance, we found the female contingent earned larger adjusted returns than the male contingent among the CFO position, but not the CEO position (Figure 2). For the CFO position, the test for the difference of two means indicated a maximum difference of greater than 8% between contingents, occurring at the 24-month time horizon and statistically significant at the 1% level. The male contingent of CFO appointments produced returns that were statistically indistinguishable from the sector average throughout the backtest, whereas the female contingent yielded an average premium.

Average returns to firms in the two contingents following the appointment of a new CEO were statistically indistinguishable from each other. The male contingent yielded a small positive premium with weak statistical significance at time horizons of 9-18 months, whereas the female contingent and the two-population difference failed to meet the test for statistical significance. A closer inspection of the standard errors for the contingents within the CEO appointments showed that our sample means would have had to differ by more than 7% (in

either direction) to meet statistical significance at the 10% threshold, compared to a difference of just 5% for the position of CFO. The difference of means between contingents for the CEO position falls well below 7%. Note that the high threshold for significance is almost entirely attributable to the small sample size of only 143 female CEO appointments.

### 3. Talent is Equally Distributed

The prior hypothesis at the outset of this study was that talent is equally distributed across genders. In the previous section, we find evidence that female executives drive greater value appreciation, improve price momentum, better defend profitability moats, and earn excess returns over their male counterparts. Do these two assertions conflict?

We argue they do not. Rather, the board of directors may be holding female appointees to a higher standard than male appointees, such that the females in C-suite positions are consequently more talented. The high male-to-female ratio of executives in C-suite positions supports this premise. Being more selective with female appointees, means that the board of directors may pass over a more qualified female in favor of a less qualified male. If this is the case, it follows that the remaining pool of female contenders for C-suite positions remains richer with talent.

In support of the aforementioned premise, we show below the results of a natural language processing (NLP) analysis which demonstrates that the achievements, education, or personal traits associated with success occur more often within the female contingent. The features associated with success for the appointed executives in this study were extracted from those executives' biographies, which are included in the S&P Capital IQ Professionals dataset. First, a dictionary was trained on the corpus excluding the female contingent (training set). The positivity of a particular word<sup>12</sup> was determined by the relative occurrence of that word<sup>13</sup> among companies that earned positive excess returns versus those that did not, inside of the training set. Separately, the relative occurrence of the same set of words in the female contingent (the test set) relative to the male contingent was evaluated. In regression plots (Figure 3), we found that the relative occurrence of language used to describe all the female executives, versus all male executives, was highly correlated with the language used to describe the successful male executives.

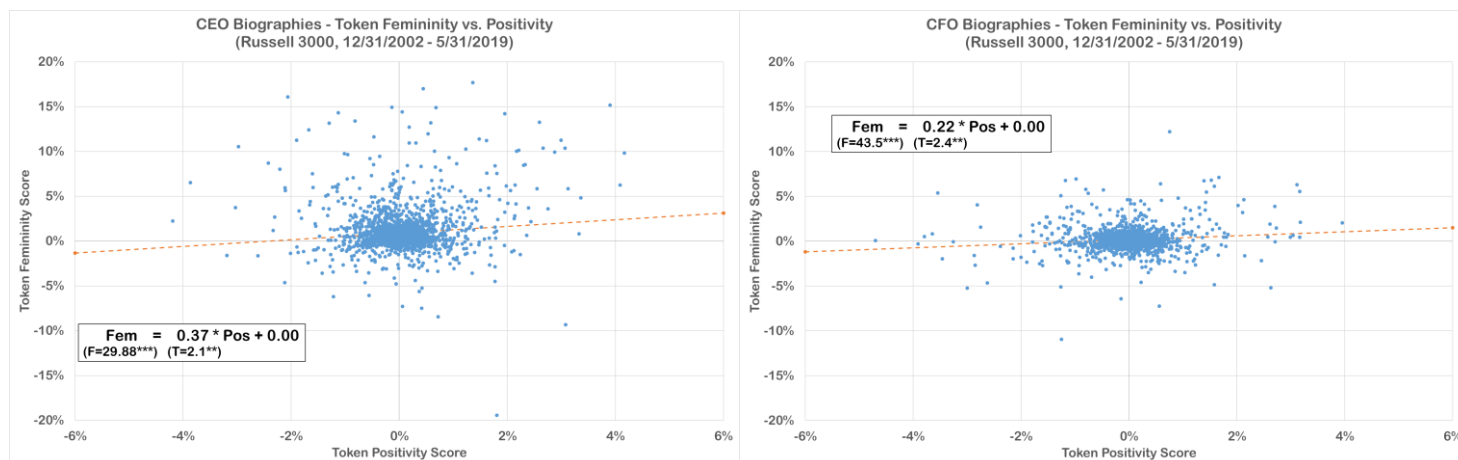
The implication of the positive correlation between the language used to describe *all* female executives and *successful* male executives is profound. Unlike some previous literature which attributes performance differences to gender-specific behaviors or aversions, **our analysis supports common features favor success for males and females alike, and those features are more prevalent in the female contingent, to date.** Our interpretation is that

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<sup>12</sup> See appendix 7.4 for examples of positive and negative words obtained from the CEO analysis.

