The Voice of Risk: Wall Street CEOs' Vocal Masculinity and the 2008 Financial Crisis

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Abstract

Did the masculinity-driven corporate culture of Wall Street change after the 2008 global financial crisis? According to the neuroendocrinology literature, the voice pitch of a male is an 'honest signal' of his testosterone level that affects risk taking for social dominance. We use digitally analyzed voice pitch of 167 Wall Street male CEO interviews on CNBC during the 2008 financial crisis and find a negative association between the voice pitch of the CEO and the risk of the firm. Additionally, deep-voiced male CEOs were more likely to be fired after the crisis.

Keywords: culture, masculinity, voice pitch, financial crisis, CEO turnover, TARP, overconfidence, self-attribution bias, testosterone, media
JEL classification: G01, G02, G20, G39

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I. Introduction

The high-testosterone culture of Wall Street has been criticized as one of the worst culprits behind the 2008 global financial crisis (Sherman (2012); Dudley (2014); Lo (2015); Graham, Grennan, Harvey, Rajgopal (2016); Karolyi (2016); Newton-Small (2016); Adams & Ragunathan (2017); Pan (2017)). Some researchers argue that financial institutions' risk taking might have been less excessive if more of their CEOs and high level executives had been female[5]. Other researchers find that the cross-sectional variation of masculinity among males in the corporate leadership is wide enough to explain their variation of corporate risk-taking (Jia, van Lent, and Zeng (2014); Sherman. Lerner, Josephs, Renshon, and Gross (2016); Kamiya, Kim, and Park (2018); Lu & Teo (2018)). In either case, researchers commonly argue that a less masculine and more feminine culture should have been promoted in Wall Street to prevent the crisis[6]. Did the firms with more masculine culture really have higher risk before the crisis? If so, did the firms try to reduce their masculinity driven culture afterwards?

Culture is "a set of norms and values that are widely shared and strongly held throughout the organization (O'Reilly and Chatman (1996))" that could "complement economic incentives (Guiso et al. (2015))." According to Graham et al. (2016), the CEO is deemed to be "the most influential person for setting the firm's culture." They find that a meaningful change in corporate culture occurs primarily through the board's appointment and dismissals of the CEOs with certain

[5] The financial industry is the one in which we find the most drastic gender pay gap (Fortune, 2015). According to the Center for American Progress, women's earnings are only (1) 61.33% of men's earnings among personal financial advisors; (2) 65.12% among securities, commodities, and financial services sales agents; and (3) 67.44% among financial managers.

[6] See Hewlett (2009) in Harvard Business Review: http://www.alternet.org/story/103502/could_we_blame_the_financial_crisis_on_too_much_testosterone_harvard_researchers_say_yes

trait that is consistent with the direction of its culture. Hence, we propose to focus on the masculinity of the CEO as a proxy for the masculine culture of the firm[7].

Neuroendocrinology researchers find that testosterone, a steroid hormone that causes sexual dimorphism in adult males, has a positive effect on risk-taking, competitive behavior, aggression, and achievement drive (Apicella et al. (2008); Coates and Herbert (2008); Coates, Gurnell, Rustichini (2009); Coates, Gurnell, Sarnyai, (2010); Sapienza, Zingales, and Maestripieri (2009); Sherman, Lerner, Josephs, Renshon, and Gross (2016); He, Yin, Zeng, Zhang, and Zhao (2019)). Moreover, they find that high testosterone is associated with lower voice pitch among men[8], because the male hormone influences the vocal folds to grow longer and thicker during puberty (Vuorenkoski, Tjernlund, Vuorenkoski, Perheentupa (1978); Harries, Hawkins, Hacking, and Hughes (1998); Dabbs and Mallinger (1999); and Evans, Neave, Wakelin, and Hamilton (2008)). In fact, Mayew, Parsons, and Venkatachalam (2013) find that deep-voiced CEOs manage larger firms and receive more pay because high testosterone - proxied by CEOs' voice pitch - drives them to pursue social dominance[9].

One empirical implication of this line of research is that deep voice of male CEO could be a valid proxy for masculinity driven corporate culture of the firm. Also, it is conceivable that the board of directors of Wall Street firms may have appointed more masculine persons as CEOs

[7] One could interpret our results in this paper from the perspective of "CEO Style" literature (Bertrand and Schoar (2003)) with a caveat of being an association study due to data limitation. We also attempted to track down the CEOs that transitioned to different companies up until 2018 to see if deep voiced CEOs either move to high risk companies or increase the risk of the scouting companies. However, out of the 38 CEOs that moved different companies, only 5 of them oved to publicly traded US firms. Hence, it was almost impossible to make meaningful statistical inference.

[8] Voice pitch is defined as "the relative highness or lowness of a tone as perceived by the ear, which depends on the number of vibrations per second produced by the vocal cords. Pitch is the main acoustic correlate of tone and intonation" (Encyclopedia Britannica, 2016).

[9] For literature about the information content of voice of the managers, please refer to Hobson *et al.* (2012), Mayew and Venkatachalam (2012), and Mayew and Venkatachalam (2013).

before the crisis to encourage more risk-taking culture among bankers. We use voice pitch of male CEO as a proxy for the degree of masculinity driven corporate culture among the Wall Street firms managed by male CEOs. Therefore, our first hypothesis is as follows:

H1: Deep voiced CEOs in Wall Street managed riskier firms before the 2008 financial crisis.

Another part of corporate policy where masculinity driven corporate culture could manifest itself is CEO compensation. It would reflect the risk preference of the CEO and the risk culture of the board of directors, because it is a mechanism to align the interest of the CEO with that of the shareholders (Holmstrom & Milgrom (1987); Sheifer & Vishny (1997)). Graham, Harvey, and Puri (2013) find that CEO pay reflects the risk aversion of the CEO. At the same time, board of directors with more masculine corporate culture would allow more high-powered compensation structure to its CEOs. Hence, we hypothesize as follows:

H2: Deep voiced CEOs in Wall Street had higher powered compensation before the financial crisis.

Given that the Dodd-Frank Act and a series of regulatory changes were passed to reflect the public opinion to influence the risk culture of the Wall Street firms that had taken excessive risk before, it is very important to examine whether such regulatory intervention indeed systematically reduced the masculinity-driven culture of Wall Street. A subtle change from a more to a less masculine culture could have been primed by the board through firing deep-voiced male CEOs, which is our third hypothesis[10]:

[10] D'Acunto (2018) finds that priming gender identity drives males to behave in a more masculine manner, confirming Mead's (1934) identity theory. One could argue that replacing more masculine CEO with less masculine or female CEOs may have reduced priming of gender identity among male bankers in Wall Street.

H3: Deep voiced CEOs in Wall Street were more likely to be fired after the 2008 financial crisis.

Interesting anecdotal evidence is the case of Barclays Bank. The bank's ex-CEO, Bob Diamond came from an investment banking background, and his average voice pitch was 111.2 Hz (below our sample mean). After the financial crisis, he was forced out in May 2012 and was replaced by Anthony Jenkins, who came from a consumer banking background and whose voice pitch was 130.3 Hz (above our sample mean; please see Figure 1).

[Insert Figure 1 around here]

To address our research questions, we use digitally analyzed voice pitch of 167 CNBC interviews of Wall Street male CEOs during the 2008 financial crisis and find a negative association between the CEO's voice pitch and firm risk. Confirming our second hypothesis, we find that voice pitch is negatively correlated with the percentage of equity compensation. We also find that deep-voiced male CEOs were more likely to be fired after the financial crisis up until 2012. Our results are robust after controlling for selection bias, various psychological biases of the CEOs, and other CEO and firm characteristics. Also, our results are robust after orthogonalizing the voice pitch against an exhaustive list of possible mechanical impact upon intra-day hormonal levels.

The high-powered compensation of bankers – largely driven by masculine corporate culture – triggered public outrage after the financial crisis. The anger came from the issues of moral hazard, which culminated when the US government decided to bail out the banks with taxpayers' money in the name of TARP (Troubled Assets Relief Plan) in October 2008. In response to the negative sentiment of the general public against the bankers, the regulators installed various clauses in the bailout plan to discipline bank CEOs. The CEOs of TARP-receiving banks had extra

difficulty in exercising their option compensation until they fully repaid the taxpayers' money: that is, their exercising of options would not be tax deductible (Bayazitova & Shivdasani (2011); Fahlenbrach & Stulz (2011); Gorton & Metrick (2012); Duchin & Sosyura (2014); Berger & Roman (2015)). [11] Given that more masculine CEOs had higher proportions of option compensation, they had more incentive to repay the TARP money faster and disentangle themselves from the regulatory strings as long as they were in CEO positions. Our analyses show that deep-voiced CEOs took shorter amounts of time to repay the bailout money to the government without much improvement in firm performance, confirming our prediction.

Lastly, we run microstructure stock volatility event study surrounding the minute of CNBC interviews during the 2008 financial crisis. Given our finding in the first subsection that the vocal masculinity of the CEO is already priced in the stock market, it is predictable that the stock volatility would not be affected permanently by the vocal masculinity of the CEO detected in the television interview if the market is efficient. However, borrowing from the "media and finance" literature (Engelberg, Sasseville, and Williams (2012) and Kim and Meschke (2014)), only unsophisticated investors would be affected by deep-voiced CEO at the minute of a media interview. Hence, we predict a transitory increase in stock return volatility. Our volatility ratio tests confirm our prediction.

