

# Leadership In Turbulent Times: Women CEOs During COVID-19

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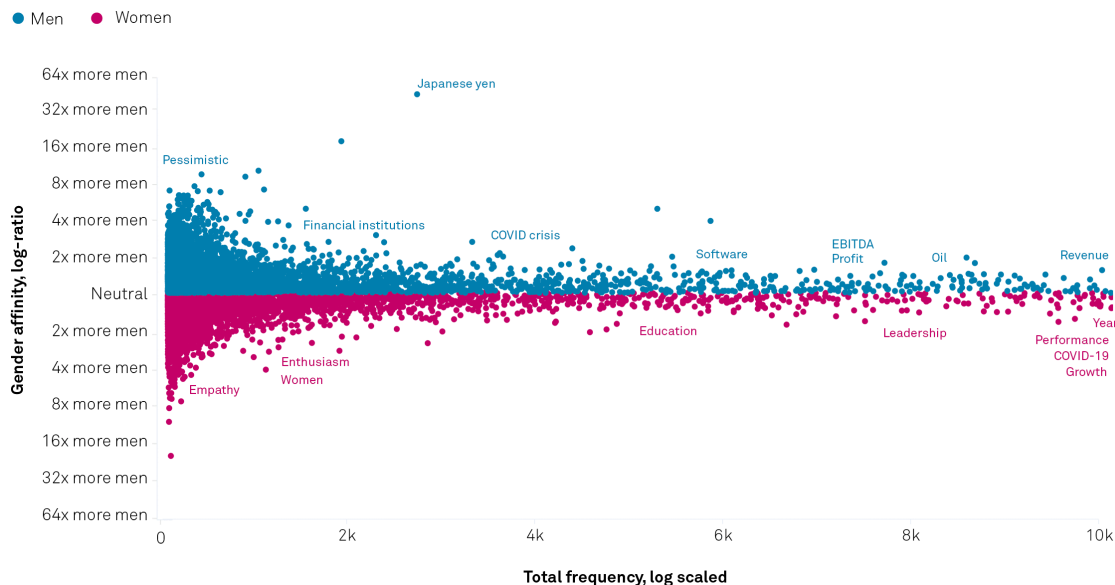
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## Key Takeaways

- Women CEOs exhibited a different leadership style than men during the COVID-19 crisis, leaning toward empathy, adaptability, accountability, and diversity, based on our sentiment analysis of earnings call transcripts of the leaders of nearly 5,000 companies in the S&P Global Broad Market Index from March 9, 2020 to Dec. 31, 2020.
- CEOs who were women exhibited a more positive communication style at the peak of the pandemic, with higher average scores for words expressing trust and anticipation. CEOs of both genders expressed negative sentiment at comparable frequency.
- Women CEOs are still significantly underrepresented. Women at companies in the S&P Global BMI accounted for 5% of CEOs on Jan. 25, 2021, compared with 4.9% on Feb. 8, 2020.
- Countries with a higher share of women CEOs also tend to have more gender-balanced labor force participation.
- Sector and country of the company best explain stock market performance for our dataset during the pandemic; gender does not play a big role for this shareholder-focused measure over the period studied. However, women CEOs displayed a leadership style aligned with a wider range of stakeholders.

Chart 1

## Ratio Of Frequency Of Word Choice To Gender In Our Sample Of Earnings Call Transcripts



## Do Women Lead Differently?

*Daniela Brandazza, Senior Director and Analytical Manager, S&P Global Ratings, President of the WINS (Women's Initiative for Networking and Success) at S&P Global*

During the first months of the COVID-19 pandemic, the global press hailed the performance of women leaders. New Zealand, South Korea, and Germany were often mentioned as examples of nations, led by women, weathering the pandemic better than countries led by men, whose political style was perceived as fitting the stereotype of masculine leadership. Women in power, said the press stories, seemed to be more responsible, caring, and prudent, while men were more willing to improvise, minimize the perils, and make risky decisions.

Those questions led to this paper. As the pandemic unfolded, taking millions of lives and a massive economic toll around the globe, business leaders of every sector had to brace their companies for impact and prepare their teams to rapidly change their priorities to navigate uncharted waters. Men and women CEOs found themselves making difficult choices to enable their companies to survive the crisis and, if possible, thrive afterward.

Do men and women have different leadership approaches and styles? If so, to what extent do these differences account for the performance of the organizations they lead? Can we find the same gender effect in the corporate world as some see in government?

This paper sheds light on how women and men CEOs exhibited different leadership styles. Our research found that women CEOs communicated more positively than men CEOs, based on sentiment analysis to examine the language of earnings call transcripts of the leaders of close to 8,500 companies from the S&P Global Broad Market Index. Women CEOs also used comparatively more words expressing emotions related to trust and anticipation. CEOs of both genders communicated negatively at comparable frequency.

The paper also offers some insights about the numbers of women in CEO positions across markets and sectors. We found that women CEOs leading companies included in the S&P Global BMI accounted for 5% of total CEOs on Jan. 25, 2021, compared with 4.9% on Feb. 8, 2020. We also found that countries with a relatively higher share of women CEOs also tend to have more gender-balanced labor force participation. At the same time, our research indicates that CEO gender was not related to a company's stock market success. Instead economic sector and geographic location best explained company performance during the COVID-19 pandemic. Also, companies led by CEOs with more experience in their current job performed better during the crisis. Yet, younger CEOs also performed better, perhaps because they led companies with a higher degree of digitalization, which performed well during the crisis.

## A Literature Review

*Dr. Gabriel Morin, Associate Professor of Leadership Development for the LARGEPA Research Laboratory in Management Sciences at Paris 2 Pantheon-Assas University*

While the topic of women leadership has been widely discussed in the literature on gender and leadership (Eagly & Johnson 1990), it has been at the top of the leadership research agenda for the past decade or so (Chin 2014; Avolio et al. 2009) and is explored by the "new leadership research paradigm," which studies how leaders develop (Morin 2016).

The current context of the pandemic crisis has reinforced this trend (Zenger & Folkman 2020; Chamorro-Premuzic & Wittenberg-Cox 2020). However, these studies focus less on women leaders as such and more on women's representation in the management bodies or even in the

organizations explored (Bell 2020). They implicitly underline the fact that occupying a very high leadership position for a woman is still perceived as an anomaly (Glass & Cook 2016; Chin 2014).

Other studies are based on qualitative empirical analyses concentrated on limited sample sizes (Zenger & Folkman 2020), both in terms of the number of companies, women, countries, or sectors involved. This makes it difficult to gain a comprehensive understanding of the phenomenon of women's leadership.

With respect to the question of whether women leaders perform better than men, existing research is inconclusive, pointing instead to ambivalence on this issue (Sandberg 2019; Eagly & Carli 2003; Foels et al. 2000).

Existing literature is ambivalent about differences in terms of leadership style between women and men (Saint-Michel 2011; 2010; Fine 2007; Eagly & Johnson 1990). Regarding the specificities of leadership by women, previous research highlights a more interpersonally oriented, transformational, and communication-oriented style, whereas leadership by men is more task-oriented, transactional, and participative (Eagly et al. 2003; Eagly & Johnson 1990).

Similarly, psychological studies on gender show a differentiated use of communication with women being more inclusive and men being more results-oriented (Wood 2001; Mason 1991), which is confirmed by the literature on women leadership (Fine 2007).

## The Research Approach

*Dr. Gabriel Morin, Associate Professor of Leadership Development for the LARGEPA Research Laboratory in Management Sciences at Paris 2 Pantheon-Assas University*

Our research aims to fill some analytical gaps by focusing on women CEOs in the macro context of the world's leading companies. We try to dig deeper into the study of leadership by women when it is exercised directly and in full force. This takes us beyond the exploration of the influence of more gender-balanced management bodies or of the company as a whole, which research has addressed so far. Who more than the CEO, through their vision and decisions, is responsible for an organization's overall success?

The object of study, or research question, in management science is not neutral from a societal point of view. Focusing on women as leaders is part of a changing vision of a world that needs to be more diverse, equitable, and sustainable. To that end, quota policy is a way forward that we believe is more of a transitional means to achieve deeper change. The impact of women CEOs as role models seems to be far more inspiring.

The other key angle of our research relates to the size of the sample. To understand this phenomenon requires a global approach. As such, we are analyzing an index comprising thousands of the world's leading companies across countries and sectors. This paper focuses on women CEOs of companies from the S&P Global BMI. This is one of the world's largest indices, with more than 11,000 of the largest listed companies in developed and emerging markets.

Our study also explores the link between company performance and CEO gender. We measured stock market performance in our research using a total return approach. Total return represents closing stock prices adjusted for stock splits, dividends, and other security-level corporate actions.

We challenge the findings of previous studies concerning the question of whether women have a leadership style and, if so, how it is defined. We drew on data from nearly 5,000 earnings call

transcripts featuring commentary by both women and men CEOs during the pandemic. We found that leadership style was different for women and men CEOs during this period.

Finally, the design of our study--grounded in data collected from transcripts with commentary from women and men CEOs in the same pandemic crisis context across countries, sectors, and organizations--addresses the following two limitations of leadership research so far:

- First, the difference between leadership by women and men sometimes has more to do with the gender of the follower than of the person who leads. Men and women followers perceive the same leadership attitude differently depending on their own gender, rather than their leader's gender (Chin 2014; Saint-Michel 2011).
- Second, other studies show that differences in leadership style also stem from the cultural, economic, organizational, and sectoral contexts in which the company concerned operates (Chin 2014).