<sup>13</sup> The phrase "relative occurrence of words" is defined as the percentage of biographies within a particular portion of the corpus that contain the word, less the same percentage in its counterpart. For example, the relative occurrence of a word in the female contingent would be equal to the percentage of female biographies containing the word, less the percentage of male biographies containing the same word. See section 4 for more details on the NLP procedure.

the male contingent is relatively 'overfished' compared to the female contingent, as a direct result of a bias preventing women from C-suite appointments (the so-called glass ceiling).<sup>14</sup>



**Figure 3. Natural Language Processing of Executive Biographies.** For each of the executives in our study, the executive's biography was parsed by a Natural Language Processing procedure, which identifies the positivity and femininity of tokenized words. A positive and significant correlation was observed in regressions of femininity score on positivity score.

Source: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019.

Assuming our interpretation is correct, the regression coefficient should approach 0 as executive appointments reach gender parity. In other words, if C-suite appointments have historically been made on the basis of merit with a proviso on male gender, we posit that removing that proviso and allowing the system to equilibrate will show that **male and female executives are equally equipped to drive their firms' success.**

#### 4. Methodology and Data

The methodology and tools used in this research are reviewed in this section.

##### 4.1. Data

**The S&P Capital IQ Professionals Dataset** profiles professionals with current and prior board/company affiliations. Data include biographies, standardized job functions, titles, education, compensation, options holdings, and full committee memberships. This dataset covers 4.5 million professionals internationally, with robust coverage for the Russell 3000 starting in 2002. Company fundamental data were obtained from the **Alpha Factor Library** package, which provides hundreds of pre-calculated factors including financial ratios, valuation metrics, and price and momentum statistics. All factors are constructed using point-in-time data. Additional company fundamentals and pricing were obtained from the **Capital IQ Financials Dataset**, which contains point-in-time global coverage of key financial metrics and reported financials. In addition to content from the S&P Global Market Intelligence ecosystem, this study utilized free third-party data from the **United States Social Security**

<sup>14</sup> See appendix 7.4 for expanded discussion and alternative explanations.



**Administration (SSA).**<sup>15</sup> The SSA maintains a database of baby first names, baby sex, year-of-birth and total count for all newborns in the United States. These data were used, as described in section 4.2.

#### 4.2. Gender Assignments

Gender assignments were made by three separate methods.

1. Included within the Professionals database is a field labeled 'prefix'. When the prefix field was equal to 'Mr.', 'Sir', 'Count', 'Father', 'Sheikh', 'Bishop', 'Lord', 'Hafiz', 'Baron', or 'Janab' then the executive was assumed to be male. When the prefix field was equal to 'Mrs.', 'Miss', 'Ms.', 'Sister', 'Lady', 'Madam', 'Countess', 'Baroness', or 'First Lady' then the executive was assumed to be female. For all other prefixes (such as 'Dr.', 'Professor', 'Lieutenant', etc.) the gender was assigned 'ambiguous' for this method.
2. The biographies of each executive were parsed for the presence of gender related pronouns ("he", "him", "his", "she", "her", "hers"). If a minimum of 90% of the pronouns in the biography were specific to one gender, that gender was assumed for the executive; otherwise, the gender was assigned 'ambiguous' for this method.
3. Data from the U.S. Social Security Administration were used to calculate the gender certainty associated with a first name and year of birth. For example, in 1975, 99.3% of babies named 'John' were male. If the gender certainty of an executive's first name in the year the executive was born was greater than 90%, then the executive's gender was assigned as such; otherwise the gender was assigned 'ambiguous' for this method.

After the 3 steps were completed for each executive in the study, the gender assignments were programmatically compared for agreement, ignoring ambiguous results. Ambiguous records were resolved by a web search.

#### 4.3. Universe and Event Detection

The constituents of the Russell 3000 were filtered to remove penny stocks and low-priced stocks, due to difficulty reliably determining the start date of the executives for many of these firms. Changes to the unique person identifier associated with the CEO or CFO position of the remaining firms triggered a potential event for analysis. To minimize the impact of interim executives on the results, a forward looking analysis was done for each potential event and if the executive was replaced within 24 months of starting the position then the event was removed from the analysis.