Given that Barber and Odean (2001) find that males are more overconfident than females, and given Ho et al. (2016)'s finding that overconfident bank CEOs were fired more after the 2008 financial crisis, one may question the incremental contribution of our paper. However, Jia, van Lent, and Zeng (2014) and Kamiya, Kim, and Park (2018) commonly find that overconfidence

[11] See: https://www.treasury.gov/initiatives/financial-stability/TARP-Programs/executive-comp/Pages/Executive_Compensation_Rules_and_Guidance.aspx)

measures are *not* correlated with masculinity measures, which suggests that masculinity measures uniquely capture the utility that comes from achieving social dominance ("winning the race no matter what") whereas overconfidence captures the tightness of the confidence interval in expecting future outcomes in any given context.

The rest of the paper proceeds as follows: Section 2 is for data and methodology, Section 3 is for empirical results and analyses, and Section 4 is for conclusion and contribution.

II. Data, Methodology, and Empirical Challenge

II.1 CNBC Interview Data during the 2008 Financial Crisis

We hand-collect our sample data by digitally voice-recording and manually transcribing 167 CEO interviews on CNBC that were aired between 1/24/2008 and 4/30/2009 (16 months), as shown in Figure 2. The period covers most of the events in the subprime mortgage crisis: the rescue of Bear Stearns, the bankruptcy of Lehman Brothers, the bailout of AIG, and the lifting of short sale ban.

[Insert Figure 2 about here]

We start by searching for CEO interview video links from the CNBC website in their archive section, "CEO interview video files." After matching the name of the company with the company identification (PERMNO) in the Center for Research in Security Prices (CRSP), we obtain 3,658 interviews. Then, we narrow the sample down to interviews with financial institution CEOs by using the Fama-French 49 industry group numbers of 45, 46, 47 and 48 that are associated with the PERMNOs. These include commercial banks, investment banks, brokerage houses,

insurance companies, and real estate investment companies.[12] While the sample is not comprised of homogeneously commercial banks, it encompasses firms in the industries directly hit by the subprime mortgage crisis, which has not thus far been explicitly attempted in the literature.

We end up with 198 Wall Street CEO interviews, and we drop eight interviews with female CEOs. Of the remaining 190 interviews, 23 are dropped because their firms do not have valid accounting data from Compustat or stock market data from CRSP for our regressions. Consequently, we use 167 interviews in our regressions. The industry breakdown is shown in Panel A of Table 1.

[Insert Table 1 about here]

Panel B of Table 1 shows the key events over our sample period, and assures that it covers the major events such as the rescue of Bear Stearns, the collapse of Lehman Brothers, the bailout of AIG, and the lifting of short sale ban. The monthly breakdown of the CEO interview sample is shown in Panel C of Table 1. As is often the case with media interviews with CEOs, some CEOs are interviewed more often than the others (Kang & Kim (2017))[13]. Due to the concern of including repeated interviews in the sample from the same firms, we use firm-level clustered standard errors in all of our regressions.

[12] Note that the 2008 financial crisis was deeply related to all of these industries in that the subprime mortgages were from real estate companies and commercial banks (Demyanyk and Van Hemert (2009); Huizinga and Laeven (2012); Mian and Sufi (2011)); CDO investment was related to insurance companies such as AIG; and derivatives packaging and sales involved investment banks such as Lehman Brothers and Bear Stearns.

[13] During our sample period, the most frequently interviewed CEOs were Robert Greifeld of NASDAQ OMX Group (12 times), Craig Donohue of CME Group (10 times), Ronald Hermance of Hudson City Bancorp (8 times), and Jamie Dimon of JP Morgan Chase (8 times). We believe that NASDAQ and CME were important for CNBC to cover the panic in the stock and commodities markets. We also note that Jamie Dimon and many others were from commercial and investment banks.

II.2 Collecting Voice Pitch Data

The voice pitch data are collected using Praat software. Voice pitch is captured in terms of fundamental frequency (F0). It is understood that voice pitch is not purely a function of frequency as it involves other voice elements such as loudness, harmonics, and how the auditory system processes the information (Plack & Oxenham (2005)). Nevertheless, measuring F0 provides a sufficiently close quantifiable indication of voice pitch (Mayew, Parsons, Venkatachalam (2013)).

To obtain the necessary audio files, our workflow (see Appendix B) involves capturing the interview video file by screen recording, compressing the video file, and splitting the audio stream from the video file. The audio stream is compressed using the Lame MP3 encoder at a 48 kHz sampling rate with a 128 kbps constant bit rate in stereo. The codec and encoder are obtained from K-Lite Codec Pack Mega. After the compression, the audio stream is saved independently as an '.mp3' file.

Each mp3 file is then digitally analyzed using Praat acoustics software version 5.3.41 (Boersma & Weenink (2013)). We generate the minimum, mean and maximum frequencies, where the mean frequency is taken as the mean fundamental frequency (F0). The audio analysis is scoped to the first 20 seconds of uninterrupted CEO speech, the duration of which is sufficient for speech analysis (Mayew, Parsons, Venkatachalam (2013)). The frequency floor (ceiling) values are set to be 75 (300) Hz as these boundaries are found to be suitable for analyzing the speech of adult males (Evans, Neave, Wakelin, and Hamilton (2008)).

II.3 CEO turnover, firm financial data, and TARP data

The accounting data in this paper are from Compustat, and the stock return data are from CRSP. The CEO turnover data are collected manually by searching news articles in Factiva. We

follow Parrino (1997) in classifying forced versus voluntary turnover. Since our analysis is only of cross-sectional regressions among the firms that had interviews during the period from 2008 to 2009, we identify forced turnovers depending on whether the CEO was forced out until the end of 2012, as shown in Figure 3[14].

[Figure 3 about here]

All TARP data are retrieved from the ProPublica database.[15] Due to the different size of assets of each bank, the ratio of the TARP money borrowed (measured in US dollars) to the total assets is used. The duration of TARP is measured by the number of days from the date TARP was first borrowed until the date it was fully repaid.

II.4 Strategies to Overcome Empirical Challenges

We recognize that CNBC interviews are not randomly assigned and that the sample is restricted to only male CEOs since research findings on vocal masculinity in neuroendocrinology is held for male population so far[16]. Thus, we run a Heckman (1977) selection model as in Kang and Kim (2017), in which we use the number of companies in the same state that had CNBC interviews in the same fiscal year as an instrumental variable.

We also acknowledge that some omitted variables, such as the CEO's psychological biases, rather than masculinity per se, might be driving the results. Therefore, we control for CEO

[14] Typically, in CEO turnover literature, the unit of observation is the firm-year. Thus, their dependent variable is a dummy variable that is one if the CEO was fired in the next fiscal year. However, in our setting, the unit of observation is the unique CEO who had multiple interviews over the crisis period of 2008 and 2009. In addition, the rescue plan of the government began to be effective in 2010, and the long term policy effort sustained well into 2011 and even 2012 due to the subsequent crisis in the EU. Thus, we believe it is more relevant to capture the CEO turnovers until 2012.

[15] The accuracy of the TARP data was checked against The New York Times (Ericson, He, and Schoenfeld (2009)) and the Investigative Reporting Workshop (2013).

[16] Moreover, only about 5% of the CEOs in the US public companies are female, and 4% of our original interview files are those of female CEOs. Their voice pitch is systematically higher than male voice pitch. More research about female executives should be done as the proportion of female CEOs rise fast.

overconfidence for the subset of the sample for which option holding data are available in Execucomp. However, a substantial number of our sample firms are not covered by Execucomp. Therefore, to be comprehensive, we control for the self-attribution bias (SAB, hereafter) of the CEO (Daniel, Hirshleifer, and Subrhamanyam (2001); Doukas & Petmezas (2007); Kim (2013)) [17], which is a dynamic version of overconfidence. We follow Kim's (2013) computational linguistic approach based on our interview transcripts to capture SAB. The results are robust whether we use option-based-overconfidence measure or SAB measure.

We manually transcribe the initial ten minutes of all interviews in a tabular format by specifying the name of the speaker and the time stamp of the beginning of the dialog spoken by each speaker (see Appendix C). The median length of the interviews is five minutes. More than 90% of the interviews in our sample finishes before ten minutes. Our transcribing brings us various advantages in our analyses.

First, we construct the SAB measure as in Kim (2013). For a detailed description of how to construct the measure, please see Appendix D. Because SAB has two sides of attributing good performance to himself and attributing bad performance to outside factors, we construct two dummy variables that comprise SAB. Firstly, we construct a dummy variable identifying self-enhancing bias, 1{SAB: Good performance b/c me}, that is equal to one if the CEO attributes good performance to himself or to his company employees, and zero otherwise. Secondly, we construct a dummy variable identifying self-protecting bias, 1{SAB: Bad performance b/c industry}, that takes the value of one if the CEO attributes bad performance to a third party, the industry, or the

[17] Daniel et al. (2001) argue that by attributing successes to oneself and failures to external factors, one becomes overconfident over time.

economy and zero otherwise. Our results are robust whether we control for a single SAB dummy variable or the two component dummy variables of self-enhancing bias and self-protecting bias.

The second benefit of transcribing is that we are able to control for narcissism of the CEO by computing the relative frequency of first-person singular pronoun to that of all first person pronouns in CEO's dialog as in Chatterjee and Hambrick (2007). For a procedure of constructing narcissism measure, please see Appendix E. Third advantage of having transcripts of interviews is that we can construct the language tone of the CEO and the tone of the show host, following Tetlock (2007).

Although the voice pitch of a male CEO is largely determined by his pubertal testosterone level, his intraday circulating hormone level could fluctuate depending on various factors, which may create some disturbances in our empirical study via affecting his voice pitch. Hence, we first orthogonalize the voice pitch of the CEO against an exhaustive list of variables that may mechanically affect the circulating hormone level on the day of the interview. Then, we use the residual voice pitch in our empirical analysis. We obtain robust results.