## Our Key Findings Regarding Leadership Style During The COVID-19 Crisis

*William Watson, Data Scientist, S&P Global Ratings*

### Natural Language Processing helps understand women CEOs' communication style during the COVID-19 crisis

To capture a CEO's communication style during the COVID-19 crisis, we collected and analyzed earnings call transcripts from 4,958 companies from Jan. 1, 2019, to Dec. 31, 2020. The ratio of women to men in senior leadership positions is often lower, and our transcript data is no exception. The total number of women CEOs in this dataset is 256 (5.16%) while the total number of men CEOs is 4,702 (94.84%). We used advanced techniques in natural language processing to compensate for this imbalance in our data.

### Women CEOs have a higher score for positive sentiment

Our first results come from the aggregation of sentiment and emotion scores per transcript per gender. We computed the average and median scores, and conducted statistical tests (see table 1). We see that, on average, women CEOs have a higher score for positive sentiment, and high scores for emotions in the categories of trust and anticipation. It is interesting to observe that women CEOs more frequently used words related to trust during the first quarter of 2020 than men. This converged toward the end of 2020.

We observe that men CEOs have higher scores for language in the categories of surprise, anger, and sadness. We cannot make a conclusion about gender for fear or negative sentiment because our p-values are high, and the mean and median do not agree on direction. (Low p-values show the statistical significance of a measure.) However, it's possible to suggest empirically that both genders used words that are associated with these emotions at the same frequency.

Some of the most frequent words used to describe negativity, sadness, and fear were, unsurprisingly, "pandemic," "crisis," and "disease," obvious references to the COVID-19 pandemic. Women and men CEOs used terms expressing anger, including "loss" and "challenge," at about the same frequency. On the other hand, in the positive category for both genders, we see terms for "growth" and "opportunity" arise. What's more, high-ranking terms for "joy" reflect a mood among both men and women that the situation will "improve" alongside "progress" and "hope." For a detailed look at the top 10 most frequent words by gender per emotion and the top 10 most-gendered terms by log-ratio, see table 4 in Appendix II.

Table 1

**Mean And Median Sentiment Scores Per Gender During The COVID-19 Crisis (March 9-Dec. 31, 2020)**

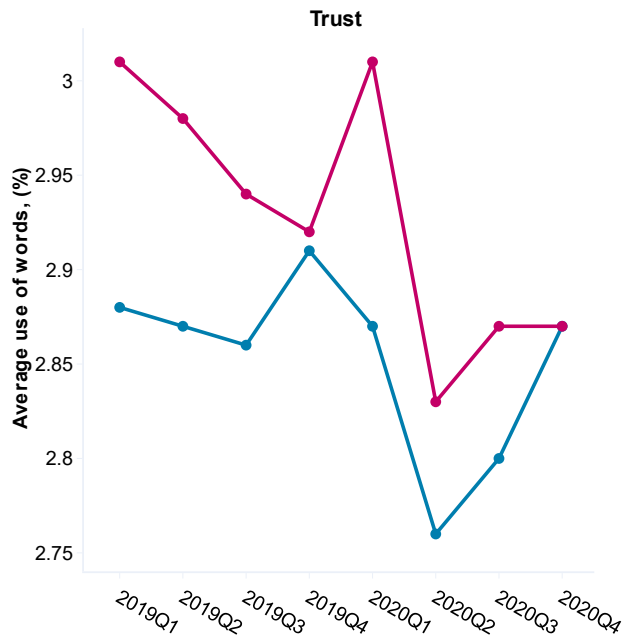
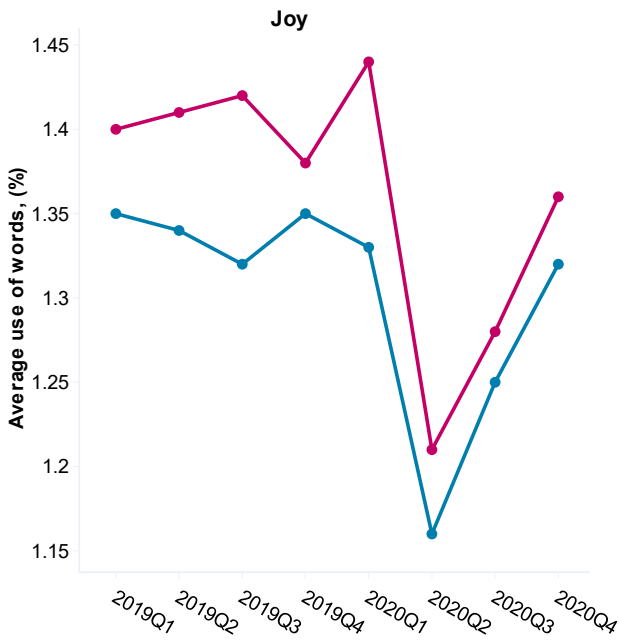
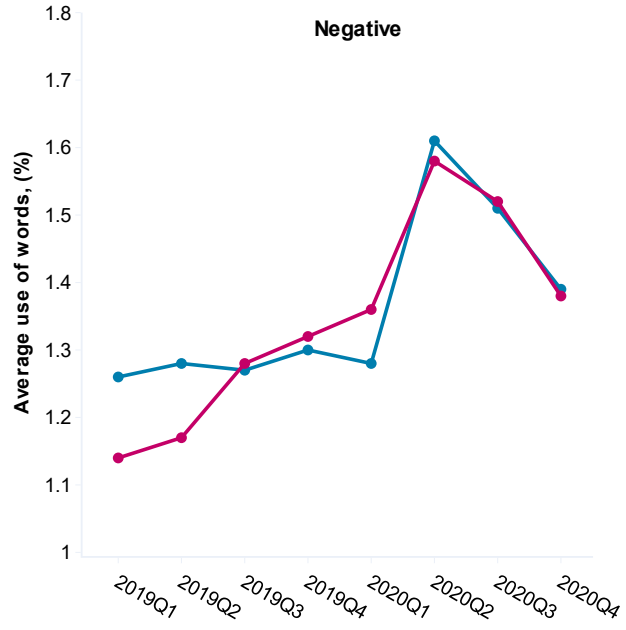
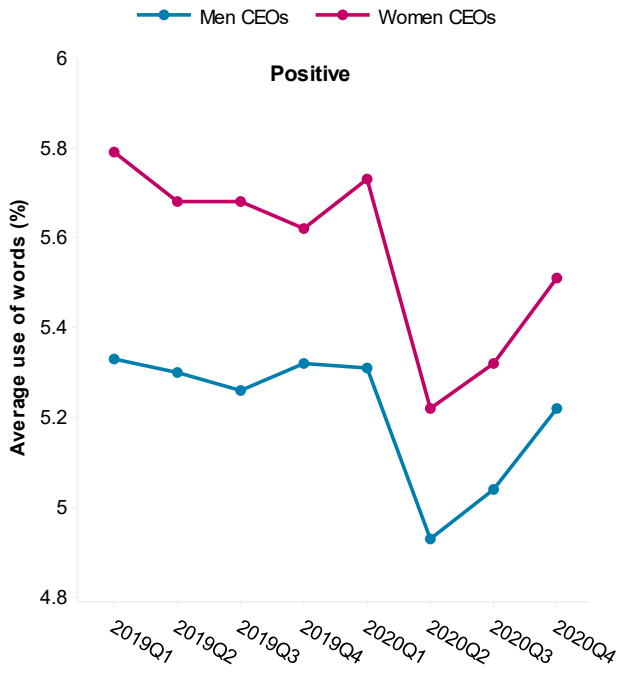
Sentiment (positive/negative) or emotion	Metric	Most significant <span style="float: right;">Less significant</span>			P-value
		Women	<	Men	
Anger	Mean	0.0050	<	0.0051	0.2421
	Median	0.0046	<	0.0047	0.1762
Anticipation	Mean	0.0237	>	0.0232	0.0101
	Median	0.0236	>	0.0228	0.0029
Disgust	Mean	0.0024	>	0.0022	0.0006
	Median	0.0019	>	0.0019	0.1306
Fear	Mean	0.0081	>	0.0080	0.2938
	Median	0.0074	<	0.0075	0.7292
Joy	Mean	0.0129	>	0.0125	0.0079
	Median	0.0125	>	0.0121	0.0060
Negative	Mean	0.0141	>	0.0140	0.8421
	Median	0.0131	<	0.0132	0.7292
Positive	Mean	0.0538	>	0.0510	0.0000
	Median	0.0534	>	0.0503	0.0000
Sadness	Mean	0.0060	<	0.0061	0.6468
	Median	0.0054	<	0.0057	0.0819
Surprise	Mean	0.0062	<	0.0064	0.1046
	Median	0.0060	<	0.0062	0.1317
Trust	Mean	0.0287	>	0.0282	0.0790
	Median	0.0283	>	0.0278	0.0272

Note: For statistical significance, we used the T-Test (unequal variances) for means and Mood’s median test for medians. p-value--a measure of the probability that an observed difference could have occurred just by random chance. The lower the p-value, the greater the statistical significance of the observed difference.