#### 4.4. Comparative Statistical Framework

Prior to averaging, financial ratios were normalized by computing a sector-relative cross-sectional Z-score by using equation 1,

$$Z_i^m(t) = \frac{m(t) - \langle m(t) \rangle_{\text{sector CS}}}{\sigma_{\text{sector CS}}^m(t)} \quad \text{eqn. 1}$$

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<sup>15</sup> Data download available at <https://www.ssa.gov/oact/babynames/limits.html>



where  $Z_i^m(t)$  is the Z-scored value of the metric,  $m$ , for firm,  $i$ , at time,  $t$ ;  $\langle m(t) \rangle_{sector\ CS}$  represents the cross-sectional average value of metric,  $m$ , for all the firms in same sector (GICS level 1) as the focal firm,  $i$ , in the universe at time,  $t$ ; and  $\sigma_{sector\ CS}^{m(t)}$  is the standard deviation of the values used to calculate  $\langle m(t) \rangle_{sector\ CS}$ .

Changes to the companies' metrics from the date the executive took office ( $t = 0$ ) to a date 24-months after the executive took office ( $t = 24$ ) were calculated by using equation 2,

$$\Delta Z_i^m = Z_i^m(24) - Z_i^m(0) \quad \text{eqn. 2}$$

where  $\Delta Z_i^m$  is the change in the Z-scored metric;  $Z_i^m(24)$  represents the Z-scored metric 24 months after the executive's start date; and  $Z_i^m(0)$  represents the Z-scored metric on the executive's start date.

#### 4.5. Natural Language Processing

The biography of each newly appointed executive in this study formed the corpus for a natural language processing (NLP) analysis. The dictionary for the analysis was defined as the set of unique tokens generated by parsing, tokenizing, and stemming (Paice 1990) all words in the corpus. The following tokens were removed from the dictionary<sup>16</sup>: 1) stop words, as defined by Python's NLTK module (Bird, Loper, Klein 2009), 2) words that were unique to one of the contingents of the corpus, such as 'chairwoman', and 3) numerical tokens such as years and dates. The final dictionary contained approximately 3,000 unique tokens.

The male contingent of the corpus was used as training data to assign a positivity score to each token in the dictionary. First, the contingent was subdivided into an outperform subset, containing firms with positive risk-adjusted returns (as were used in Figure 2), and an underperform subset. The positivity score was calculated by using equation 3,

$$Pos_i = \frac{N_i^{Outperform}}{N^{Outperform}} - \frac{N_i^{Underperform}}{N^{Underperform}} \quad \text{eqn. 3}$$

where  $Pos_i$  is the positivity score of token  $i$ ;  $N_i^{Outperform}$  ( $N_i^{Underperform}$ ) is the number of biographies in the outperform (underperform) subset that contain token  $i$ ; and  $N^{Outperform}$  ( $N^{Underperform}$ ) is the total number of biographies in the outperform (underperform) subset.

Using the full corpus (male and female contingents), a femininity score was assigned to each token in the dictionary, by using equation 4,

$$Fem_j = \frac{M_j^{Female}}{M^{Female}} - \frac{M_j^{Male}}{M^{Male}} \quad \text{eqn. 4}$$

where  $Fem_j$  is the femininity score of token  $j$ ;  $M_j^{Female}$  ( $M_j^{Male}$ ) is the number of biographies in the female (male) contingent that contain token  $j$ ; and  $M^{Female}$  ( $M^{Male}$ ) is the total number of biographies in the female (male) contingent.

<sup>16</sup> The removal of tokens from the dictionary was performed on the basis of standard NLP protocol (such as removal of stop words) and logic (such as removal of gender specific words). To ensure that the removal of tokens was not creating spurious relationships, robustness checks were performed and are discussed in appendix 7.4, along with an expanded discussion on the NLP methodology.

## 5. Concluding Remarks

In one of the largest studies on gender in the C-suite, to date, evidence of underrepresentation and outperformance among female executives relative to their male peers has been presented. Specifically, over the time-horizon of the study, female CEOs saw more value appreciation and improved stock price momentum for their firms; whereas female CFOs drove more value appreciation, better defended profitability moats, and delivered excess risk-adjusted returns for their firms. We proposed that the observed outperformance was a result of above-average talent among female executives. The female contenders for C-suite positions represent a relatively underutilized pool of talent, possibly attributable to a higher degree of scrutiny from the firms' board of directors and consequently resulting in the tendency of females in C-suite positions to be more talented. As support for the premise, a natural language processing (NLP) technique was applied to the biographies of executives and the conclusion that female executives more frequently possessed the attributes associated with success among their male counterparts was demonstrated. If our premise is correct, the differences cited should dissipate when females are equally represented in C-suite positions. **In other words, talent is equally distributed and until executives are selected on the basis of talent without other biases, we expect change pays.**

## 6. References

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## 7. Appendix. Extended Discussion

In the interest of brevity, common questions or opportunities for thought leadership related to this research, but tangential to the primary narrative, have been consolidated in the appendix below.

