Voice Pitch Predicts Labor Market Success among Male Chief Executive Officers

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Abstract

A deep voice is evolutionarily advantageous for males, but does it confer benefit in competition for leadership positions? We study a large sample of male public-company Chief Executive Officers (CEOs) and find that CEOs with deeper voices manage larger companies, and as a result, make more money. A 1% decrease in voice pitch is associated with a $30 million increase in the size of the firm managed, and in turn, $19 thousand more in annual compensation. The effects of voice pitch on labor market success are more pronounced in settings where the CEOs have more discretion. The results support recent experimental predictions suggesting voice pitch matters in leadership selection.

Keywords: voice pitch, dominance, corporate leadership

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Among males, deep voices are correlated with evolutionary success. Deep-voiced men are judged as more attractive by women (Fienberg, Jones, Little, Burt & Perrett, 2005), mate more frequently (Hodges-Simeon, Gaulin & Puts 2011), and father more children (Apicella, Feinberg & Marlowe, 2007). Such success has been attributed to perceptions of deep voiced males as more physically and socially dominant (Wolff & Puts, 2010; Puts, Hodges, Cárdenas & Gaulin, 2007; Puts, Gaulin & Verdolini 2006).

But is a deep voice associated with success in economic settings where mate selection is not the objective? Recent laboratory evidence suggests that deep-voiced individuals are perceived to have greater leadership capacity, and may be more successful in obtaining leadership positions (Klofstad, Anderson, & Peters 2012; Tigue, Borak, O'Connor, Schandl & Feinberg, 2011). Perceptions of enhanced leadership capacity generally stem from listeners viewing deep voiced males as more competent, persuasive, confident and trustworthy (Klofstad et al., 2012; Tigue et al., 2011; Apple, Streeter & Krauss 1979; Burgoon, Buller & Woodall, 1996). Whether this laboratory evidence is descriptive of the role of voice pitch in actual competition for leadership positions is unknown. To investigate this issue, we analyze a large sample of public company Chief Executive Officers (CEOs) to assess whether, and to what extent, a deep voice is associated with labor market success.

We measure labor market success using the size of the firm over which our sample CEOs preside, and predict that deeper voiced males will manage larger firms. If a male with a deep voice is perceived to have greater leadership capacity, we should observe deeper voiced CEOs being matched with firms that have more physical, financial and human resources to manage. In addition to the prestige and reputational enhancements that stem from operating a large firm,

larger firms pay more in compensation (Gabaix & Landier, 2008). As such, we also investigate whether deeper voiced CEOs are paid more.

The Moderating Role of Managerial Discretion

The upper echelons perspective posits an influential role for a firm's CEO in shaping organizational outcomes although their decisions are influenced and shaped by other members of the top management team. However, the extent to which CEOs influence decisions and exhibit leadership capacity is dictated by the latitude in decision making available to them (Hambrick & Finkelstein, 1987). The management literature suggests that managerial discretion in decision making varies across firms due to organizational and environmental constraints that limit the scope of managerial decisions. For example, industries in which the firm operates differ in terms of product differentiability, capital intensity, the degree of competition and other constraints, each of which can constrain management discretion. Therefore, CEOs in "weak situations" facing higher levels of discretion are more likely to influence decisions. Consistent with this intuition, Adams, Almedia & Ferreira (2005) examine the role CEO power plays on firm performance and finds the effect is stronger for firms in high-discretion industries.

One potential reason larger firms may covet CEOs with leadership characteristics, such as a deep voice, is that in larger firms, more individuals within the company provide inputs into the decision making process. During debates over project selection, for example, subordinates may acquiesce to a deep voiced CEO because of the leadership capacity his vocal pitch connotes: they trust his judgment, are more persuaded by his arguments and his confidence, and believe he is competent. However, a CEO's leadership capacity can have an impact only if there is a decision to be made, i.e., a "weak situation" with high discretion exists, in the first place. Therefore, we predict that the effect of voice pitch on labor market outcomes is stronger among

firms that operate in high-discretion industries and weaker among firms that operate in low-discretion industries.

Method

Sample

To identify a set of executives for analysis, we start with a list of male CEOs from the Standard & Poor's 1500 stock index analyzed by Engelberg, Gao & Parsons (in press). We restrict attention to only male CEOs because of the sexually dimorphic nature of voice pitch (Titze, 1994) and the poor representation of female CEOs among S&P 1500 firms (Bertrand & Hallock, 2001). We intersect the Engelberg et al. (in press) observations with the Mayew & Venkatachalam (2012) CEO speech corpus, which is derived from publicly broadcast telephonic earnings conference calls archived in the Thomson Reuters *StreetEvents* database (www.streetevents.com). For CEO observations in Engleberg et al. (in press) missing a speech sample, we search the Thomson Reuters *StreetEvents* database and other internet based sources, such as YouTube and company websites, to locate sources of CEO speech. When multiple sources exist we select the one closest in calendar time to the fiscal year end of the observation. These collection efforts result in identification of CEO speech for 792 unique CEOs, with 216, 551 and 25 of the cross sectional observations having fiscal year ends in 2006, 2007 and 2008, respectively.