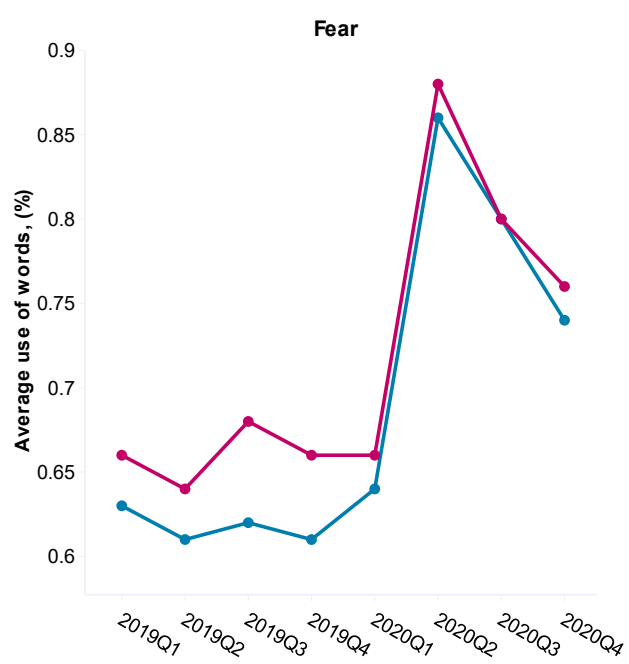
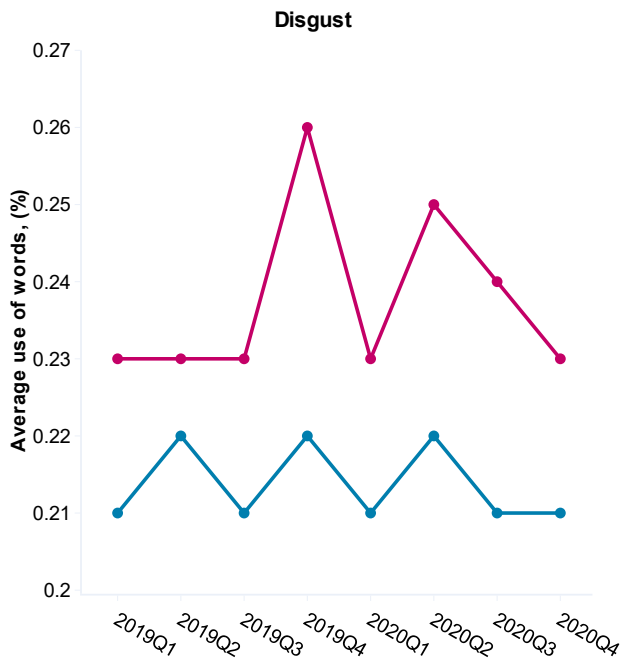
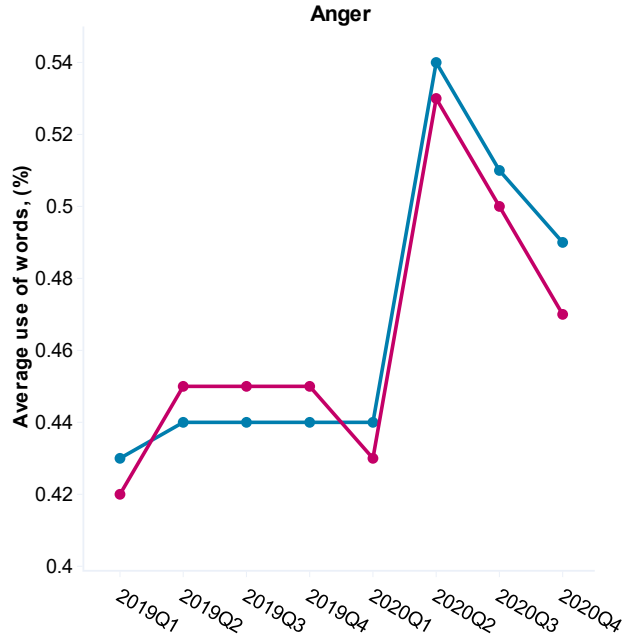
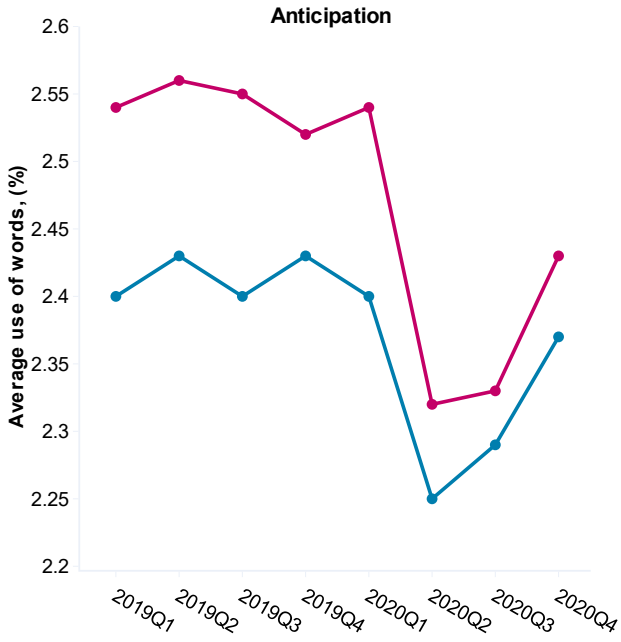
We also look at the evolution over time for each emotion, from Jan. 1, 2019, to Dec. 31, 2020, to see if the COVID crisis affected CEO sentiment, and if differences developed over time. In chart 2, we see that in the second quarter of 2020, when COVID-19 was declared a pandemic, scores for positive sentiment, joy, anticipation, and trust dropped for both genders. Meanwhile, scores for negative sentiment, sadness, fear, and anger increased.

Chart 2

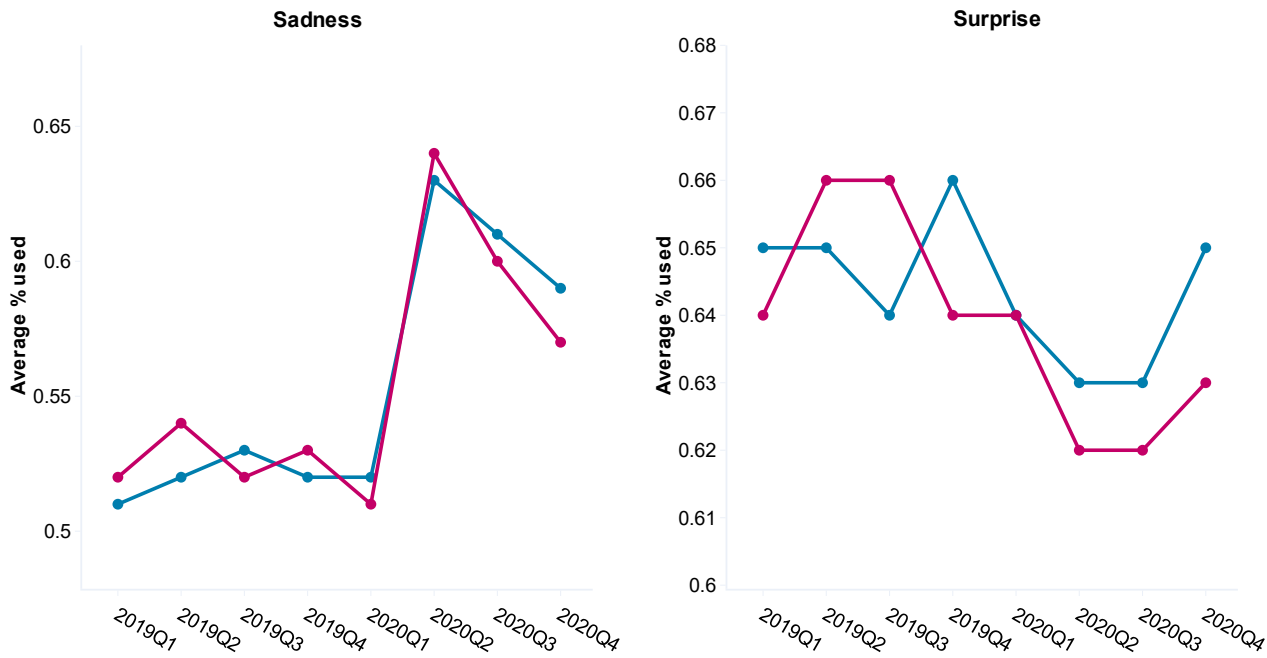
Mean Scores For Sentiments And Emotions Per Gender, First-Quarter 2019 To Second-Quarter 2020



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### There is gender affinity for key concepts and words