### 7.1. Diction: Gender vs. Sex

We would be remiss to publish an article on gender without a brief discussion on the modern vernacular. Historically, “gender” and “sex” were interchangeable terms that referred to the set of two identities: male and female. Today, the terminology has evolved such that “sex” refers to chromosomal (XX versus XY) identity; whereas gender refers to social and cultural identities that extend beyond male and female. Conflating the two terms can be misconstrued as dismissive of gender-nonconforming identities and, therefore, the choice of diction is explained below.

In this work, we apply “male” and “female” labels to company executives. The use of these binary assignments would favor using the term “sex”. However, the use of the executives’ preferred pronouns and prefix (see section 4.2) in making the assignments would favor using the term “gender”. A deeper examination of the topic,<sup>17</sup> has revealed a single precedent within our study in which an executive was male by sex and female by gender: Martine Rothblatt, CEO of United Therapeutics. In this case, our approach to gender assignment labeled Dr. Rothblatt as female. This precedent was used as a tie-breaker and, consequently, the term “gender” is used throughout. We underscore the thought and analysis that went into this decision and emphasize no intention to dismiss non-binary gender identities.

### 7.2. Small Sample Size

The results of this research have been caveated by the small sample size of female appointments to C-suite positions. Small sample sizes can be especially problematic for parametric tests and, as such, an alternative approach is to perform a non-parametric test, such as the Mann-Whitney test to compare two distributions. Tables A1, A2, and A3 provide side-by-side comparisons of statistical significance obtained from the student’s T-test and the Mann-Whitney test for the two population differences summarized in tables 1, 2, and 3, respectively. The non-parametric tests mostly corroborate our results and produce higher levels of confidence in several cases. In three cases, results that were statistically significant at the 10% level or better saw declines in significance below the typical 10% threshold. For this reason, we would be highly skeptical in the ability to reproduce the results out-of-sample. However, in both frameworks, there remains evidence of above-average skill among the female appointees, including a return premium among female CFOs.

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<sup>17</sup> Kerrigan, S., 2018. “27 Most Successful LGBT+ Entrepreneurs, Executives, and Opinion Leaders.” Interesting Engineering. <https://interestingengineering.com/27-most-successful-lgbt-entrepreneurs-executives-and-opinion-leaders>

**Table A1: Firm Characteristics Associated with CEO Appointments**  
(Russell 3000, 12/31/2002 – 5/31/2019)

	On Appointment Date		2Y Change Post Appointment Date	
	T-Stat	Mann-Whitney	T-Stat	Mann-Whitney
Market Beta	-2.04% (-0.61)	-2.04% (98.66%)	-5.59% (-1.38)	-5.59% (41.58%)
Size (Log MCap)	1.28% (0.16)	1.28% (87.22%)	-1.55% (-0.66)	-1.55% (50.70%)
Value (Book / Market)	3.03% (0.57)	3.03% (37.14%)	-12.55%** (-2.28)	-12.55%** (4.62%)
Investment (CAPEX / Sales)	-2.84% (-0.63)	-2.84% (47.69%)	3.00% (0.76)	3.00% (38.38%)
Profitability (Gross Profit / Assets)	2.43% (0.28)	2.43% (96.65%)	-0.75% (-0.16)	-0.75% (69.41%)
Profitability (EBITDA / Assets)	-8.99% (-1.51)	-8.99% (12.64%)	1.05% (0.24)	1.05% (61.71%)
Momentum (12M-1M)	5.30% (0.67)	5.30% (26.37%)	8.61% (0.98)	8.61% (22.47%)
Momentum (6M)	-4.50% (-0.54)	-4.50% (60.07%)	19.96%* (1.77)	19.96%** (3.35%)
Accruals	-15.61%*** (-2.92)	-15.61%*** (0.72%)	10.41%** (2.21)	10.41%* (9.03%)
Leverage (Debt / Assets)	-18.59%*** (-2.91)	-18.59%*** (0.80%)	11.41%** (2.16)	11.41%*** (0.66%)
Board Size	0.52* (1.94)	0.52* (5.20%)	0.15 (0.79)	0.15 (27.08%)
Board Female Participation	12.01%*** (13.99)	12.01%*** (0.00%)	1.54%* (1.94)	1.54% (19.69%)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