Evans et al. (2007) find that the testosterone level is higher and the voice pitch is lower in the morning than in the evening in the same person. Additionally, researchers have found that testosterone level peaks out at the age of 30 and decreases thereafter (Feldman et al. (2002); Harman et al. (2001); Gonzalez-Sales et al. (2016)).

Further, Christiansen et al. (1985) find that the testosterone level is inversely correlated with the stress level. Thus, CEOs under more (less) pressure may speak with a higher (lower) voice pitch due to lower (higher) testosterone. Such pressure could be captured in four different ways.

First, *ceteris paribus*, a live interview would be more stressful than a recorded interview because there is no chance for the CEO to recover from potential mistakes in a live broadcast.

Thus, we predict that CEOs would speak in a higher pitch in live interviews due to lower testosterone levels caused by higher stress (Christiansen et al. (1985)). Our second candidate proxy for stress measure is the annual stock performance of the firm because it directly hits CEO's compensation and because it reflects the information about the fundamentals of the firm. Third, we use daily stock market index return as a proxy for the Wall Street CEO's stress levels. During the 2008 global financial crisis, Wall Street firms were at the epicenter of the market collapse because it was a historically unprecedented crisis of their own creation. Therefore, if the market index tanks on the day of the interview, the stress level would be higher, which would reduce testosterone and increase the voice pitch.

On the other hand, Apple, Streeter, and Koauss (1979) find that high-pitched voices are perceived as less trustworthy and more nervous. Taking this into consideration, Wall Street CEOs commonly had every reason to sound trustworthy and confident (less nervous) in their television interviews to calm down the market during the 2008 financial crisis. Hence, we could equally expect that the Wall Street CEOs may have tried to talk in a deeper voice in their interviews when the market performed worse. While the prediction works both directions, we let the data tell the story.

Our last set of measures for CEO stress levels is the language tone of the speakers: either that of the CEO or the journalist (show host). As in Tetlock (2007), a quantified language tone would capture the qualitative information about the company, especially if it is spoken by the CEO. More specifically, if the CEO has to release more negative information in the interview, he would feel more stressed, which would in turn lower his testosterone level. Consequently, he would speak in a higher pitch. Additionally, if the show host speaks in a more negative tone, the interviewee would feel more pressure about the situation and speak in a higher pitch. However, the journalist

may have an incentive to cover the company more positively due to concerns about the advertisement income of their own media company as in Gurun & Butler (2012). Hence, the tone of journalists may be less correlated with the voice pitch of the CEO. Thus, we do not make any prediction.

We also include a dummy variable that is one if the group of show hosts includes at least one female to see if a different gender composition of the interviewers affects the voice pitch of male interviewees.

Lastly, to steer clear of the concern that the results may be driven by the CEOs that have more capability of speaking with wider range of voice pitch, we also regress the CEO's voice pitch on the *variation* of voice pitch throughout the interview. Because we hand-transcribe the initial ten minutes of all interviews by tagging the detailed time stamp of each speaker's dialog, we can estimate the pitch variation. We initially measure the CEOs' voice pitch at the time point of every integer second using Praat. We then estimate the standard deviation of the voice pitch during the CEO's speech over the initial 10 minutes of the interview.

Since masculinity could be also be proxied by a facial masculinity measure, such as the facial width-to-height ratio (fWHR) as in Kamiya, Kim, and Park (2018), and He et al. (2019), we hand collect the face pictures of the CEOs being interviewed and control for fWHR. We obtain robust results. Some readers may wonder if this paper is about a horse-race between the measure of facial masculinity and that of vocal masculinity, but our sample is too small to do that. All that we document here is that the measures of masculinity work in consistent and coherent manner as proxies for masculinity driven corporate culture whether it is facial dimension or vocal dimension.

III. Results

III.1 Summary Statistics

Summary statistics are shown in Table 2. The mean voice pitch of the CEOs is 125.31 Hz, with a standard deviation of 18.82 Hz. These figures are comparable to what is reported in the literature (127±17.7 Hz of the CEOs in Mayew, Parsons, Venkatachalam (2013); 122.8±17.4 Hz of the winners and 131±19.1 Hz of the losers in presidential elections around the world in Banai et al. (2017)). We find that our sample CEOs are identified as having self-enhancing bias in approximately 22 percent of the interviews and that they are identified as having self-protecting bias in approximately the same proportion of the interviews. We find that, on average, CEOs' usage of the first-person singular pronoun is approximately six percent of the total first person singular and plural pronouns in our sample interviews. This measure of language-based-narcissism is much lower than was reported (mean=21%, std=9%; N=352) in Chatterjee & Hambrick (2007). The average tone score of the CEO is 0.014 (std=0.02), which is significantly lower than the tone score of the show hosts (mean=0.019, std=0.018) with a t-stat of 3.50. This suggests that the CEOs were more optimistic than the show hosts about the prospects of their own firms during the financial crisis.

[Insert Table 2 around here]

In our sample interviews, 43.7% of them are morning interviews and 76.6% are live interviews. We also find that at least one female journalists were included in the interviewer group for 61.1% of the time. To the extent that the interviewed CEOs were in the Execucomp dataset with valid option holding data available from the Execucomp, 69% of them are identified as being overconfident. This is comparable to 61.8% reported in Hirshleifer, Low, and Teoh (2012) and

61.57% in Ho, Huang, Lin, and Yen (2016). The average age of the CEO is 55.5, and tenure is 6.7 years. The VEGA and DELTA of compensation are $307 and $2,710, respectively, which is higher than what is reported in the literature (100.84 and 341, respectively, in Hirshleifer et al. (2012)). This implies that Wall Street CEOs' compensation has been significantly higher powered than that of the nonfinancial firms' CEOs. The average stock performance of the firms during the fiscal year before the interview was -6.9% (std=38.6%), and the idiosyncratic risk of the firms using the market model with daily SP500 index return was 7.5%. All these appear consistent with the fact that the sample period is in the middle of the financial crisis. The TARP amount was on average 3% of total assets of the sample firms that were bailed out by the government, and the banks took approximately 582 days on average to repay the tax-payers' money.

III.2 Self-Selection Bias

Since CNBC interviews are not randomly assigned, we address the self-selection bias issue using the Heckman (1977) selection model. In the first stage probit regression model, we estimate the probability of conducting a CNBC interview by regressing the CNBC interview dummy on the number of interviews on CNBC conducted by other firms' CEOs in the same state (region), stock market performance, and firm size. The model is as follows:

$$\Phi(\text{CNBC interview}_{it}) = \beta_0 + \beta_1 Z_{it} + \beta_2 Ret_{it} + \beta_3 Size_{it} + \epsilon \ldots\ldots\ldots\ldots\ldots(1)$$

where $\text{CNBC interview}_{it}$ is a dummy variable that is one if the CEO of firm *i* had an interview with CNBC in fiscal year *t*, Ret_{it} is firm *i*'s stock market performance, and $Size_{it}$ is firm *i*'s size in fiscal year *t* We use the number of other CEO interviews conducted in the same state of firm *i* in fiscal year *t* as our instrumental variable, denoted by Z_{it} following Kang & Kim (2017) because when CEOs accept or reject media interview offers, they may consider their neighboring

companies' CEO media exposure due to mimetic motivation or peer pressure. At the same time, the journalists' choice may be affected by the geographical proximity of a company that was recently interviewed due to the social network of referrals among CEOs. However, an interview with a neighboring firm's CEO would not be correlated with the outcome variables of the sample firms such as compensation structure, CEO dismissals, or TARP repayment. The result is shown in Table 3. We find that our instrumental variable has significant predictive power for CNBC interview selection ($\beta_1 = 0.201$, p-value<0.01). Consistent with the literature, CEOs from larger and better-performing firms are more likely to accept TV media interviews. We obtain the Inverse Mills Ratio (IMR) from the first-step probit regression and include this IMR in all of our main regressions to control for any possible self-selection bias.

[Insert Table 3 about here]

III.3 Orthogonalizing Voice Pitch

As described in section II, CEO's voice pitch could be affected by various mechanical factors such as hormone level during the day. For example, it is found that the testosterone level is higher and the voice pitch is lower in the morning than in the evening in the same person (Evans et al. (2007)), testosterone level peaks out at the age of 30 and decreases thereafter (Feldman et al. (2002); Harman et al. (2001); Gonzalez-Sales et al. (2016)), and testosterone level is inversely correlated with the stress level (Christiansen et al. (1985). Thus, CEOs under more (less) pressure may speak with a higher (lower) voice pitch due to lower (higher) testosterone. To address such concern, we run a first stage regression and obtain the residual voice pitch to work throughout the remainder of the paper.

$$Voice\ \text{Pitch}_{\text{ijt}} = \beta X_{ijt} + \epsilon_{ijt} \ldots\ldots\ldots\ldots\ldots\ldots (2),$$

where the subscript *i* is for the unique CEO, and *t* is for date of the interview. X is a vector of an exhaustive list of variables that may mechanically affect the testosterone level: (1) a dummy variable that is one if the interview was aired in the morning; (2) a dummy variable that is one if the interview was live; (3) CEO age and age squared to capture a potentially concave relationship; (4) pitch variation of the CEO within the interview; (5) a dummy variable that is one if there was a female among the show hosts; (6) the stock performance of the firm over the previous twelve months; (7) the S&P500 performance on the interview day; (8) the language tone of the CEO and that of the show host, where the tone is measured following Loughran & McDonald (2011); and (9) idiosyncratic volatility.