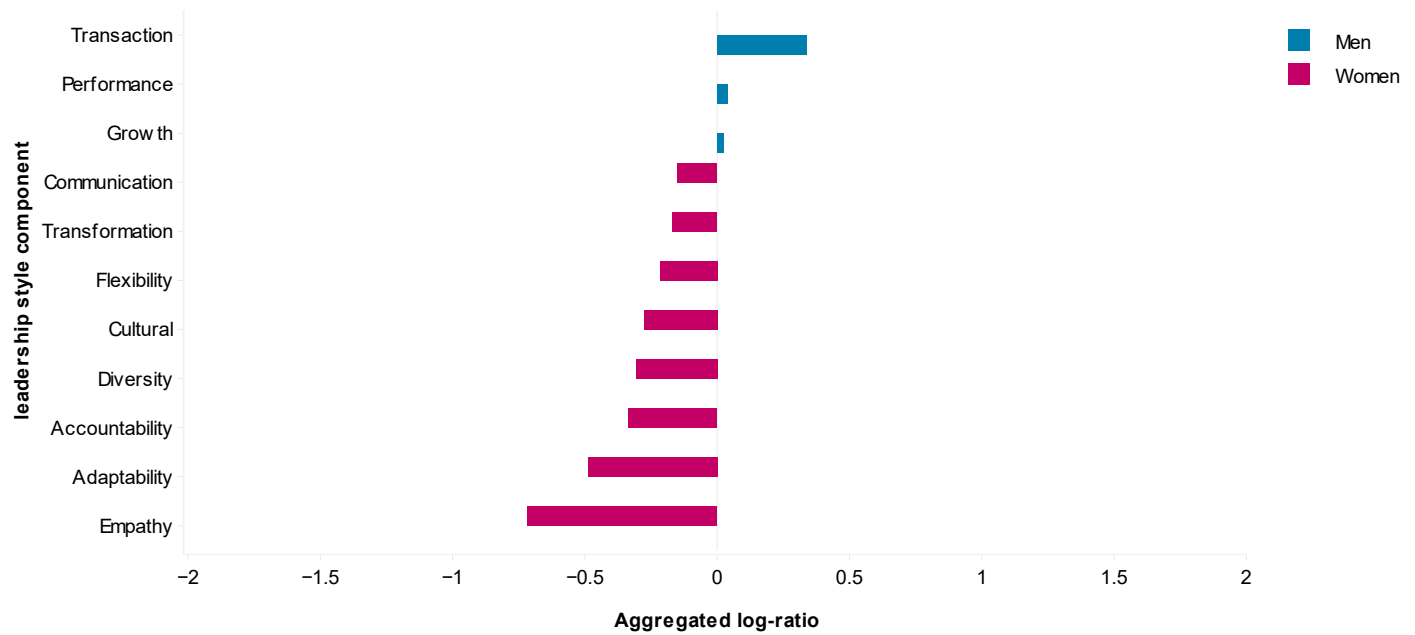
We also focused on organizing words based on their gender affinity, either tilting toward women or men for average use per transcript (see chart 1 at the beginning of this report). In the chart, we see the distribution for each word’s log-ratio, contrasted with its total frequency usage across the entire corpus. The more a term was used, the less affinity it had for gender. These include common English terms such as “the” and “of.” However, as we look at the more intermediate frequent words, we see differences arise. Some differences are due to gender representation in sectors like health, education, oil, and software. Some commonality occurs regarding crisis (covid-19) or general company growth and performance. However, some major differences arise between smaller variations, such as for the term “covid-19\_crisis” (that more men used) over an “outbreak” (which more women used). Even in expressions of emotions, differences arise for terms such as “pessimistic” versus “enthusiasm.” For our dataset, for terms occurring over 100 times, 15.7% were women-associated (log ratio less than -0.5), 26.5% were associated with men (log ratio greater than 0.5), and 57.8% were shared (log ratio between -0.5 and 0.5).

### Women CEOs demonstrate a leadership style that values empathy, adaptability, accountability, and diversity

We then used the dataset of CEO words to see if they could tell us something about leadership style. We built a model to give us the top 30 contextually relevant words for each component (see chart 3). The components of leadership styles we considered were growth, adaptability, communication, flexibility, accountability, empathy, performance, diversity, transaction, transformation, and cultural. These are all grounded in leadership style and theory.

Chart 3

**Top 30 Similar Words Per Component Of Leadership Style**



We found that women CEOs expressed language in the categories of empathy, adaptability, accountability, and diversity, for example. Men CEOs were more focused on transaction-related words (see chart 3). Mentions of words related to performance and growth appear to be gender-neutral in earnings calls. In the context of flexibility, we found women CEOs talking about agility, comfort, and financial flexibility (see table 4), while men CEOs were mentioning predictability, redundancy, stability, and scalability. For instance, in the leadership style of transformation, women CEOs spoke more about realignment, revitalization, simplification, modernization, and operational excellence, while men CEOs talked more about reorganization, integration, and cultural transformation.

**Women CEOs spoke more about clients, while men CEOs talked more about metrics**

Next, we wanted to test the premise that men CEOs are more prone to discussing metrics, which would show a performance-dominant leadership style. Indeed, we found that men CEOs more frequently used terms related to metrics like “EBITDA” and “profit.” Interestingly, women CEOs leaned toward terms related to customers (see chart 4).

Finally, we delved into terms related to family and labor, finding that words such as “state\_of\_emergency” and “unemployment” are highly associated with men, in contrast to concepts such as “paternity” and “maternity” for women (see chart 5).

Chart 4

**Top 30 Similar Words Per Component Of Metric-Related Concepts**

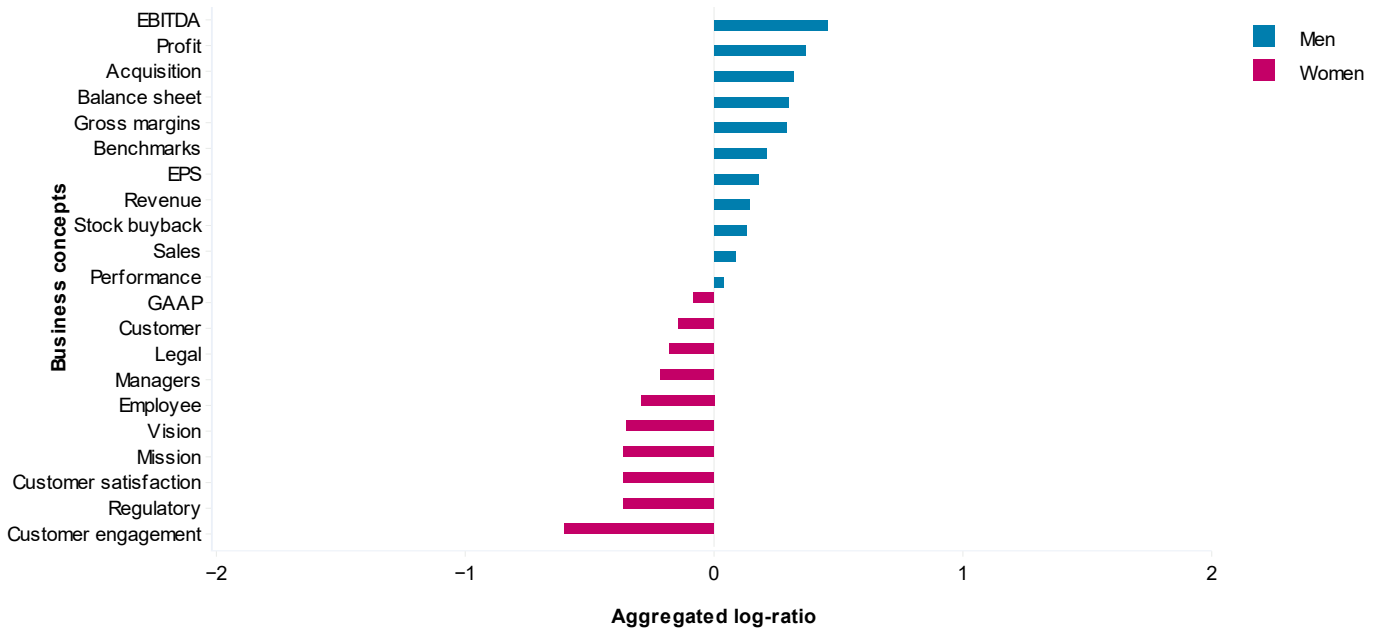
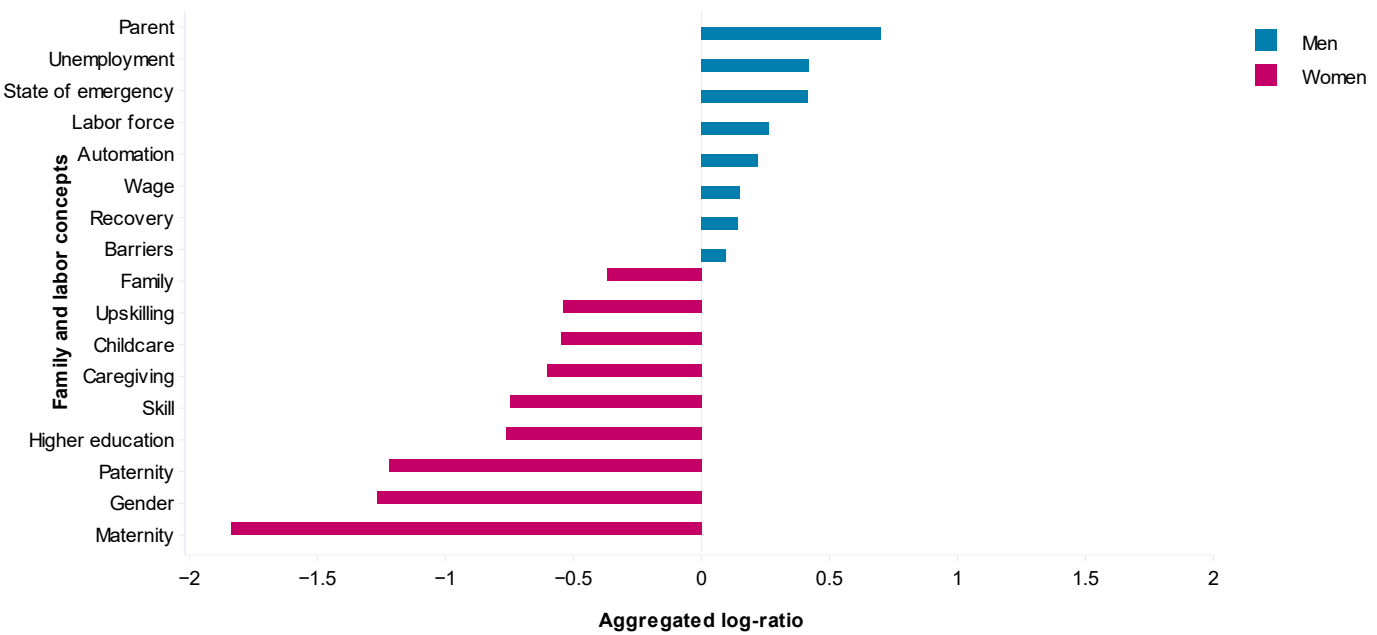