**Table A2: Firm Characteristics Associated with CFO Appointments**  
(Russell 3000, 12/31/2002 – 5/31/2019)

	On Appointment Date		2Y Change Post Appointment Date	
	T-Stat	Mann-Whitney	T-Stat	Mann-Whitney
Market Beta	1.66% (0.34)	1.66% (44.79%)	4.84% (1.00)	4.84% (98.87%)
Size (Log MCap)	-1.43% (-0.29)	-1.43% (54.05%)	2.14% (1.29)	2.14% (33.79%)
Value (Book / Market)	0.90% (0.22)	0.90% (43.47%)	-9.67%** (-2.43)	-9.67% (22.89%)
Investment (CAPEX / Sales)	-6.50%** (-2.42)	-6.50%* (8.81%)	5.74% (1.32)	5.74%* (6.26%)
Profitability (Gross Profit / Assets)	10.16%** (2.12)	10.16%** (2.62%)	3.94% (1.46)	3.94% (14.79%)
Profitability (EBITDA / Assets)	7.50%* (1.73)	7.50%* (9.67%)	6.21%* (1.92)	6.21% (10.19%)
Momentum (12M-1M)	-2.32% (-0.53)	-2.32% (87.17%)	-0.89% (-0.15)	-0.89% (99.23%)
Momentum (6M)	0.21% (0.05)	0.21% (69.24%)	1.12% (0.17)	1.12% (89.70%)
Accruals	-5.04% (-1.44)	-5.04% (10.03%)	-8.10% (-1.39)	-8.10% (70.48%)
Leverage (Debt / Assets)	-10.28%** (-2.27)	-10.28%** (1.58%)	-2.75% (-1.07)	-2.75% (31.21%)
Board Size	0.24 (1.51)	0.24 (14.50%)	-0.10 (-0.98)	-0.10 (57.44%)
Board Female Participation	2.62%*** (5.07)	2.62%*** (0.00%)	-0.43% (-1.33)	-0.43% (53.22%)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

Source for tables A1 and A2: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019. Indices are unmanaged, statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities they represent. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not a guarantee of future results.

**Table A3: Adjusted Returns Following New Executive Appointments by Gender  
(Russell 3000, 12/31/2002 – 5/31/2019)**

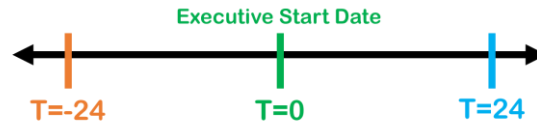
Time Horizon	CEO		CFO	
	T-Stat	Mann-Whitney	T-Stat	Mann-Whitney
12 Month	-4.16% (-1.44)	-4.16% (30.34%)	4.37%** (2.49)	4.37%** (1.96%)
24 Month	-1.64% (-0.40)	-1.64% (80.41%)	8.08%*** (2.66)	8.08%*** (0.85%)
36 Month	-2.49% (-0.42)	-2.49% (71.10%)	7.07%* (1.81)	7.07%* (5.79%)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

Source: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019. Indices are unmanaged, statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities they represent. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not a guarantee of future results.

### 7.3. Event-Study Window

In section 2, the rightmost columns of tables 1 and 2 evaluate the average change in select company financial metrics following the appointment of a female versus male executive. Per section 4, the change in the metric was evaluated by calculating a Z-score for the metric on the date the executive took office and comparing to a Z-score for the metric 24 months after the executive took office.



**Figure A1. Timeline.** A visual representation of the measurement of time within our event-study framework. In the main paper, changes to company metrics were measured from T=0 to T=24. In this section, we compare to changes measured from T=-24 to T=24.

Although the beginning of the executive’s tenure is a logical starting point from which to measure changes attributable to the executive’s efforts, this point in time may also represent a period of aberrantly high uncertainty for the firm. Furthermore, the appointment of a new executive may be preceded by a transitional period lasting several months, resulting in atypical performance for the firm. As an alternative, the analysis was repeated by comparing the metric value 24 months post- to 24 months pre-appointment, or symbolically,  $Z_i^m(24) - Z_i^m(-24)$ . The corresponding columns from tables 1 and 2, labeled  $Z_i^m(24) - Z_i^m(0)$ , are included in table A4 for ease of comparison.

Leading up to the executive’s replacement, a company may see uncertainty manifest in the form of increased book-to-market multiples (distress). If this were the case, then the post-appointment decline in the ratios discussed in section 2 would simply be a return to the previous baseline as the new executive became seasoned in the position and the uncertainty dissipated. However, the value appreciation is comparable in both magnitude and statistical

significance in all specifications of table A4, strengthening our assertion that the effect is owed to the actions of the new executive.

Likewise, for the CEO position, increases in momentum and female board participation were comparable or enhanced; and for the CFO position, increases in profitability metrics were comparable or enhanced. The fact that these values are slightly larger in the adjusted approach indicates that some of the difference may be attributable to the changes occurring before the executive took office, such as a cultural shift towards diversity and inclusion (which is supported by the larger and more significant increase in female board participation).

Lastly, in section 2, we suggested that the accruals and leverage changes observed for the female executives were likely mean reverting or cyclical values. For example, table 1 shows that accruals for the female contingent are significantly lower at the beginning of the executive's tenure, but subsequently increase post-appointment. In this section, we find that accruals are statistically indistinguishable when comparing 24-month post-appointment to 24-month pre-appointment, supporting the assertion that the changes are an oscillation around the sector mean.