In our orthogonalizing regression, we find some interesting patterns consistent with prior literature on the fluctuation of circulating testosterone. We find that the voice pitch is lower by approximately 8.7~9.2 Hz (t-stat=2.94~3.07) if the interview was done in the morning. We also find that younger male CEOs speak in a lower voice pitch than the older ones with a concave relationship with respect to age, and CEOs with a wider voice range (pitch variation) tend to speak in a higher pitch.

In addition, Wall Street CEOs spoke in a higher pitch when the stock market index was performing badly on the day of the interview, supporting the prediction that the CEO stress level has a negative relationship with the stock market performance, and a positive relationship with the voice pitch in turn. When those CEOs spoke more negative (positive) words, their pitch was higher (lower), confirming that their delivery of negative information triggers more stress, lower testosterone, and a higher voice pitch. We also find marginally significant evidence that CEOs speak in a higher voice pitch in live interviews, which is another proxy for CEO stress level. We

obtain residuals from regression (2) of Table 4, and we work with those residuals throughout the rest of the paper.

[Insert Table 4 about here]

III.4 Vocal Masculinity and Firm Risk

We first test whether the Wall Street firms with more masculine culture, proxied by low voice pitch of the CEO, were riskier before the financial crisis. Our risk measure is the natural logarithm of daily stock return volatility over the fiscal year that ended immediately before the CNBC interview. We recognize that there could be a look-ahead bias as the dependent variable precedes our key explanatory variable in terms of time span. However, the time between fiscal year end and the CNBC interview is less than one year, and our purpose here is to check for simple associations. Moreover, if the market is efficient, CEO's risk preference coming from masculinity would have been already priced in the stock market through return volatility in the first place.

When we regress firm risk against vocal masculinity, we also control for existing economic factors that are known to affect the firm risk level. We follow Coles, Daniel, and Naveen (2006) and control for compensation VEGA and DELTA. We also control for overconfidence, age, and tenure of the CEO. Lastly, we control for firm characteristics such as size, leverage, stock performance, accounting performance (ROE), market-to-book, and firm age. For the initial three regressions, denoted as "Interview" columns in Table 5, our unit of observation is all the interviews that have a valid VEGA and DELTA, i.e., the sample in the Execucomp data (N=89). However, some CEOs ran multiple interviews during our sample period. Therefore, for the last three regressions, denoted as "CEO" columns in Table 5, we restrict the sample to the last conducted interview of each CEO (N=34).

In support of our first hypothesis, we find a negative and significant relationship between firm risk and CEO's voice pitch. The coefficient of -.008 (t-stat = 2.58) in the fifth regression in Table 5 indicates that CEOs, whose residual voice pitch is one standard deviation (16.24 Hz) lower than the mean, work for a bank whose daily (annual) stock return volatility is 0.32% (5.09%) point higher than the sample mean of 2.63% (41.7%). The association is economically - as well as statistically – significant, because the increase in volatility is 12.2% higher than the mean. The results of the control variables reported in Table 5 are consistent with prior research. We find significant positive correlation between VEGA and risk. We also find a negative correlation between ROE and risk because the sample period is financial crisis. Additionally, we find that the younger the CEOs, the riskier the firms they manage, which is consistent with the fact that testosterone decreases after peaking at the age of 30 while our sample CEOs are well over 30 years old (55.5).

Some readers may question whether the result is robust when we control for facial masculinity as in Jia et al. (2014), Gomulya et al. (2016), and Kamiya, Kim, and Park (2018). Thus, we construct a facial masculinity measure that is a dummy variable equal to one if the fWHR of the CEO belongs to the top quartile of the sample and zero otherwise. Though the coefficient of the facial masculinity dummy is statistically insignificant, the sign is positive. The correlation between voice pitch and the masculine face dummy is 0.18; however, it is not statistically significant. This finding seems to suggest that vocal masculinity may be another dimension of masculinity that is not fully captured by facial masculinity.

[Insert Table 5 about here]

III. 5 Vocal Masculinity and CEO compensation

CEO pay would reflect the risk preference of the CEO and the risk culture of the board of directors because it is a mechanism to align the interests of both parties. The board of masculine corporate culture would allow the CEOs to have more high-powered compensation, which would imply more equity-based compensation to the CEO. Kamiya et al. (2018) find that masculine-faced CEOs prefer a compensation structure that increases in stock return volatility, which implies more loading onto stock options and ownership. Extending the idea to vocal masculinity, we predict that deep-voiced CEOs would prefer high-powered incentives, which is represented by a higher percentage of equity compensation relative to total compensation. Our dependent variable in this setting is the percentage of equity compensation out of total compensation, which is defined as (TDC1-salary-bonus)/TDC1 in the Execucomp data as of the fiscal year that ended after respective CNBC interviews. Our empirical model is shown below.

$$\%\text{Equity Comp}_t = \beta_1 Voice\ Pitch_t + \gamma X_t + \epsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

X is a vector of control variables. We control for the formant position of the CEO voice as in Mayew et al. (2013). The CEOs' overconfidence dummy is also included because overconfident CEOs prefer high-powered compensation (Humphery-Jenner et al. (2016)). As for further psychological traits of the CEO, we control for the narcissism of the CEO. O'Reilly et al. (2014) find that narcissistic CEOs have higher equity ownership as they accumulate more tenure and widen the pay gap between themselves and non-CEO executives because of their drive to achieve grandiosity and dominance. We also control for CEO age, age squared, and tenure. For firm characteristics, we use stock performance over the past one year before the interview, accounting performance measured by ROE, idiosyncratic risk measured by the root mean squared error using

a market model based on the monthly S&P 500 index return over the trailing 3 years, firm size measured as the natural log of assets, and the market-to-book ratio. We also include the inverse Mills' ratio (IMR) to control for the selection bias to be interviewed by CNBC. The results are shown in Table 6.

[Insert Table 6 around here]

The coefficient of voice pitch is negative and significant at the 5% level (-0.002; t-stat=-1.99). A one standard deviation lower residual voice pitch of 16.24 Hz is associated with a 3.25% higher equity compensation from the sample mean of 77% (std=19.2%), which is also economically significant. We also find that more narcissistic CEOs tend to have higher-powered compensation, with a coefficient of 1.733 (t-stat=2.42). A one standard deviation higher narcissism measure is associated with a 2.95% increase in %Equity compensation. Overall, our results support our prediction that more masculine CEOs represented by lower voice pitch are granted with more equity compensation.

III. 6 Vocal Masculinity and Forced CEO turnover

Having found out the evidence that the Wall Street firms with more masculine culture were riskier and gave higher powered pay to their CEOs, we address the third and most important research question in this subsection. Did the Wall Street firms reduce its degree of masculinity driven culture after the 2008 financial crisis? If so, more deep-voiced CEOs would have more likely been fired, because the CEO is the most symbolic figure representing the firm's corporate culture.

For each interviewed CEO, we trace the career outcome until the end of 2012 (Figure 3) and check whether the CEO was forced out using the Parrino (1997) algorithm. We use logit

regression in which the dependent variable is one if the CEO was forced out after the interview by the end of 2012 and zero otherwise. Our empirical model is as follows:

$$Prob(Forced\ Out) = \beta_1 Residual\ Voice\ Pitch + \gamma X + \epsilon \ldots\ldots\ldots\ldots\ldots (4),$$

where X is a vector of controls for CEO characteristics and firm performance used in CEO turnover literature. For the CEOs' personal characteristics, we control for CEO's facial masculinity, self-attribution bias, narcissism, formant position of the voice, age, and tenure. For firm characteristics, we control for trailing one-year stock market performance, ROE, size (natural log of total assets), and idiosyncratic risk (the root mean squared error of the market model using monthly S&P 500 index returns over the trailing three years).[18] Additionally, we control for TARP bailout money divided by total assets because the CEO of a bank that received taxpayer money for mismanaging the bank would be more likely to receive extra critical scrutiny by the regulators and be forced out in the end. We also control for the IMR from the first-stage regression of being interviewed by CNBC, as shown in Table 3. Since some CEOs had multiple CNBC interviews in our sample, we use standard errors clustered at the CEO level. The results are shown in Table 7. The unit of observation is the interview in the first three regressions, and that of the observations in the fourth regression is the last observation for each unique CEO. The last column is the marginal effect based on the fourth logit regression.

[Insert Table 7 around here]

The results strongly support our hypothesis. The coefficient of voice pitch is negative (-0.17 in the fourth regression) and statistically significant at the one percent level. The marginal

[18] Peters and Wagner (2014) and Bushman *et al.* (2010) find that the probability of CEO dismissal is positively associated with firm-specific risk.

effect is -0.003, which means that a one standard deviation *decrease* in the residual voice pitch of 16.24 Hz *increases* the probability of forced CEO turnover by 4.87%. Given that the unconditional likelihood of forced turnover for unique CEOs in our sample is 20% (for the interview sample, it is 17.4%), the results suggest that the CEO dismissal probability increases by 25%, or by about a quarter. Therefore, the effect of masculinity on dismissal after the financial crisis was economically as well as statistically significant. Note that the observation period between our sample period (CNBC interviews) and the end of CEO turnover collection (2012) is approximately 3 years. To put into perspective in terms of the literature, the unconditional probability of firing a CEO in a fiscal year is 2.25% per year (Jenter and Kanaan (2015)). Using this figure, we compute the expected probability of the CEO *not* being fired to be (1-2.25%)^3=93.4%. Hence, the unconditional probability of being fired over three years should be 6.6%. Therefore, our back-of-the envelope calculation tells us that the Wall Street CEOs during/after the 2008 financial crisis are almost 2.6 times more likely to be fired than the CEOs in Jenter and Kanaan's (2015) paper. We also find that more masculine-faced CEOs were also more likely to be fired (coefficient of 4.61 with a t-stat of 3.30 in the fourth regression and its marginal effect of 32.7%). This suggests that our finding is not confined to the vocal dimension of masculinity but is ubiquitous across different dimensions of masculinity. The coefficients of the control variables are consistent with what has been documented in the literature. CEOs with SAB, especially those who blame the bad performance of their company on outside factors, are more likely to be fired, which is consistent with Kim (2013). Also, CEOs whose bank had higher idiosyncratic risk are more likely to be fired.