Chart 5

**Top 30 Similar Words Per Component Of Family And Labor Concepts**



## Insights Regarding Women CEO Representation

### We are very far from gender equality at the CEO level

*Katie Darden, Financial Institutions Research Director, S&P Global Market Intelligence*

Women CEOs continue to be significantly outnumbered globally by CEOs who are men. In fact, as of Jan. 25, 2021, only 5% of a sample of more than 8,000 CEOs from the S&P Global BMI were women (see table 2). This shows that there is still a wide gender gap in the highest corporate ranked position, in addition to the already known gender gap in corporate boards. In those countries where we observed more gender parity at corporate boards, there were deliberate policies implemented throughout the years. Women around the world continue facing increasing challenges, and companies will play a critical role in retaining and developing their talent and their capacity to assume leadership positions.

Table 2

#### CEO Gender At S&P Global Broad Market Index Companies

	Men CEOs	Women CEOs	Men (%)	Women (%)
<b>2020</b>	8,047	411	95.1	4.9
<b>2021</b>	8,031	427	95.0	5.0

2020 data was compiled Feb. 8, 2020. 2021 data was compiled Jan. 25, 2021. Data includes CEOs for 8,458 companies worldwide. These companies are S&P Global Broad Market Index constituents for which CEO data was available through S&P Global Market Intelligence as of the compilation dates and for whose CEOs we were able to apply a gender category in both years. Excludes co-CEOs. Source: S&P Global Market Intelligence.

### Countries with a more gender-diverse labor market do better at fostering women CEOs

*Marion Amiot, Senior Economist, and Nicole Serino, Credit Market Research, S&P Global Ratings*

The number of women CEOs does not come close to matching the number of men CEOs in any of the 61 countries covered by the S&P Global BMI companies whose CEO data we analyzed. This suggests that more progress is needed worldwide to close the gender gap at the leadership level. That said, some countries are ahead of others in terms of CEO diversity. Looking at the S&P Global BMI, Norway and Singapore score the highest with women representing 14% and 12% of women CEOs, respectively (see chart 6). By contrast, Japan and Brazil have the lowest share of women CEOs at only 0.8% and 0%, respectively (see chart 7).

Chart 6

**It Is Much Easier To Find A Women CEO In The Philippines Than In Japan**

Share of women CEOs leading companies in the S&P Global Broad Market Index

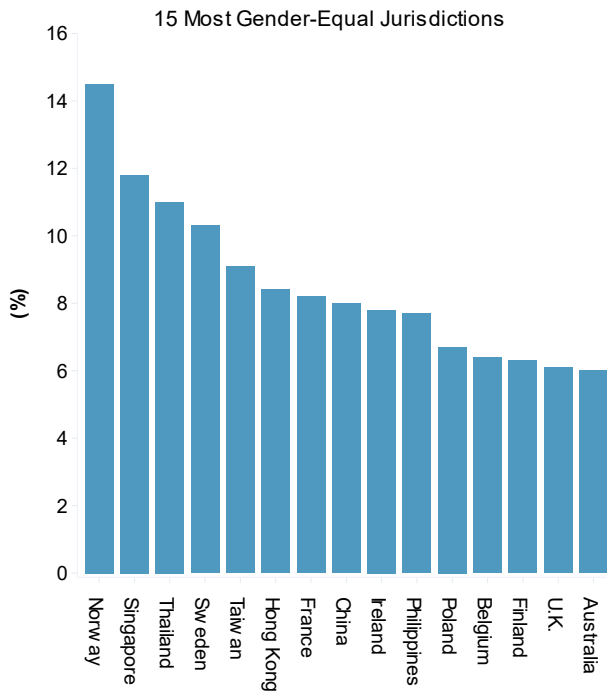
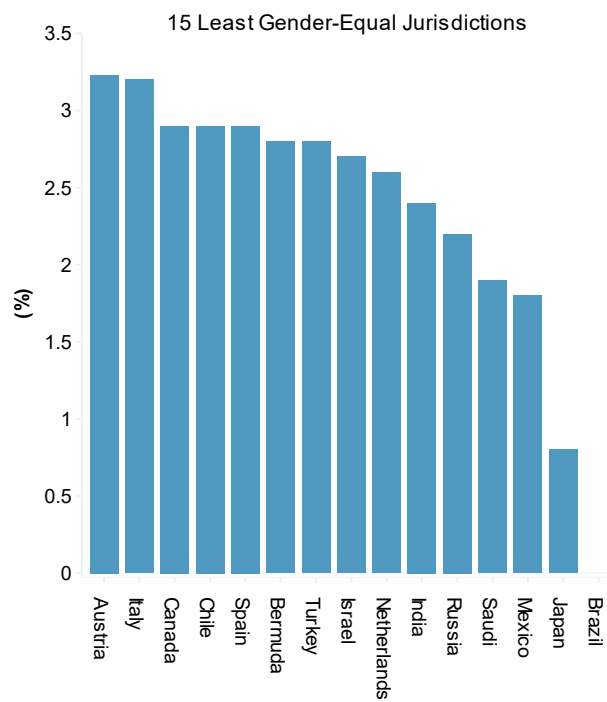


Chart 7



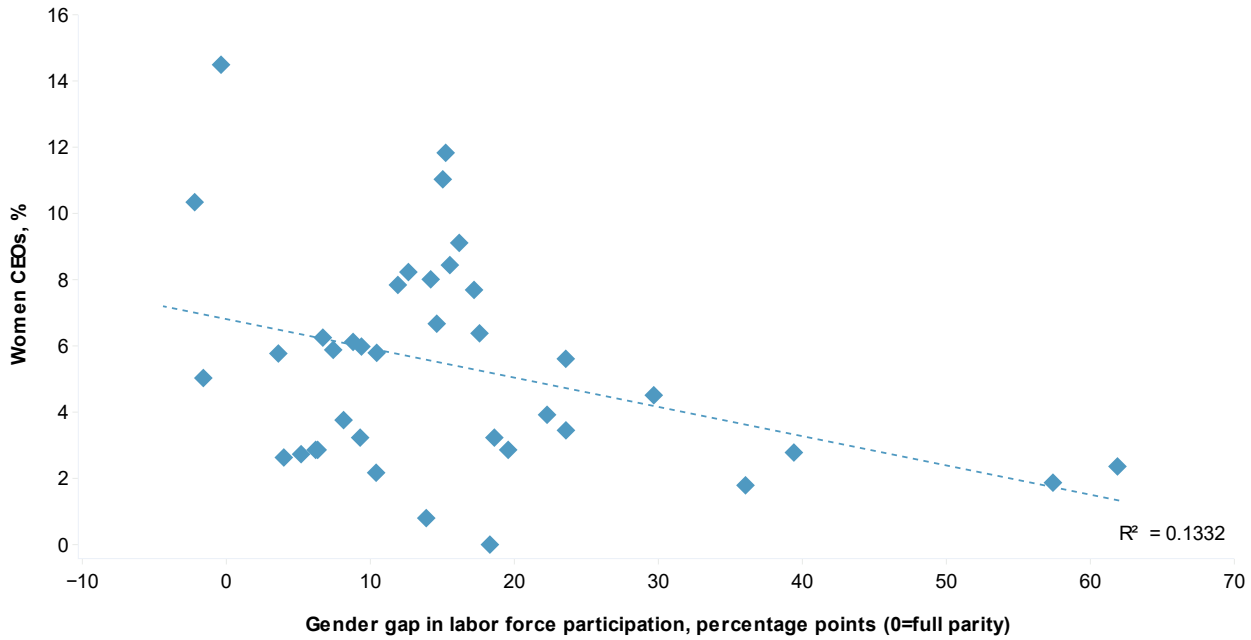
Source: S&P Global Broad Market Index.

The composition of the labor force can explain part of these differences. Countries exhibiting a relatively higher share of women CEOs also tend to have a more gender-balanced labor force, that is, similar rates of labor market participation for men and women (see chart 8). A simple linear regression suggests that the gender gap in the labor force explains about 13% of the cross-country variation in the CEO gender gap. To close that gap, policymaking could play a role. For example, countries with better access to child care are more likely to attract and retain a higher share of women in the workforce. Only then can larger numbers of women start a career, climb the ladder, and one day, perhaps, become CEO.