Measures

Voice pitch. Vocal depth is captured by measuring each CEO's vocal fundamental frequency (F_0), which listeners perceive as voice pitch. We follow the extant literature (Puts et al., 2006; Puts, Apicella, & Cárdenas, 2012; Evans, Neave & Wakelin, 2006) and measure voice pitch using the PRAAT acoustics software program, version 5.2.05

(http://www.fon.hum.uva.nl/praat/). The median CEO in our sample exhibits F_0 of 125.5 Hz, comparable with standard values for adult males of comparable age in the general population. In the supplementary online material, we provide examples of a low and high pitched CEO from our sample as well as the precise steps taken to execute the measurement of voice pitch.

Labor market outcomes and control variables. We measure firm size using the total assets managed by the CEO. Total assets are measured in millions of dollars, at fiscal year end obtained from the Standard & Poor's *Compustat* database (www.compustat.com). We obtain total annual CEO compensation, in thousands of dollars, from the Standard & Poor's *Compustat ExecuComp* database. We obtain CEO age in years directly from *Execucomp* to control for experience, and identify whether the CEO has an advanced degree from the *Boardex* database (www.boardex.com) to control for education effects. The median sample CEO is 56 years old, operates a firm with $2.427 billion in assets, and is paid $3.692 million annually.

Managerial discretion. We utilize the Hambrick & Abrahamson (1995) four factor determinant model of industry rankings to characterize the degree of managerial discretion our sample CEOs face. The four factors are research and development intensity, advertising intensity, capital intensity and annual sales growth. For each four digit SIC code in our sample in each fiscal year, we calculate the 5-year average factor value for each firm in the industry available on the Standard & Poor's *Compustat* database, and select the median value as the industry value. We then input this value into the Hambrick & Abrahamson (1995) discretion model to obtain the industry discretion level. To minimize the effects of measurement error in our discretion scores (Adams et al., 2005), we classify firms in the top 20% of our sample scores as high discretion and the bottom 20% of our sample as low discretion. In the top quintile, the highest proportion of observations comes from innovative industries like the computer software, pharmaceuticals, and

semiconductors. In the bottom quintile the highest proportion of observations come from the petroleum/natural gas production and electric services industries.

Results

Table 1 presents descriptive statistics for our variables of interest. We log transform each continuous variable to correct for skewness. To assess whether an association exists between labor market success and voice pitch, we first regressed firm size on voice pitch in Column A of Table 2. We find a negative and significant association of -1.367 (p=0.002), implying a 1% decrease in voice pitch (1.25 Hz for the median CEO) is associated with a 1.367% increase in the size of the CEO's firm (about $33 million for the median firm). Controlling for the CEO's age and education in Column B decreases this estimated dollar magnitude only slightly, to $30.5 million, and we observe that more experienced and educated CEOs are employed by larger firms.

CEOs covet larger firms in part because they pay larger salaries (Gabaix & Landier, 2008), implying deeper voiced CEOs should be paid more in annual compensation. The vocal pitch-compensation relation estimated in Column C of Table 1 is -0.523 (p=0.028), which suggests a 1.25 Hz decrease in voice pitch yields a $19 thousand increase in annual compensation. Column D reveals firm size mediates this association (p=0.002), driving the direct effect down to a statistically insignificant -0.023 (p=0.897). This implies that the pay premium for a deep voice occurs precisely because deeper voiced CEOs are employed by larger firms, and there is no additional premium in compensation for a deep voice.

These findings from our exclusively male CEO sample also may speak to the well-documented underrepresentation of women in large firms and the gender gap in compensation. Bertrand & Hallock (2001) document that female executives in the S&P 1500 are paid less than males and a substantial fraction of this gender disparity stems from the fact that females tend to

be employed by smaller firms. Klofstad et al. (2012) suggests this may stem from markets viewing voice pitch as a universal indicator of leadership capacity, in which case females will be disproportionally under-represented because female voice pitch is biologically higher than males by almost two fold. To assess this conjecture, we note that adult females in the population exhibit an average voice pitch of roughly 210 Hz. If voice pitch was the sole determinant of firm size for a female CEO, our estimate from Column A of Table 1 would imply that the size of the firm run by a female CEO with a voice pitch of 210 Hz would be about $1.5 billion. For the female CEOs listed in the S&P 1500 stock index during our sample period, the median firm size is strikingly similar at roughly $1.7 billion in assets. While certainly not a complete and causal explanation for the low proportion of females in large firms, our results are consistent with the idea that perceptions of leadership capacity may be tied to dimorphism in voice pitch across genders.