III. 7 Vocal Masculinity and Duration of TARP

As a rescue plan for the massive scale of the financial crisis in 2008 after Lehman Brothers' bankruptcy on September 15, 2008, the US government prepared the TARP to stabilize the financial system (Bayazitova & Shivdasani (2011); Mishkin (2011); Duchin & Sosyura (2014); Berger & Roman (2015)). One of the key features of the bailout program was that bank executives' excessive risk-taking incentives were restricted as long as the bank was under the TARP program. For example, the tax deduction for CEOs' option compensation was limited to $500,000 per year, which curbed the option exercise of the CEOs. The US Treasury limited the total compensation for chief executives at TARP-receiving banks to $500,000 in February 2009. Our reasoning is that the personal disutility effect of this restriction would have been more salient for the CEOs who had high-powered (option-based) compensation, who in turn were more likely to be masculine. Therefore, to be able to exercise their option without restriction, more masculine CEOs had stronger incentive to quickly repay the TARP money. Hence, we predict that deeper voiced CEOs took shorter time to repay the TARP money. We restrict the sample to the financial institutions that received TARP money among the CNBC-interviewed Wall Street firms. We hand-collect the date of full repayment of TARP money as well as the date of initial TARP money allocation.

In Table 8, the number of days it took for the firm to exit TARP is used as our dependent variable. Our key explanatory variable is the residual voice pitch of the CEO. We control for the CEO's SAB as an alternative measure of overconfidence because further restricting the sample to those with a non-missing overconfidence measure reduces the degrees of freedom to a suboptimal level. We also control for narcissism without a specific prediction. Other control variables are the formant position of the CEO's voice, age and tenure. For firm characteristics, we control for ROE,

idiosyncratic risk, firm size, market-to-book, and the inverse Mills' ratio to be interviewed by CNBC. The results are shown in Table 8.

[Insert Table 8 around here]

In Panel A of Table 8, the unit of observation is a CNBC interview. Thus, some firms are included repeatedly, which necessitates the use of standard errors clustered at the firm level. In the last two regressions of Panel A, we restrict the sample to firms for which there was no CEO turnover until the exit of the TARP repayment. The reason for the restriction is due to the concern that the results may be driven by the firms that replaced the CEO or by the preference of new CEOs.

Table 8 panel A shows that the coefficient of residual voice pitch ranges from 9.2 (t-stat=2.00) to 10.67 (t-stat=2.61), depending on the specification. This means that one standard deviation lower voice pitch is associated with a 149~173-day earlier repayment of TARP money starting from its unconditional mean of 582 days. The effect of masculinity, proxied by voice pitch, is not only statistically but also economically significant. Interestingly, we find that the CEOs who attribute good performance to themselves (self-enhancing bias) during the TV interviews are more likely to repay TARP faster by approximately 209 days. We also find that younger CEOs repay TARP faster. It may be that younger CEOs have a higher testosterone level, which drives the person to seek more option-based compensation and early graduation from TARP. Another possibility is the career concern. The younger CEOs may want to get rid of the stigma of being in the TARP receivership earlier in their career. The coefficient of CEO tenure is negative and significant, which suggests that inexperienced CEOs take longer time to graduate from TARP. Consistent with the literature, we find that more profitable firms and larger firms graduated from

TARP faster (Bayazitova & Shivdasani (2011). The coefficients of ROE and size are both negative and significant.

In Panel B of Table 8, we use the Cox proportional hazards model (duration model) and the unit of observation is CEO. Coherently, both masculinity measures strongly suggest that more masculine CEOs (either by voice pitch or face) exited TARP earlier than less masculine CEOs.

Overall, the results in Table 8 largely support our prediction. While Bayazitova and Shivdasani (2011) find that CEOs with excessive compensation or with compensation higher than $500,000 were more likely to exit TARP faster due to concerns about executive compensation flexibility, our evidence provides a more refined answer to the question. Our results show that part of the early repayment was driven by masculine CEOs that had more equity compensation with more risk appetite.

III. 8 Vocal masculinity and performance after TARP repayment

If the early repayment of TARP was purely based on the improvement of the economic fundamentals of the financial institution, the subsequent performance would be better than that of late-exiting firms. Berger and Roman (2015) find that the TARP recipient banks realized competitive advantages and increased their market power and that the positive outcome was concentrated on early repaying banks. However, Duchin and Sosyura (2014) find evidence that TARP-repaying banks seemingly improved financial stability in terms of regulatory capital ratios but, in fact, did not improve much in terms of the risky asset class in which they invested. Thus, they find an increase in volatility after TARP repayment. Hence, we conjecture that part of the insignificant improvement in performance may have been driven by the fast repayment by masculine CEOs, who are more risk lovers, as found in the previous subsection.

For the performance measure, we look at the daily alpha of the market model using the S&P 500 index returns over the fiscal year after the financial crisis until 2013. Among the 20 TARP-receiving banks in Panel B of Table 8 that did not have CEO turnover by 2012, we find that 16 of them repaid the TARP money in full by the end of 2012. We split the 16 exited banks into a group of CEOs with high-pitched voices (N=9) and a group of CEOs with low-pitched voices (N=7) using the sample mean of 125.31 Hz. Figure 4 shows the average alpha of the two subsamples over 2011, 2012, and 2013. We find that the alpha of the low-pitched group was negative 0.181% (t-stat=-5.68) in 2011, 0.052% (t-stat=1.43) in 2012, and -0.001% (t-stat=-0.06) in 2013. In comparison, the alpha of the high-pitched group was -0.089% (t-stat=-2.25) in 2011, 0.035% (t-stat=0.80) in 2012, and 0.015% (t-stat=0.8) in 2013. The performance of the more-masculine TARP-repaying banks was worse than that of the less-masculine TARP-repaying banks in 2011 (the p-value of the one-tailed t-test of the difference in mean is 0.054; and the p-value of the one-tailed test of the median (Wilcoxon Rank Sum test) is 0.062). The performance difference became insignificant in 2012 and 2013. One might argue that the performance improvement was present over the 2011-to-2012 period; however, the improvement quickly disappeared. The result largely supports the point that the TARP repayment driven by masculine CEOs did not result in any better improvement of economic performance than that driven by less masculine CEOs in the long run.

[Figure 4 around here]

III.9 Intraday Volatility Event Study

Given that the masculinity driven corporate culture of the firm is a public information that is conveyed by vocal (or facial) masculinity of the CEO, do investors react (again) to the vocal masculinity of the CEO when the CEO shows up on television media? Literature in media and

finance thus far commonly documents that unsophisticated individual investors transitorily overreacts to the attention-drawing media exposure of the CEO (Kim & Meschke (2014); Engelberg et al. (2012)). Given that the degree of CEO masculinity or the CEO risk preference must have already been priced before the interview (as in Table 4), we predict that we will only find a transitory increase in stock volatility when masculine CEO shows up on media.

Hence, we run a stock volatility event study using microstructure (TAQ) data and daily (CRSP) data surrounding the interviews. We are able to conduct this study because we have the exact timestamp of the interviews up to the minute, using the Eastern Standard Time. We run regressions of volatility ratios where our dependent variable is the stock return volatility *from* the minute (day) of the interview divided by the volatility *before* the minute (day) of the interview. For microstructure data, we sample the price at every time point of 30 equal "return intervals" before the minute of the interview and the same number of intervals from the beginning of the interview. We use various lengths of return intervals: 15 seconds, one minute, five minutes, and ten minutes. When the price information at the exact time point is missing, we attribute the most recent price as the current price. Then, we compute the returns, and the standard deviation of the returns. For daily study, we compute return volatility using 30 trading days before and after the interview.

Since the distribution of volatility ratio is positively skewed due to extreme values (skewness ranges from 4.71 to 8.17 depending on the interval), we take a natural log to use it as the dependent variable. Our key explanatory variable is the dummy variable that is one if the residual voice pitch is lower than the sample mean and zero otherwise. We also use the wide face dummy variable. We control for attention level using Nielsen viewership data, SAB dummies,

narcissism and the language tone of the CEO and the language tone of the show hosts, idiosyncratic volatility, firm size, and market-to-book ratio.

Interestingly, as can be seen in Table 9 results, we detect a significant jump in volatility for deep-voiced CEO interviews only when we use short time intervals such as 15 seconds and one minute. We fail to find any significant volatility increase for masculine-voiced CEOs for longer time intervals such as 10 minutes or one day. The result is largely similar when we consider the coefficients of a wide face dummy. A volatility increase affected by masculinity is detected only in the intraday study, supporting our prediction. Moreover, the result seems slightly stronger for vocal cues than for visual cues.

[Insert Table 9 about here]

In addition, our results for the controls are largely in line with the existing literature. Higher viewership is met with more increase in volatility. A more negative language tone generates a more transitory increase in volatility; however, only the tone of the CEO is relevant.

Though we discuss in the last subsection below, we recognize that the Wall Street CEO interviews on CNBC during the financial crisis is not purely media attention driven event, but rather a very informative event. To the extent that their discussion captured by language tone carries more negative information about the risk of the firm in the middle of the global crisis, more audience would watch it. Indeed, our results in Table 9 seem to suggest that the viewership soaked up the explanatory power of language tone in the multiple regression analysis of daily volatility ratio.