Chart 8

### A Higher Share Of Women CEOs Reflects A More Gender-Balanced Distribution In The Labor Force

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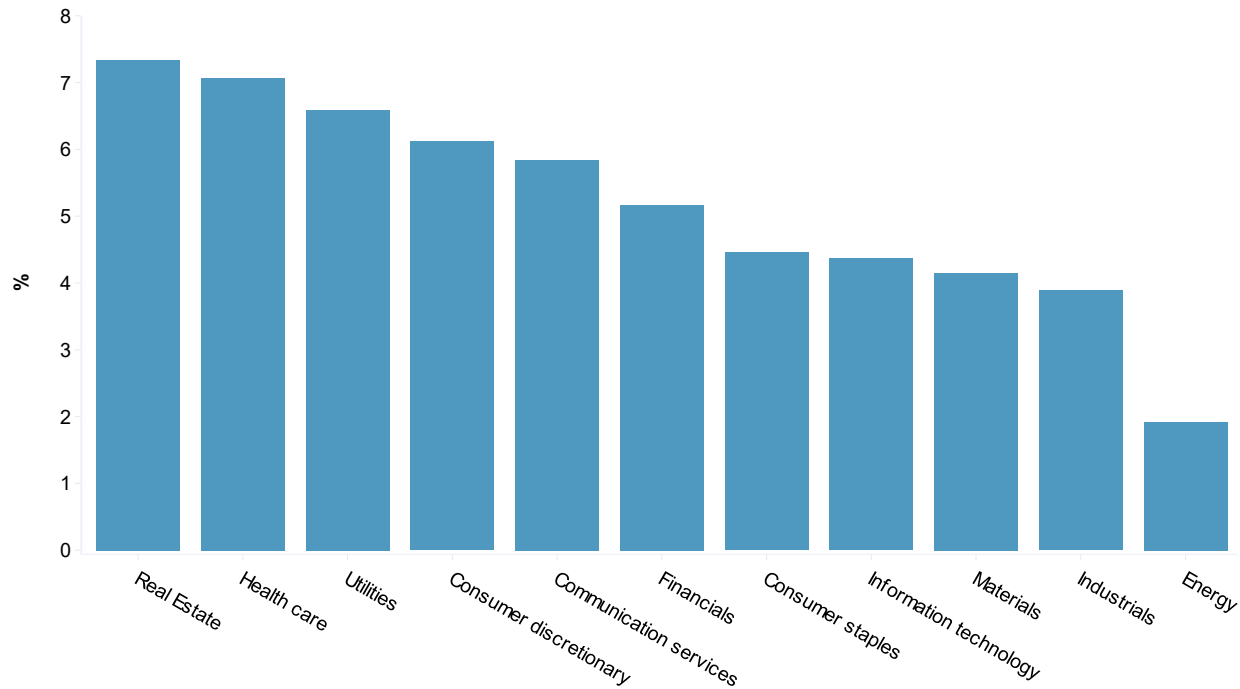


Note: For the 61 countries covered by companies in the S&P Global Broad Market Index whose CEO data we analyzed.  
Source: S&P BMI Index, ILO, S&P Global.

Taking a more sector-specific look at the CEO gender gap, data suggest that some industries seem to have more women CEOs than others. For example, in the S&P Global BMI, real estate and health care companies are around four times more likely to have a women CEO than a company in the energy sector (see chart 9).

Chart 9

Share Of Women CEOs: Sector Breakdown



Note: For about 8,000 CEOs of companies in the S&P Global Broad Market Index.

Factors accounting for company performance during the COVID-19 crisis

To analyze whether CEO gender helps explain companies’ performance in the first year of the pandemic, we turned to stock market performance. We would have preferred a broader measure of performance, but since we are looking at a recent time period, we were constrained in our choice of indicators. Most companies had not yet released their annual results when the analysis was conducted. Thus, we measured stock market performance by looking at companies’ total returns between March 10, 2020, and Dec. 31, 2020. Equally, our choice of control variables for the model was constrained by the availability of data. We had information only about each company’s sector and country and the CEO’s age and experience in the company (that is, years in the position).

Using a quantile regression, we find that CEO gender doesn’t explain companies’ total returns performance. This is regardless of which of the five percentiles where the company’s performance lies--from best to average to the worst--see table 3. This corroborates some of S&P Global’s previous findings in “When Women Lead, Firms Win,” and underscores that gender does not determine success. Putting these findings in the light of previous research would also suggest that diversity among a group of leaders is more likely to shape performance than the gender of one leader. What likely matters more than gender is a mix of both experience and views, a conclusion from our previous study, “The Changing Face of Tech.”

Economic sector and geographic location best explained company performance during the COVID-19 pandemic. Also, companies with CEOs with more experience in their current job (proxied by job tenure) performed better, highlighting that knowledge of the business may have helped. Our model also suggests that companies with relatively younger CEOs tend to have performed better.

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However, we believe age here is likely an indicator of the degree of digitalization of the companies. In other words, younger CEOs (i.e., younger than our sample average of 56) were more likely to work in those digitalized companies that fared better or even benefited from this crisis. Companies that were more digitalized and able to swiftly shift to work from home during lockdowns suffered less activity losses during the pandemic regardless of their geography or sector, which are the other factors we have controlled for in our model.

Table 3

### Drivers Of Companies' Total Returns Between March 10 And Dec. 31, 2020 - A Quantile Regression

Quantile regression results show the relationship for the worst-(0.1) to best performing companies-(0.9) in our sample

Quantile	0.10	0.30	0.50	0.70	0.90
(Intercept)	(9.27)	9.92	32.39***	67.14 ***	154.46***
<b>CEO traits</b>					
Gender	1.43	(0.82)	2.74	2.50	16.19
Approximate age	(0.24)**	(0.31)***	(0.49)***	(0.89)***	(1.92)***
Current job tenure	0.11	0.12 *	0.19*	0.35**	0.88**
<b>Region</b>					
Americas	11.43*	16.14 ***	20.53***	27.72**	43.23***
Asia	7.65	11.22**	14.12***	20.43**	30.85***
Europe	9.00	11.70**	10.31**	14.78*	12.22
Oceania	4.55	2.87	5.15	4.85	11.32
<b>Sector</b>					
Consumer discretionary	5.42	14.70 ***	17.26***	28.60***	92.64***
Consumer staples	7.54**	(0.75)	(10.06)***	(15.42)***	(38.69)***
Energy	(5.08)	(1.69)	(2.37)	9.59	17.47
Financials	(1.40)	(0.60)	(6.10)	(11.74)**	(37.92)***
Health care	(5.09)	4.00	6.36	20.68***	38.00***
Industrials	7.02**	8.51**	3.84	5.27	(9.61)
Information	17.99***	24.11***	26.69***	39.67***	59.17***
Materials	22.10 ***	25.33***	22.73***	30.81***	28.47**
Real estate	(12.63)***	(14.62)***	(25.98)***	(34.06)***	(70.71)***
Utilities	(6.08)*	(8.94)**	(16.59)***	(19.26)***	(36.68)**

Note: Over the period of March 10, 2020, and Dec. 31, 2021. Approximate age and job tenure are expressed in years. Statistical significance levels are as follow: \* = 10%, \*\* = 5%, \*\*\*=1%; we run a quantile regression to overcome the skewed distribution of our data and ensure that the coefficients are not disproportionately influenced by outliers/the skew. Source: S&P Global estimates.



## Looking Ahead

*Daniela Brandazza, Senior Director and Analytical Manager, S&P Global Ratings, President of the WINS (Women's Initiative for Networking and Success) at S&P Global; Katie Darden, Financial Institutions Research Director, S&P Global Market Intelligence*

Much of the business community is warming to a stakeholder capitalism model that emphasizes a company's creation of value in society and the economy, instead of a narrower focus on value created primarily for shareholders. Under this approach, employees are one of many stakeholders. A commitment to an increasingly diverse and inclusive workforce and leadership is part of that vision.

Even if companies do not consider employees as stakeholders, the consideration of their needs is obviously a good practice for attracting and retaining talent. Prior S&P Global research shows the importance of flexibility and adaptability as elements of corporate cultures and policies that employees view are best in class ("Something's Gotta Give"). To the extent that CEOs demonstrate a commitment to such ideas through their public communications, it may benefit other leaders to follow their example. As our research shows, women CEOs may be leading the way in this regard even if they remain small in number.

The main conclusions of this global research about women's leadership shed light on their communication style during a moment of crisis, relying on data from relatively formatted communications (conference calls about corporate earnings). We see several opportunities for further research about women leaders in times of crisis and their role in creating social capital. Several studies have shown that organizations appoint proportionally more women to head up their organizations in times of crisis (Glass & Cook 2016; Barreto et al. 2009; Bruckmüller & Branscombe 2010). This bias, known as the glass cliff, is a point to be followed up by research that might, for example, revisit the data after the pandemic is over. Similarly, investigating the differences established here between the CEO communication styles of women and men leaders is relevant to exploring how this key element of leadership influences social capital (Day 2000). That is, how do CEOs promote a set of shared values to achieve a common purpose? Conducting a series of interviews with women CEOs who lead companies in the S&P Global BMI can help to do this. We are putting these two points on our research agenda.