**Table A4: Two-Sample Differences (Female-Male) in Firm Characteristic Changes Associated with CEO and CFO Appointments (Russell 3000, 12/31/2002 – 5/31/2019)**

	CEO Analysis		CFO Analysis	
	$Z^m(24)$ - $Z^m(0)$	$Z^m(24)$ - $Z^m(-24)$	$Z^m(24)$ - $Z^m(0)$	$Z^m(24)$ - $Z^m(-24)$
Market Beta	-5.59% (-1.38)	-3.22% (-0.61)	4.84% (1.00)	-0.74% (-0.13)
Size (Log MCap)	-1.55% (-0.66)	-3.08% (-0.83)	2.14% (1.29)	0.67% (0.28)
Value (Book / Market)	-12.55%*** (-2.28)	-15.23%*** (-2.41)	-9.67%*** (-2.43)	-7.54%* (-1.71)
Investment (CAPEX / Sales)	3.00% (0.76)	6.28% (1.13)	5.74% (1.32)	-2.59% (-0.39)
Profitability (Gross Profit / Assets)	-0.75% (-0.16)	-0.83% (-0.13)	3.94% (1.46)	7.69%*** (2.28)
Profitability (EBITDA / Assets)	1.05% (0.24)	-0.48% (-0.08)	6.21%* (1.92)	7.16%* (1.88)
Momentum (12M-1M)	8.61% (0.98)	18.96%* (1.67)	-0.89% (-0.15)	-6.82% (-1.00)
Momentum (6M)	19.96%* (1.77)	28.01%*** (2.69)	1.12% (0.17)	-0.37% (-0.06)
Accruals	10.41%*** (2.21)	5.64% (0.91)	-8.10% (-1.39)	5.37% (0.79)
Leverage (Debt / Assets)	11.41%*** (2.16)	9.06% (1.33)	-2.75% (-1.07)	-6.86%* (-1.89)
Board Size	0.15 (0.79)	0.52** (2.21)	-0.10 (-0.98)	-13.55 (-1.05)
Board Female Participation	1.54%* (1.94)	6.79%*** (5.98)	-0.43% (-1.33)	0.12% (0.29)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

Source: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019. Indices are unmanaged, statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities they represent. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not a guarantee of future results.



#### 7.4. Natural Language Processing Methodology

The natural language processing methodology utilized in section 3 included a step where tokens were filtered from the dictionary. Tokens like ‘wom’ (the stem for the word ‘woman’), which were found exclusively in the female contingent, could not possibly provide valuable insight in this analysis because a positivity score cannot be calculated for tokens absent from the training set (that is, the male contingent). The removal of numeric tokens, such as ‘1982’, was also performed. Unlike financial filings, numeric tokens in biographies usually represent dates. In a best case scenario, the numeric tokens would likely just add noise to the analysis. However, understanding the impact of filtering these tokens may be of interest to some readers. Table A5 provides regression coefficients and significance for alternative specifications. While the logical argument for filtering some tokens from the dictionary is sound, the impact on the analysis was minimal.

**Table A5: Slope Regression Coefficients for NLP Specifications  
(Russell 3000, 12/31/2002 – 5/31/2019)**

	1	2	3
CEO	0.29* (1.9)	0.36** (2.3)	0.37** (2.1)
CFO	0.63*** (2.7)	0.21*** (2.6)	0.22** (2.4)

\*\*\* = Significant at the 1% level; \*\* = Significant at the 5% level; \* = Significant at the 10% Level

**Specification 1:** Dictionary includes all words, except stop words.

**Specification 2:** Dictionary includes all words except stop words and gender-specific words.

**Specification 3:** Dictionary includes all words except stop words, gender-specific words, and numeric tokens.

Source: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019.

Empirically, the NLP results show that there exists a correlation between words that occur more often in the female biographies and words that occur more often in the male biographies associated with firms that outperformed. Within the main paper, an interpretation of this result is offered. An alternative interpretation consistent with these results would be that females have not pursued C-suite positions, or have not pursued the education that those positions require, until recently. The female executives we observe in those positions now, may be more ambitious than their female peers. While this alternative is markedly different in some ways, it is consistent with an equivalent innate talent in females and a bias (or ‘higher bar’) imposed on females, but earlier in their career than at the point they are evaluated by the board of directors. In other words, this narrative would argue that females have been dis-incentivized from pursuing a career path that would lead to C-suite appointment before being eligible for consideration.