III. 10 Stock Return Event Study

To make our study complete, we also run stock market event studies using market adjusted model. The existing papers about the impact of media attention on stock return that reports

transitory run-up and reversal (Tetlock (2011); Engelberg et al. (2012); Kim and Meschke (2014)) run event studies based on non-informative media event, such as stale news. Our sample is different in that it is very informative news event, because the CNBC interviews of Wall Street CEOs during the 2008 financial crisis were heavily confounded by important news announcements whose main players are the very companies the CEOs manage. Sometimes, the CEO interviews were taken as releases of important information as in Bear Stearns CEO interviews, because they were discussing the financial position of their own firms and the prospect of the firms in the middle of the meltdown of global markets. Therefore, it would be difficult to predict a run-up and reversal. Instead, due to the selection bias of coming up to the media when CEOs have good news on average, we predict that the stock market response to the interview to be positive and permanent. Our event study results based on cross-sectional t-statistics are shown in Table 10.

[Insert Table 10 about here]

Table 10 shows the cumulative abnormal returns based on market adjusted model, where S&P 500 index return is used as the market return. We set up various event windows. For microstructure event study, we use five minutes, eight minutes, 15 minutes, and 50 minutes before- and after- the starting minute of CNBC interviews as the event window, respectively. For daily event study, we use [0], [-1,1], and [0,10] trading days as our alternative event windows. We find that cumulative abnormal return of 69 basis points (t-stat=1.66) over the 30-minute event window centered at the first minute of interviews is statistically significant. Additionally, we find one-day abnormal return is 1.22% (t-stat = 2.69), two-day abnormal return 1.54% (t-stat=2.07), and the eleven-day abnormal return from the event day until the tenth trading day is 1.76% (t-stat=1.39). Though the longer window event study fails to give statistically significant results, the magnitude

of cumulative abnormal return is not decreasing but increasing, which largely confirms our prediction of selection bias.

IV. Conclusion and Contribution

Using digitally analyzed voice pitch of Wall Street CEO interviews on CNBC, we find that masculinity driven culture indeed is associated with higher firm risk before the crisis. Our CEO turnover study supports that masculinity driven culture was significantly curbed after the crisis due to the regulatory intervention and public opinion. We also find that the television interviews by deep-voiced CEOs and masculine faced CEOs increase the stock return volatility in a transitory fashion, which suggests that their masculinity of voice is already priced.

This paper contributes to the literature on corporate culture (Sherman (2012); Dudley (2014); Lo (2015); Graham, Grennan, Harvey, Rajgopal (2016); Karolyi (2016); Newton-Small (2016); Adams & Ragunathan (2017); Pan (2017)) by finding direct evidence that masculine corporate culture increases firm risk. Lo (2015) argues that one of the most challenging aspects of behavioral risk management in corporate risk culture is the question of how to measure the behavioral laws of motion (pp.36). Our paper provides one avenue to improve the measurement: the voice pitch of the bankers because voice pitch is an "honest signal of testosterone that drives a person to take risks" in search of social dominance (Evans et al. (2008)). We find that the deep-voiced CEOs managed riskier firms before the financial crisis and that they were more likely to be fired after the crisis with the regulatory effort of the Dodd Frank Act of 2010. After ten years of financial crisis, the implication of our finding is very important because the Trump administration is attempting to at least partially roll back the Act to free bankers from "onerous regulatory restrictions" and to stimulate more business. Whether the roll-back would mean a revival of a masculinity-driven culture on Wall Street is worth investigating in the future.

This paper also adds to the fast growing literature about the impact of masculinity on risk taking (Mayew, Parsons, and Venkatachalam (2013); Cronqvist (2016), (2015); Sherman, Lerner, Josephs, Renshon, and Gross (2016); He, Yin, Zeng, Zhang, and Zhao (2019); Jia, van Lent, and Zeng (2014); Gomulya (2016); Sherman. Lerner, Josephs, Renshon, and Gross (2016); Kamiya, Kim, and Park (2018); Lu & Teo (2018)). One could interpret our results as the association of CEO style of masculinity with firm risk policy as in the CEO style literature (Bertrand & Schoar (2003)). The new dimension of masculinity that we introduce in this paper is that of voice, while the extant literature has focused on facial dimension. However, we do recognize that due to the small sample problem, we cannot run horse-race between those two measures nor can we claim causality.

We also add to the media and finance literature. Starting with Huberman and Regev (2001), researchers have been investigating whether non-informative media attention affects stock price in a systematic manner (Antweiler and Frank (2004); Das and Chen (2007); Tetlock (2007), (2011)); Engelberg and Parsons (2011); Engelberg et al. (2012); Gurun and Butler (2012); Kim and Meschke (2014); Solomon, Soltes, and Sosyura (2016); Kang & Kim (2017); Gentzkow, Kelly, and Taddy (2017); Frank and Sanati (2018)). Typically, researchers have investigated the impact of media-driven attention on abnormal return, which is the first moment. We report a transitory volatility (the second moment) impact on the known risk preference (masculinity) of the CEO at the time of a TV interview.

This paper also adds to the banking crisis literature (Boyd & DeNicolo (2005); Diamond & Rajan (2009); Bebchuk & Spamann (2009); Bayazitova & Shivdasani (2011); Fahlenbrach & Stulz (2011); Barth et al. (2012); Beltratti & Stulz (2012); Gorton & Metrick (2012); Boyd & Hakenes (2014); Duchin & Sosyura (2014); Berger & Roman (2015); Ho et al. (2016). Some researchers argue that governance failure caused the 2008 financial crisis (Bebchuk & Spamann

(2009); Diamond & Rajan (2009); Kirkpatrick (2009)) whereas others find counterevidence (Beltratti & Stulz (2012)). Recently, Ho et al. (2016) reported that overconfident bank CEOs were more aggressive in subprime lending, which caused the financial crisis. We propose another channel of influence that is distinctly different from overconfidence: a masculinity-driven corporate culture that created a problem of "Too-Masculine-To-Fail," in addition to the problems of "Too-Big-To-Fail" or "Too-Complex-To-Fail."

Lastly, our methodology contributes to the researchers and practitioners in FinTech (Philippon (2016); Yermack (2017); Berg, Burg, Gombovic, and Puri (2018)) and to the newly burgeoning literature of Social Signal Processing (Burgoon et al. (2017); Scherer (2005); Konar et al. (2015)), in which various nonverbal social cues such as voice pitch, facial expressions, and hand gestures are digitally analyzed to extract useful signals automatically. Many financial firms, such as banks, brokerages, and insurance companies, provide smart phone apps that enable customers to conduct financial transactions via voice messaging or face recognition. Most of them accumulate the voice file data related to various customer services in their call centers. These Big Data would open up rich opportunities of in-house research about directly testing the causal impact of vocal masculinity upon personal financial risk taking, which would help the firms to advance their assessment of customers' risk preference. Moreover, our findings have significant implications for the AI (artificial intelligence)-based selection of human capital, at least in the context of bank CEO selection. Recently, an increasing number of global banks and firms around the world have been adopting AI-based video interviews when recruiting college graduates. The video clips and voice files of interviewees are digitally analyzed as in HireVue (Buranyi (2018); Riley (2018)). The results of our paper suggest that voice pitch is informative about male candidates' risk preferences even after controlling for mechanical drivers such as stress level, age, and the time of the day of the interview. Equivalent study about female voice pitch would be very interesting for future research.