Understanding women leaders as role models and the value they bring to our society is part of a changing vision of a world that needs to be more diverse, equitable, and sustainable. Our research indicates that countries and companies still need to do much more to ensure such a vision in the future. Foremost, they need more equitable participation in the workforce, which our research shows is related to higher shares of CEOs who are women. This is unsurprising but comes at a time when women are reportedly pulling back or out of the workforce in greater numbers to care for others in response to COVID-19-related needs for health care, child care, or education. This represents a huge economic loss and a missed opportunity when companies and countries ignore women's potential. As we have shown, women CEOs, though small in number, have a broader notion of leadership that places greater emphasis on stakeholder leadership in an era when stakeholder capitalism is taking root. In this sense, women CEOs seem to be in the vanguard.

## Appendix I: How We Constructed Our CEO And Transcripts Databases

*Katie Darden, Financial Institutions Research Director, S&P Global Market Intelligence*

S&P Global conducted this analysis based on S&P Global Market Intelligence professionals data, market data, and transcripts data for the constituents of the S&P Global BMI.

Using the S&P Capital IQ and S&P Global Market Intelligence platforms, we screened for constituents of the S&P Global BMI and compiled CEO data for those companies on Jan. 25, 2021. This resulted in a list of more than 11,200 individuals whom we categorized by gender.

A similar analysis, for which data was compiled on Feb. 8, 2020, provided a point of comparison for the Jan. 25, 2021, data. The resulting more limited comparative sample included CEOs for nearly 8,500 companies worldwide. These companies are S&P Global BMI constituents for which CEO data was available through S&P Global Market Intelligence as of the compilation dates and for whose CEOs we were able to apply a gender category in both years.

We consider that these dates--Feb. 8, 2020, and Jan. 25, 2021--serve adequately as bookends to the first unsettling year of the COVID-19 crisis. The first date preceded by slightly more than one month the date when the World Health Organization declared the COVID-19 outbreak to be a pandemic. While we cannot consider the second date to represent the end of the pandemic, which continues around the world, it came as mass vaccination efforts had begun.

We identified the gender of the individuals covered in the analysis based on several factors, including honorifics, personal pronouns, and given names. The categorization methodology prioritized gender identification based on honorifics, followed by pronouns. If neither of these markers were available in individuals' biographical data, we used first, or given, names for gender categorization. First name-based gender determinations were largely determined using Genderchecker.com and Genderize.io databases. We looked for possible indicators of gender neutrality and gender identities other than men and women during the classification process.

### Assumptions and limitations

As part of the categorization process, we made certain assumptions about gender identity based on these markers. For example, we categorized a CEO as a man if that person's professional biographical description used the honorific title "Mr." or the personal pronoun "he," absent contradictory indicators. We looked for possible indicators of nonbinary gender identities, such as the use of personal pronouns other than "he" and "she," as well as honorific titles, such as "Mx.," that might indicate a gender identity other than "man" or "woman." Even so, we recognize that our assumptions that certain pronouns, honorifics, and given names correspond to certain gender identities may be flawed. It is our hope that the benefits of our research for furthering diversity outweigh potential errors in this classification process.

For the natural language processing-enabled transcript analysis described in more detail below, we identified nearly 5,000 companies from our larger Jan. 25, 2021, list that met all the following criteria:

- CEOs from the Jan. 25, 2021, dataset were hired before March 2020, and
- Transcripts with CEO commentary were available through S&P Global Market Intelligence

## Appendix II: How We Analyzed Earnings Call Transcripts

*William Watson, Data Scientist, S&P Global Ratings*

### Preprocessing

For preprocessing, we applied the spaCy tokenizer pipeline per transcript, then a Gensim phrase transformer to merge significant bigrams and phrases as a single token. Here, a token was considered a single unit, which could be a word (example: employee) or a bigram (example: independent\_contractor) (Mikolov et al., 2013). In addition, standard English connection words (such as: of, for, on, and) were included for phrases (examples: bank\_of\_america, working\_from\_home). This allowed us to reduce the ambiguity among individual words that compose larger concepts.

### Sentiment and Emotion analysis

We aimed to identify and compare overall sentiment (positive or negative) as well as eight emotions (anger, fear, anticipation, trust, surprise, sadness, joy, and disgust). To achieve this, we used the NRC Word-Emotion Association Lexicon (EmoLex) (Mohammad & Turney, 2010, 2013) that contains over 14,182 unigrams (single word units) and 13,901 binary associations. Note that a word can have multiple associations or no associations at all. The number of words associated with each concept in the lexicon are:

- Sentiment: negative: 3,324, positive: 2,312
- Emotion: fear: 1,476, anger: 1,247, trust: 1,231, sadness: 1,191, disgust: 1,058, anticipation: 839, joy: 689, and surprise: 534

Our objective was to capture both sentiment and emotion from transcripts of earnings calls to show how women and men CEOs led during the COVID-19 crisis. For each transcript, the emotion and sentiment scores were computed based on the EmoLex, akin to a frequency count of words associated with a particular emotion or sentiment. These were then normalized by the number of tokens in the transcript. Our analysis looked at average word use in transcripts published on March 9, 2020 (a few days before the official WHO declaration of the pandemic on March 11, 2020). We also carried out a time-series analysis of the evolution of sentiment and emotion in those transcripts from Jan. 1, 2019, to Dec. 31, 2020, to capture usage before the pandemic, so we could make more informed conclusions about the effect of the COVID-19 crisis on word choice in the transcripts.

In the following table, we list the top 15 words in our analysis for each emotion and by gender. We see that both genders expressed the toll the pandemic was taking in their use of words for the emotions of anger, disgust, fear, sadness, and negative. For example, “pandemic,” “disease,” and “crisis” are some of the most frequent words for both genders in these categories. Small differences appear for the most frequent words, indicating uniform usage between gender for this frequency band. We also display the top 10 words with the most skewed log-ratio scores per gender for each emotion, i.e., the most gendered terms. Note that the words themselves have an association with an emotion, and are not just synonyms for said emotion. For example, the word “cash” has associations with anger and joy, reflecting different contextual meanings for the same word.

Table 4

**The Top 15 Words By Associated Emotion And Gender For Women And Men CEOs**

Emotion	Gender	Top 10 Most Frequent Words	Top 10 Largest Log Ratio Words
Anger	Men	demand, cash, versus, money, hit, limited, execution, loss, challenge, disruption	cad, tariff, pound, casualty, wound, dispute, terrible, badger, losing, wireless
	Women	demand, cash, versus, disease, limited, execution, hit, disruption, challenge, loss	disease, cancer, rail, anxiety, mortality, penetration, vote, death, tighten, treat
Anticipation	Men	time, continue, good, expect, long, start, coming, share, opportunity, production	cement, passenger, quest, advent, monetary, farm, luck, reconciliation, harvest, prosper
	Women	continue, time, good, expect, start, long, opportunity, share, coming, plan	oracle, hypothesis, holiday, uplift, delight, chocolate, rail, anxiety, passion, champion
Disgust	Men	remains, finally, larger, delay, disease, uncertain, bad, gross, interested, winning	cad, deteriorated, collapse, tariff, terrible, dispose, epidemic, backwards, bankruptcy, adverse
	Women	remains, finally, disease, larger, uncertain, delay, cancer, powerful, feeling, interested	disease, cancer, sick, death, treat, humble, powerful, rigor, weight, uncertain
Fear	Men	pandemic, cash, change, risk, difficult, government, case, remains, confidence, execution	cop, collapse, rod, casualty, wound, terrible, wan, epidemic, god, war
	Women	pandemic, change, cash, risk, remains, difficult, government, case, disease, confidence	stroke, tumor, disease, disorder, cancer, anxiety, kill, mortality, compassion, accident
Joy	Men	good, kind, share, cash, pretty, progress, grow, improve, hope, improvement	wages, advent, music, beer, luck, reconciliation, harvest, beach, prosper, recreational
	Women	good, kind, share, progress, pleased, cash, grow, pretty, improve, improvement	holiday, baby, uplift, delight, chocolate, pledge, beauty, equality, joy, favorite
Negative	Men	demand, pandemic, lower, crisis, margin, risk, government, case, small, decline	delinquency, cad, deteriorated, catheter, collapse, tariff, pound, monsoon, casualty, wound
	Women	demand, pandemic, lower, crisis, risk, versus, remains, decline, small, serve	stroke, fabrication, epilepsy, tumor, disease, disorder, cancer, ash, rail, depression
Positive	Men	growth, continue, good, expect, question, kind, increase, level, customer, important	sir, radio, wages, quest, equilibrium, believing, advent, music, monetary, sugar
	Women	continue, growth, good, expect, kind, question, customer, focus, important, increase	famous, oracle, holiday, baby, hospitality, uplift, unlimited, justice, persistence, household
Sadness	Men	pandemic, lower, margin, case, debt, limited, negative, execution, income, loss	deteriorated, collapse, music, monsoon, casualty, wound, terrible, wan, losing, epidemic
	Women	pandemic, lower, margin, case, disease, limited, execution, debt, income, negative	stroke, disease, cancer, depression, anxiety, kill, mortality, mother, accident, sick
Surprise	Men	good, expect, hope, deal, finally, organization, money, larger, unique, guess	luck, wireless, epidemic, invite, spirits, trip, abrupt, entertainment, overdue, money
	Women	good, expect, hope, organization, unique, finally, larger, exciting, excited, advance	hypothesis, shopping, accident, leisure, destination, enthusiasm, excited, festival, advance, gift
Trust	Men	continue, good, expect, kind, team, level, important, share, provide, related	sir, cop, cement, banker, believing, advent, rod, unity, principal, verification
	Women	continue, good, expect, team, kind, important, share, provide, level, related	oracle, coach, fabrication, uplift, justice, lender, school, chocolate, pledge, proof

## **Word embeddings for contextually relevant terms and concepts**

To quantify and operationalize leadership styles and concepts for CEOs, we first needed to extract what could be relevant terms or phrases for each concept. There are many ways to describe the same event. For example, COVID-19 can also be referred to as the coronavirus, the COVID outbreak, the corona pandemic, or C-19. However, these are functionally the same concept and should be included as one “topic.”