As a final point of discussion, the fact that biographies are ‘current view’ and not point-in-time is emphasized. Therefore, the analysis has an inherent look-ahead bias. However, the salient conclusions of the analysis should not be impacted by this unavoidable deficiency. The features of the career paths that differentiate the successful male executives from the less

successful male executives (as defined in section 4) are correlated to the same features that differentiate all female executives from all male executives. The differentiation may be, in part, examining the executives' careers during or post-appointment as opposed to strictly pre-appointment. However, the correlation of these features is what is important.

Tokens with the most positive and negative scores in the trained dictionary are summarized in table A6.

**Table A6: Top 15 Most Negative and Most Positive Words in Dictionary  
(CEO Analysis, Russell 3000, 12/31/2002 – 5/31/2019)**

	Root Word	Stem	Positivity	Femininity
<b>Most Negative</b>	principal	princip	-4.20%	2.23%
	commercial	commerc	-3.86%	6.50%
	accounting	account	-3.19%	-1.63%
	formerly	form	-3.04%	3.73%
	co.	co.	-2.98%	10.54%
	prior	pri	-2.62%	-1.65%
	held	held	-2.42%	8.69%
	previously	prevy	-2.34%	1.18%
	asset	asset	-2.30%	2.66%
	financial	fin	-2.11%	5.95%
	business	busy	-2.06%	16.09%
	industries	industry	-2.01%	-1.36%
	new	new	-1.90%	11.26%
	ovation	ov	-1.90%	-0.67%
	metrics	met	-1.88%	-1.28%
	...	...	...	...
<b>Most Positive</b>	wharton	wharton	2.36%	0.64%
	incorporated	incorp	2.44%	2.16%
	administration	admin	2.55%	5.85%
	more	mor	2.66%	10.37%
	school	school	2.75%	3.60%
	company	company	2.88%	9.90%
	productivity	produc	3.00%	11.25%
	career	car	3.07%	10.36%
	chairman	chairm	3.08%	-9.33%
	year	year	3.12%	5.83%
	health	heal	3.33%	0.80%
	role	rol	3.36%	4.81%
	independent	independ	3.90%	15.17%
	division	divid	4.09%	6.26%
	technology	technolog	4.17%	9.83%

Source: S&P Global Market Intelligence Quantamental Research. Data as of June 6, 2019.

## Our Recent Research

### **June 2019: Looking Beyond Dividend Yield: Finding Value in Cash Distribution Strategies**

- Investors have historically been rewarded for investing in higher-yield stocks globally.
- Historical test results for yield-oriented strategies were stronger in the Russell 3000 Growth than in the Russell 3000 Value universe.
- Cash flow growth and capital efficiency metrics can enhance the performance of a shareholder yield strategy.

### **June 2019: The Dating Game: Decrypting the Signals in Earnings Report Dates**

The first part of this report focuses on companies that deviate from a historical reporting pattern. What does an advancement or delay of an earnings report date typically say about a company's fundamentals, and should investors take notice of this event? The second part of this report examines a related topic – the market's reaction to companies that postpone a previously scheduled (announced) earnings release date.

### **May 2019: Bridges for Sale: Finding Value in Sell-Side Estimates, Recommendations, and Target Prices**

This report looks at the informativeness of analyst recommendation revisions, target price revisions, and estimate dispersion, primarily within the post-2002 regulatory environment, and finds significant results in all three areas:

- Investors should focus on shifts in consensus recommendations, as the recommendation level by itself often reflects pro-management and high-growth biases.
- Target prices, labeled by some practitioners as “fiction” likewise provide insight into changing analyst attitudes. The six-month change in target price gap (the spread between target and market price) produces statistically significant results globally.
- Analyst estimate dispersion acts as an indicator of corporate quality – high quality companies have more stable revenue and income streams that are more amenable to forecasting

### **February 2019: U.S Stock Selection Model Performance Review**

U.S. stock returns faced headwinds due to the uncertainty around monetary and fiscal policies in 2018. At this time last year, we reported 15 months of consecutive positive returns for the S&P 500 (Dec 2016 to Jan 2017) which tied the previous 1959 record for longest winning streak for the index. Shortly thereafter, we saw the streak break when February yielded a return of -3.69%. Four of twelve months (Feb, Mar, Oct, and Dec) in 2018 saw S&P 500 declines, which pushed cumulative index returns down 7.18% on the year. The primary manifestation of this uncertainty was geopolitical events including the mid-term elections, trade tariffs, and a government shutdown that stretched into 2019 to become the longest shutdown in history.

### **February 2019: International Small Cap Investing: Unlocking Alpha Opportunities in an Underutilized Asset Class**

Institutional investors typically overlook or underweight small cap equities in global mandates for a number of reasons, including a higher risk level (relative to large caps), a lack of operational history, liquidity, and information/data gaps which make it challenging to make informed investment decisions. However, investors who are willing to embrace the risk in small cap investing also stand to reap the benefits of allocating to this asset class – potentially earning higher risk-adjusted performance and portfolio diversification. In this report, we examine international small cap performance across various themes and provide actionable insights for both fundamental and quantitative investors, by identifying key drivers of small cap stock performance.