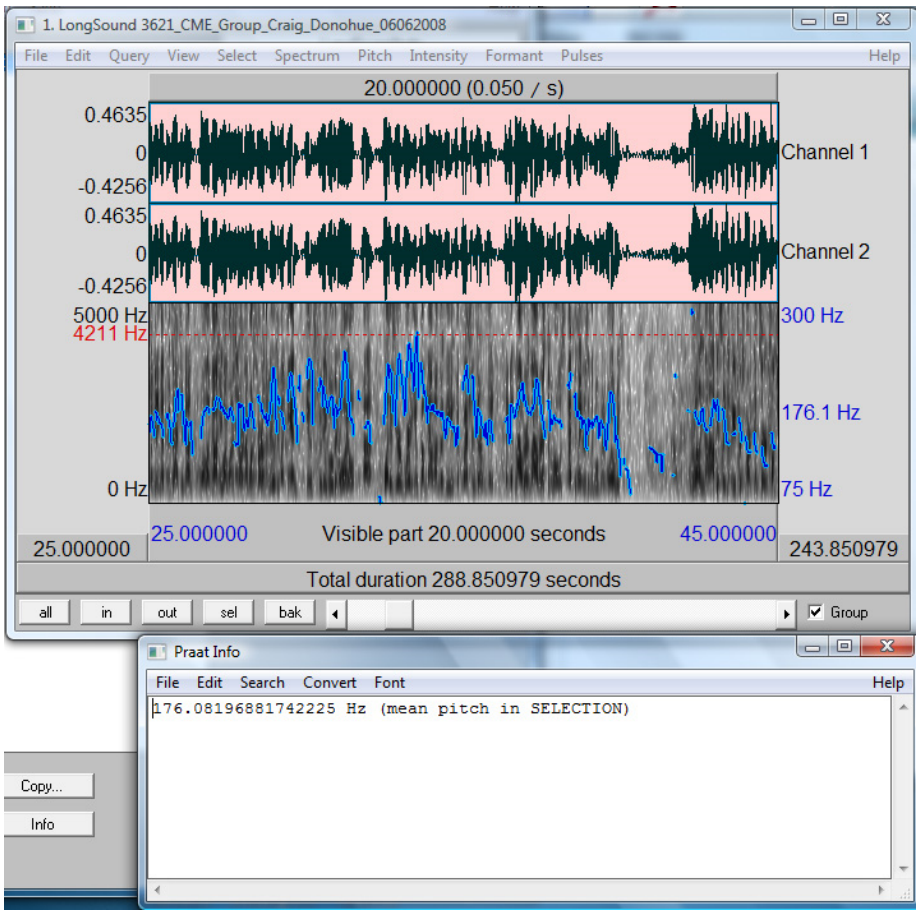
Appendix A. Variable Definitions

Variable	Definition
1{CEO forced out}	1 if the CEO was forced out by the end of 2012 and 0 otherwise
Voice Pitch	The mean voice pitch over the initial 20-second sample of the CEO's conversation in the CNBC interview
1{Masculine Face}	1 if the facial width-to-height ratio of the CEO belongs to the highest quartile in the male CEO sample
1{SAB: Good performance b/c me}	Self-enhancing bias whereby good performance is attributed to himself or to his firm. For a detailed explanation of self-attribution bias, please refer to Appendix D
1{SAB: Bad performance b/c industry}	Self-protecting bias whereby bad performance is attributed to external factors. For a detailed explanation of self-attribution bias, please refer to Appendix D
CEO Narcissism	Percentage of first person singular pronouns out of the total first person pronouns spoken by the CEO in the transcript of the interview. For a detailed explanation of self-attribution bias, please refer to Appendix E
1{overconfident}	Option-based overconfidence measure using a 67% threshold, following Malmendier and Tate (2008)
CEO age	Age of the CEO we obtained from either Execucomp or Google searching
CEO tenure	Tenure of the CEO we obtained from either Execucomp or Google searching
%CEO tone	The number of negative words minus the number of positive words using the Harvard IV dictionary divided by total word counts from the CEO's conversation in the transcript of the interview
%Host tone	The number of negative words minus the number of positive words using the Harvard IV dictionary divided by total word counts from the show host's conversation in the transcript of the interview
Pf	Formant position of the voice, as defined in Appendix B.
Stock performance	The twelve-month stock return over the fiscal year immediately before the CNBC interview
ROE	Net income in fiscal year t divided by lagged book value of equity
Total Assets	Book value of total assets in Compustat
idiosyncratic risk	The root mean squared error in the daily market model of regressing the stock return of the firm against the S&P 500 index return.
TARP/Assets	The total bailout money received divided by total assets
TARP duration	The number of days it took the firm to repay the TARP money
Viewership	The number of adult viewers of CNBC

Appendix B. Measuring the Voice Pitch of the CEO

Mayew, Parsons, and Venkatachalam (2013) find that CEOs with a lower voice pitch (F0) manage larger firms and receive more compensation, indicating their male dominance at work in a corporate setting. Following their method, we used Praat software to measure the voice pitch of the CEO. We searched for CEO interview video clips on CNBC's archive website. Since the minimum length of the voice recording of the CEO had to be 20 seconds, we ensured that the video clip was longer than 20 seconds and that the length of the CEO's speech was more than 20 seconds. We downloaded the sound files in MP3 format using the free online service from YouTube mp3 (http://www.youtube-mp3.org/). Following Mayew, Parsons, Venkatachalam (2013), we ran Praat acoustic software version 5.3.41 to measure the fundamental frequency (F0) over the first 20 seconds of the CEO's speech in each of the downloaded sound files. Our procedure includes setting the pitch floor as 75 Hz and the ceiling as 300 Hz in recognition that these are the well accepted boundaries for analyzing the speech of adult males (Puts, Hodges, Cardenas, and Gaulin, 2007).

Appendix Figure 1



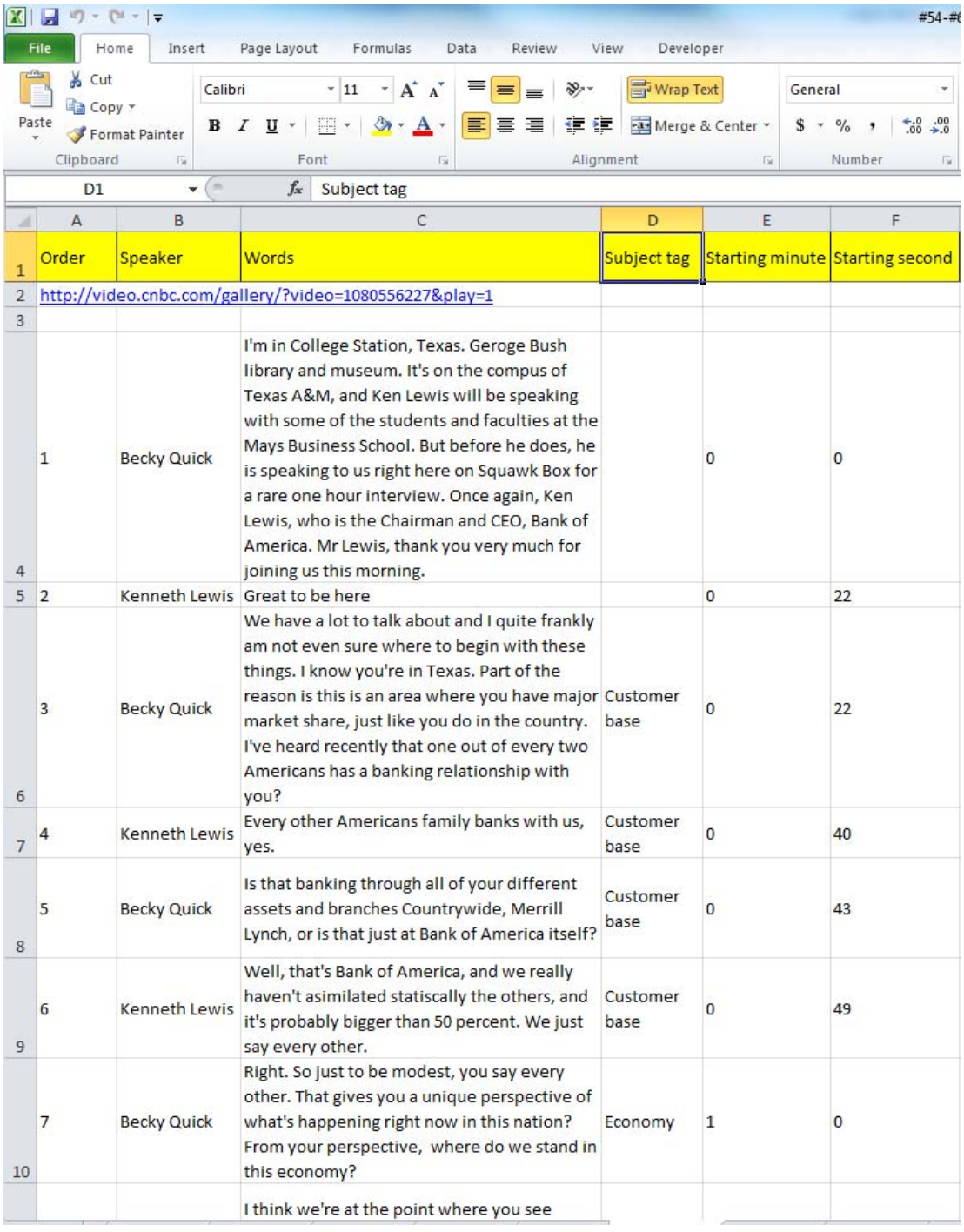
The figure above is the screenshot when we obtain the mean pitch of the voice over the 20-second segment. The upper part of the figure shows the soundwaves (duplicate is shown in parallel), spectrogram, and voice pitch (thick blue line graph).

Formant position (P_f) is another sexually dimorphic acoustic feature. Puts, Hodges, Cardenas and Gaulin (2007) argue that through the evolutionary process, a lower male voice – characterized by a lower fundamental frequency (voice pitch) and a lower formant position – came to be perceived as a sign of physical dominance among men. Puts, Apicella, and Cardenas (2011) find that a formant position is an indicator of men's threat potential. We follow Puts, Apicella, and Cardenas (2011) in measuring formant position as the average standardized formant ($Std.F_i$) value for the first four formants using Praat software via GSU Praat formant quantification add-on tools.

$$P_{f_j} = \frac{\sum_{i=1}^{4} Std.F_{ij}}{4}, where\ Std.F_{ij} = \frac{F_{ij} - AvgF_i}{StdevF_i} \quad \text{.....(A.1.),}$$

where *j* is a subscript of the CEO and *i* is the subscript for the *i*th formant. We set the maximum thresholds of F_1 as 1000, F_2 as 2850, F_3 as 3750, and F_4 as 4500 Hz. Before standardizing, mean F_1 =653±119, mean F_2 =1722±162, mean F_3 =2837±158, and mean F_4 =3866 ±165. Through this procedure, we find the average and standard deviations of the formant positions are 0.006 and 0.781, respectively.