To build each topic, we created a Word2vec model using all words in each transcript (Mikolov et al., 2013). Using the Skip-Gram algorithm, this model learns associations among words within a context window of 5 tokens. This results in a high-dimensional set of word vectors, where vectors that are close together in the embedding space have similar contextual meanings and distant vector pairings have different meanings. The trained word embedding provides a meaningful way to suggest the context or perspective around a given word. For our purpose, we query the model for a concept token, for example, “empathy,” and retrieve a list of similar words such as “compassion,” “teamwork,” “humility,” and “kindness.” This allows us to aggregate a more robust topic. By resolving the different ways CEOs refer to the same topic, this method provides a more holistic view of what they are discussing.

## **Normalized log-ratio for gender affinity**

With our set of relevant terms and phrases for each topic, we then measured affinity for each token against our classes: men and women. For this analysis, we used the following algorithm from the field of computational linguistics (Hardie, 2014a, 2014b):

1. Calculate word frequency per transcript
2. Normalize the frequency by the transcript token length
3. Average the normalized frequency per gender
4. Compute the log-ratio between the average for women versus men

This procedure provides several benefits. First, word use is normalized per transcript to accommodate words used exclusively by a single person, as the lack of usage elsewhere in the class will penalize the average. Second, by averaging transcript frequencies, we reduce the bias that would stem from unbalanced vocabulary sizes (there are more men in our dataset, so the variety and amount of words are significantly higher). Third, we smooth the ratio comparison to avoid outliers from non-occurrence by a factor of  $1e-6$ .

Log-ratios show the magnitude and direction for a gender affinity. In our example, since the numerator is men, log-ratios that are positive simply indicate words that men use more, and negative log-ratios indicate words that women use more. This choice was arbitrary. The metric is symmetric if flipped. To reduce the effect of outliers, we aggregate the top 30 contextually relevant words queried from the embedding model in our calculation.

## **Limitations**

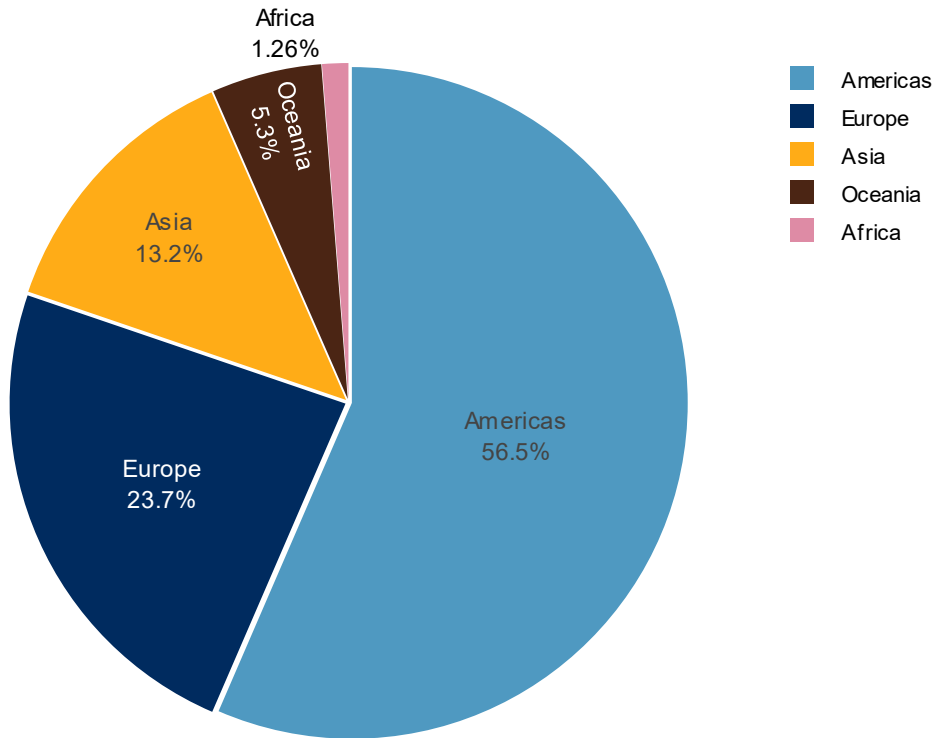
We recognize there are certain limitations regarding transcript data availability for the transcript analysis presented in the previous pages, which significantly reduces the sample of companies from the S&P Global BMI. As a result, our transcript data is not entirely representative of the S&P Global BMI and our sample has a different geographic and sectoral distribution. For example, 50% of the companies extracted in the sample for the transcript analysis are based in the U.S. (see chart 10), while the S&P Global BMI is a more global index. The data used for this analysis also displays a lower share of women CEOs overall and a slightly different sectoral distribution (see

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chart 11). We recognize that there is a sector bias in the distribution of women and men in the dataset: Women CEOs transcripts are almost twice as likely to come from health care companies than in the men's sample. Men CEOs are more likely to work in financial, industrials, and technology companies.

Chart 10

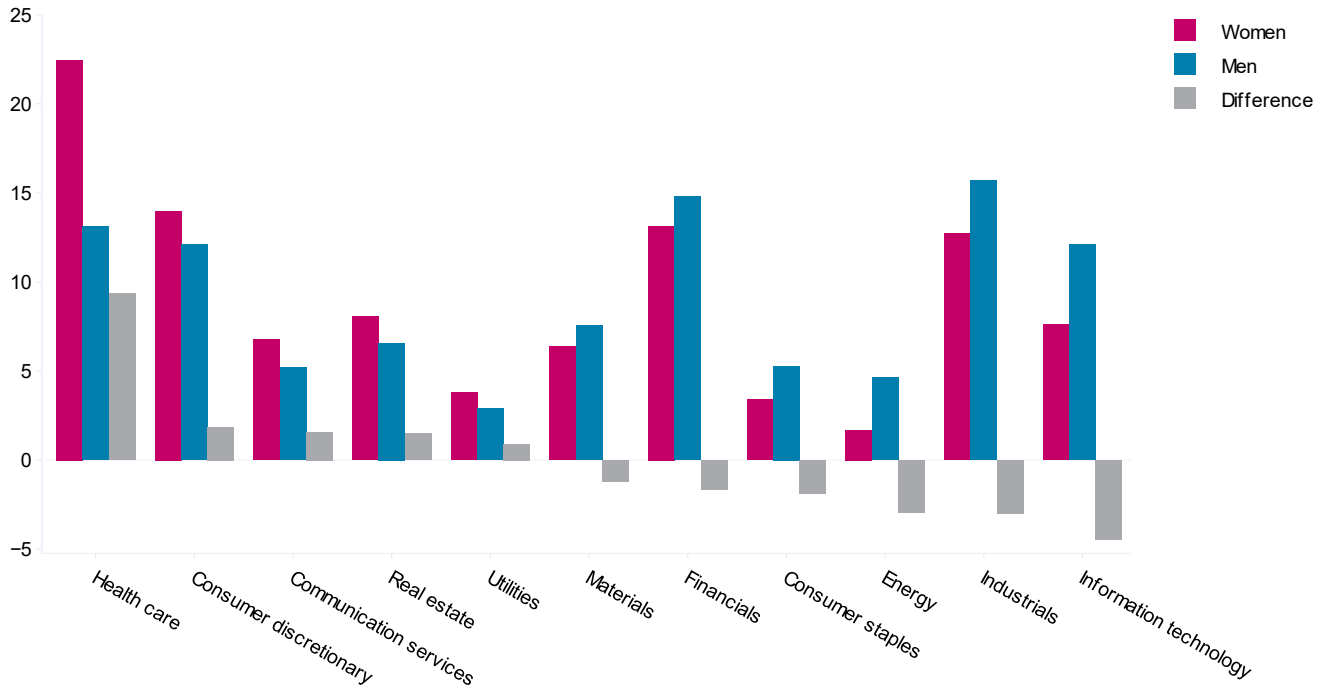
### Regional Distribution



Source: S&P Global BMI Index - transcripts dataset, S&P Global.

Chart 11

**Health Care And Real Estate Companies Are About 4X More Likely To Have A Woman CEO Than Energy Companies**



Sources: S&P Global Broad Market Index, S&P Global Ratings.

The way CEO phrases were classified might also have limitations. We worked on phrases to discover associations, to be agnostic to CEOs themselves. Although the methodology aims to reduce the possibility of unconscious bias influencing how each statement was classified, we recognize there might be some limitations about how the classifications or associations were made.

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