To assess whether managerial discretion moderates the association between labor market success and voice pitch, we re-estimate the model in column B in two subsamples: the lowest quintile and highest quintile of industry managerial discretion. The results reveal that the association between voice pitch and firm size is negative and significant in the high discretion subsample (b=-2.119, $p<0.01$) and insignificant in the low discretion subsample (b=0.251, p=0.769). The difference in coefficients is statistically significant (p=0.039) implying that voice pitch is associated with labor market success primarily in firms where managers have more discretion in decision making.

Discussion

Our results both quantify the economic effects of voice pitch in a CEO labor market setting and offer external validity for recent experimental evidence suggesting voice pitch

matters in leadership selection. We cannot completely rule out the possibility that voice pitch is correlated with some other observable physical CEO trait we cannot measure. For example, we cannot measure the height of CEOs in our sample, and it has been shown that taller individuals both hold jobs of higher status and earn more (Lindqvist, in press). We deem it unlikely, however, that body size attributes are responsible for our findings given no robust association exists between voice pitch and body size in humans (Fitch 1997; Künzel, 1989). However, it is a common misconception that voice pitch indicates body size (Rendall, Vokey & Nemeth, 2007), and future research might examine the conditions under which voice pitch and body size measures like height interact to exacerbate or diffuse perceptions of leadership capacity.

It is plausible that facial attributes may be a confounding effect given both voice pitch and facial traits are linked with testosterone (Evans, Neave, Wakelin, & Hailton, 2008; Dabbs & Mallinger, 1999). The facial width-to-height ratio (WHR) has recently been forwarded as an important CEO characteristic that identifies favorable leadership traits stemming from power and dominance (Wong, Ormiston and Haselhuhn, 2011), and perhaps the ability to facilitate cooperation (Stirrat & Perrett 2012). We were able to obtain forward facing pictures and in turn measure WHR for 581 of our sample CEOs. WHR is not correlated with voice pitch at conventional levels (ρ= 0.057; p=0.166) in our sample, and Table S1 in the Supplemental Material available online reveals that re-estimation of Table 1 after controlling for WHR does not impact the association between voice pitch and labor market outcomes.

An additional important caveat is that we cannot measure the particular aspects of the CEO's job that benefit from having a deep voice. Do subordinates or other members of management actually acquiesce more quickly yielding more efficient decision making? Is a deep voice always advantageous and if not, in what settings is it detrimental? Future research will

hopefully identify more precisely a mapping between CEO traits and direct aspects of productivity.

We view our results as advancing the literature on leadership by identifying an important and objectively measured physical characteristic of male CEOs. Our evidence is consistent with a trait known to indicate success in biological competition also being associated with success in securing leadership positions at top corporations. Voice pitch is certainly not the only trait that matters as it goes without saying that there are likely a myriad of characteristics that influence how the CEO is perceived. Leaders are exceedingly complex and not easily summarized, be it by scale, tape measure, or microphone.

Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data.

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Table 1

Descriptive Statistics and Correlations (n = 792)

Variable	Minimum	Maximum	Mean	Median	SD
Voice Pitch (ln F_0)	4.488	5.283	4.836	4.833	0.136
Firm Size (ln Assets)	3.014	14.117	7.992	7.795	1.655
Total Compensation (ln Total Compensation)	5.089	11.122	8.241	8.214	0.914
CEO Age (ln Age)	3.611	4.407	4.028	4.025	0.116
Education	0.000	1.000	0.519	1.000	0.500

Table 2

Results of Regression Analysis Predicting Labor Market Success and the Moderating Effect of Managerial Discretion

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	(A)		(B)		(C)		(D)		(E) Firm Size: High Discretion Industries		(F) Firm Size: Low Discretion Industries	p-value of coefficient difference (E) vs (F)
Dependent Variable:	Firm Size		Firm Size		Total Compensation		Total Compensation					
Intercept	14.603	***	9.875	***	10.772	***	5.432	***	14.956	***	4.434	0.193
	(2.180)		(2.972)		(1.152)		(0.885)		(5.153)		(6.202)	
Voice Pitch (ln F_0)	-1.367	***	-1.249	***	-0.523	**	-0.023	†	-2.119	***	0.251	0.039
	(0.450)		(0.452)		(0.238)		(0.177)		(0.765)		(0.853)	
CEO Age (ln Age)			1.007	**					0.614		0.738	0.932
			(0.468)						(0.905)		(1.120)	
Education			0.198	*					0.333		-0.007	0.308
			(0.117)						(0.236)		(0.236)	
Firm Size (ln Assets)							0.366	***				
							(0.015)					
N	792		792		792		792		157		159	
Adjusted R^2	0.0113		0.0179		0.005		0.4378		0.0312		-0.0161	
Overall F	10.06	***	5.81	***	4.81	**	309.05	***	2.68	**	0.17	

Note: This table displays unstandardized regression coefficients. Heteroskedasticity robust standard error are shown in parenthesis. *p<.10, **p<.05, ***p<.01, two-tailed. † A test of mediation using the product of coefficients method for large samples following Preacher & Hayes (2008) confirms firm size mediates the effects of voice pitch (Z=3.15, p=0.002).