### **January 2019: Value and Momentum: Everywhere, But Not All the Time**

“Momentum” and “Value” strategies have had well-documented return premia in multiple geographies and asset classes. Average monthly returns to momentum are larger than average returns to value, caveated by large pullbacks (“crashes”) in the momentum portfolio. Practitioners often include both approaches in their investment strategy.

- Dynamically weighting value and momentum strategies by a function of the trailing volatility in the momentum portfolio produces a superior information ratio (IR), total return, and lower maximum drawdown compared to a naïve equal weighting.
- Results are consistent in six regions (U.S., Europe, Asia Ex-Japan, Japan, Latin America, and Emerging Markets) and in multiple robustness checks. We maintain dollar neutrality and persistent leverage of 1.0 in all specifications.
- Monte Carlo simulation supports the conclusion that the shift of tail density from left- to right-tail drives the performance improvements. That is, large drawdowns are avoided.

### **November 2018: Forging Stronger Links: Using Supply Chain Data in the Investing Process**

Supply chain data can greatly enrich the investment process. Many of the insights gleaned from the supply chain can extend beyond what may be immediately obvious to investors. This report leverages the Panjiva content set, focused on global maritime shipping, to draw out seven major investment use cases. Working examples are provided from previously published research, including links to underlying reports, for each instance.

- Lower latency, higher frequency and finer granularity vs. financial data
- Detection of anomalous activity
- Risk event impact assessment
- Automated channel checks
- Industry deep dives
- Capital markets activities
- Thematic trading candidate identification

### **September 2018: Their Sentiment Exactly: Sentiment Signal Diversity Creates Alpha Opportunity**

Investors sometimes view sentiment signals as interchangeable: one indicator is the same as the next. Our research shows that this is far from the case.

- Companies where management is both positive/optimistic and fact-focused outperform historically.
- Hedge fund sentiment confirms and complements management sentiment.
- Market sentiment surrounding earnings calls amplifies the effectiveness of earnings transcript-based signals.
- Analyst sentiment, as reflected in target price/recommendation changes, adds an important voice to ownership-based signals.

**September 2018: Natural Language Processing – Part II: Stock Selection: Alpha Unscripted: The Message within the Message in Earnings Calls**

- Sentiment-based signals: Firms whose executives and analysts exhibited the highest positivity in sentiment during earnings calls outperformed their counterparts.
- Behavioral-based signals: Firms whose executives provided the most transparency by using the simplest language and by presenting results with numbers outperformed their respective counterparts.
- Positive language from the unscripted responses by the executives during the Q&A drove the overall predictability of the positive sentiment signal.
- The sentiment of CEOs has historically been more important than the sentiment of other executives.
- The aggregate sentiment of analysts historically enhanced the predictability of the 3-month FY1 EPS analyst revision signal.

**July 2018: A Case of ‘Wag the Dog’? - ETFs and Stock-Level Liquidity**

- We present an ETF price impact model, which posits single-day impact of up to 370 bps / day on an individual security and up to 250 bps / day on the index itself. Analyses indicate the effect is transitory and reverses over a period of 3-5 trading days.
- The Feb 2018 market correction was accompanied by a \$25B outflow of assets from ticker SPY, the SSGA S&P 500 Trust ETF. Modeling suggests that as much as one-third of the pullback was due to price pressure from ETF trading and that securities more sensitive to ETF flow underperformed.
- Sensitivity to ETF flow is used to build a risk model, which generates improved performance in a historical optimization. We offer a method for estimating ETF sensitivity for funds, using the S&P Global Ownership dataset.

**June 2018: The (Gross Profitability) Trend is Your Friend**

Trend strategies based on changes in stock price or earnings are widely used by investors. In this report, we examine the performance of a trend strategy derived from gross profitability (“GP”). Gross profitability trend (“GPtrend”), was proposed by Akbas et al. who argued that the trajectory of a firm’s profitability is just as important as the level (GP). We define GPtrend as the year-on-year difference in either quarterly or trailing twelve month GP, where GP is calculated as revenue minus cost of goods sold, divided by total assets. Our back-tests confirm that GPtrend has historically been an effective stock selection signal globally, with the added benefit of low to moderate correlation with commonly used investment strategies.

**May 2018: Buying the Dip: Did Your Portfolio Holding Go on Sale?**

**March 2018: In the Money: What Really Motivates Executive Performance?**

February 2018: [The Art of the \(no\) Deal: Identifying the Drivers of Canceled M&A Deals](#)

January 2018: [U.S Stock Selection Model Performance Review](#)

September 2017: [Natural Language Processing - Part I: Primer](#)

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