Appendix C. Manually transcribing CNBC interviews in tabular format



	A	B	C	D	E	F
1	Order	Speaker	Words	Subject tag	Starting minute	Starting second
2	http://video.cnbc.com/gallery/?video=1080556227&play=1					
3						
4	1	Becky Quick	I'm in College Station, Texas. Geroge Bush library and museum. It's on the compus of Texas A&M, and Ken Lewis will be speaking with some of the students and faculties at the Mays Business School. But before he does, he is speaking to us right here on Squawk Box for a rare one hour interview. Once again, Ken Lewis, who is the Chairman and CEO, Bank of America. Mr Lewis, thank you very much for joining us this morning.		0	0
5	2	Kenneth Lewis	Great to be here		0	22
6	3	Becky Quick	We have a lot to talk about and I quite frankly am not even sure where to begin with these things. I know you're in Texas. Part of the reason is this is an area where you have major market share, just like you do in the country. I've heard recently that one out of every two Americans has a banking relationship with you?	Customer base	0	22
7	4	Kenneth Lewis	Every other Americans family banks with us, yes.	Customer base	0	40
8	5	Becky Quick	Is that banking through all of your different assets and branches Countrywide, Merrill Lynch, or is that just at Bank of America itself?	Customer base	0	43
9	6	Kenneth Lewis	Well, that's Bank of America, and we really haven't asimilated statiscally the others, and it's probably bigger than 50 percent. We just say every other.	Customer base	0	49
10	7	Becky Quick	Right. So just to be modest, you say every other. That gives you a unique perspective of what's happening right now in this nation? From your perspective, where do we stand in this economy?	Economy	1	0
			I think we're at the point where you see			

We manually transcribed the first ten minutes of each CEO interview in a tabular format. The tables contain the order of the dialog, name of the speaker, conversation transcript or the piece of dialog, the subject of the conversation, and the minute and second of the beginning of the interview.

Appendix D. Measuring Self-Attribution Bias (SAB)

We first explain how "self-referencing" is defined and then explain how SAB is constructed. Then, we move on to how two different SAB dummies are constructed.

Self-referencing is measured as follows: We narrow the CNBC interview scripts down to only the words spoken by the CEOs. We identify causal sentences where the CEO said "because" or "hence." For the sentences with "because," we search whether first person pronouns, e.g., "we" or "I", were spoken subsequently. For sentences with "hence," we search whether first person pronouns were spoken in the previous sentence. If we identify one of these pronouns, we count it as one case of self-referencing ("causal_we"). We perform the same exercise to find cases of referencing others in causal sentences by using the list of words in the LIWC (Linguistic Inquiry and Word Count) dictionary by Pennebaker, Booth, and Francis under "You" "SheHe" and "They", following Li (2010). In addition, we use "economy," "industry," and "competitor(s)" as the third-person pronoun category because attributing the poor performance of the company to industry competitors and the economy would be a manifestation of self-serving attribution bias. If we identify one of these words, we count it as one case of other-referencing (causal_other). For each interview script, we count the number of words by the CEO and measure the net self-referencing using the following definition:

$$Self\_referencing = \frac{\text{Causal\_we} - \text{Causal\_other}}{Number\ of\ words\ by\ CEO}$$

Following Li (2010), we construct an SAB measure by regressing the self-referencing measure on firms' abnormal stock market performance, which is measured by the alpha of the Fama-French 4-factor model using market, size, book to market, and momentum factors (Carhart (1997); Fama and French (1996)) over the estimation window of [-150,-31] trading days prior to CEO interviews. We first run the following regression based on the whole CNBC interview sample.

$$Self\ Referencing = \beta_0 + \beta_1 ALPHA_{FF4F} + \varepsilon$$

Then, the SAB measure is constructed as follows:

$$SAB = 1_{\{ALPHA_{FF4F} \geq 0 \wedge \varepsilon \geq 0\}} + 1_{\{ALPHA_{FF4F} < 0 \wedge \varepsilon < 0\}}$$

- $1_{\{ALPHA_{FF4F} \geq 0 \wedge \varepsilon \geq 0\}}$: attributing good performance to myself (or ourselves)→Self-enhancing bias (SEB) = 1{SAB: Good performance b/c me}
- $1_{\{ALPHA_{FF4F} < 0 \wedge \varepsilon < 0\}}$: attributing bad performance to others (or industry)→Self-protecting bias (SPB) = 1{SAB: Bad performance b/c industry}

- We use SEB and SPB separately in the regressions; however, the results are robust when we use SAB as a whole (untabulated).

Appendix E. Measuring Narcissism of the CEO

CEO narcissism is the ratio between the number of first person *singular* pronouns ("I" words) in the CEO's interview transcript and the number of all first person pronouns ("I" words and "We" words) in the CEO's interview transcript.

$$\text{CEO Narcissism} = \frac{\#\text{"I" words}}{\#\text{"I" words} + \#\text{"We" words}}$$

We refer to the LIWC (Linguistic Inquiry and Word Count) dictionary by Pennebaker, Booth, and Francis. "I," "Id," "I'd," "I'll," "I'm," "Im," "Ive," "I've," "me," "mine," "my," and "myself" belong to the "I" category. "our," "ours," "ourselves," "us," "we," "we'd," "we'll," "we're," "weve," and "we've" belong to the "We" category. We exclude "lets" and "let's" from the dictionary.

Appendix Table 1. CEOs who had more than one CNBC interview during the sample period

Rank	CEO Name	Firm Name	Interviews
1	ROBERT GREIFELD	NASDAQ OMX GROUP	12
2	CRAIG DONOHUE	CME GROUP	10
3	RONALD HERMANCE	HUDSON CITY BANCORP	8
4	JAMIE DIMON	JPMORGAN CHASE & CO	8
5	JOHN KOELMEL	FIRST NIAGARA FINANCIAL GROUP	8
6	DUNCAN NIEDERAUER	NYSE EURONEXT	8
7	JOE MOGLIA	TD AMERITRADE HOLDING CORP	5
8	LAURENCE FINK	BLACKROCK	5
9	EDWARD LIDDY	AIG	5
10	RUSSELL GOLDSMITH	CITY NATIONAL BANK	5
11	THOMAS JAMES	RAYMOND JAMES FINANCIAL	4
12	RONALD WILLIAMS	AETNA	4
13	JOSEPH FICALORA	NEW YORK COMMUNITY BANCORP	4
14	THOMAS WILSON	ALLSTATE CORP	4
15	CHARLES SCHWAB	CHARLES SCHWAB CORPORATION	3
16	ALEXANDER WYNAENDTS	AEGON	3
17	DOMINIC FREDERICO	ASSURED GUARANTY LTD	3
18	BRADY DOUGAN	CREDIT SUISSE	3
20	RONALD KRUSZEWSKI	STIFEL FINANCIAL	3
21	JOSEPH PLUMERI	WILLIS GROUP HOLDINGS	3
22	THOMAS WATJEN	UNUM GROUP	3
23	KENNETH LEWIS	BANK OF AMERICA	3
24	JEAN-FRANCOIS THEODOR	NYSE EURONEXT	2
25	LARRY GOLDSTONE	THORNBURG MORTGAGE	2
26	RICHARD WARD	LLOYDS OF LONDON	2
27	TOM JOYCE	KNIGHT CAPITAL GROUP	2
28	ED CLARK	TORONTO DOMINION BANK	2
29	LAURENCE GELLER	STRATEGIC HOTELS & RESORTS	2
30	SANDY FLOCKHART	HSBC ASIA PACIFIC	2
31	MARK TUCKER	PRUDENTIAL	2
32	LLOYD BLANKFEIN	GOLDMAN SACHS & CO	2
33	BERNARD DAN	MF GLOBAL	2
34	TOM GEISEL	SUN BANCORP	2
35	FREDERIC TOMCZYK	TD AMERITRADE HOLDING CORP	2
36	JOSEF ACKERMANN	DEUTSCHE BANK	2

Table 1. Sample Breakdown and Summary Statistics

Panel A. Industry breakdown of our sample by Fama French 49 industry classification

FF49 code	Industry category	Interviews	Firms
45	Banking	50	23
46	Insurance	27	13
47	Real Estate	3	3
48	Financial Trading	87	34
	Total	167	73

Panel B. Timeline of crisis and sample period

Date	Event
08/08/2007	BNP Paribas' suspends withdrawals from 3 of its investment funds with heavy exposure to US Subprime mortgages (Geithner, 2014)
03/16/2008	Bear Stearns rescued by JPMorgan Chase
09/07/2008	Fannie Mae & Freddie Mac taken into government conservatorship
09/15/2008	Lehman Brothers bankruptcy
09/16/2008	AIG bailed out ($85 billion)
09/17/2008	Permanent ban on naked short sales of all US stocks
09/26/2008	TARP ($700 billion of bailout money) approved in the House
10/03/2009	Enactment of TARP by US president
10/09/2008	Lifting of short sale ban

Interview sample period: 1/24/2008~4/30/2009. The sample period ends six months after the lifting of the short sale ban. The period covers the rescue of Bear Stearns, the bailout of AIG, and most of the major turmoil in the market.

Panel C. Interview frequency by month and year

	year	
month	2008	2009
1	2	8
2	3	17
3	16	16
4	10	15
5	10	
6	13	
7	13	
8	6	
9	11	
10	12	
11	8	
12	7	
Total	111	56

Table 2. Summary Statistics

	N	mean	std	p10	p50	p90
1{CEO forced out}	167	0.174	0.380	0	0	1
Voice Pitch	167	125.311	18.820	102.389	123.688	152.650
Residual Voice Pitch	167	-0.173	16.240	-19.773	-1.357	22.994
Pitch Variation	167	27.043	8.223	17.428	26.774	37.401
1{Masculine Face}	167	0.240	0.428	0	0	1
1{SAB: Good performance b/c me}	167	0.216	0.412	0	0	1
1{SAB: Bad performance b/c industry}	167	0.222	0.417	0	0	1
CEO Narcissism	167	0.060	0.017	0.038	0.060	0.081
%CEO tone	167	0.014	0.020	-0.009	0.013	0.037
%Host tone	165	0.019	0.018	0	0.018	0.043
1{Morning interview}	167	0.437	0.498	0	0	1
1{Live interview}	167	0.766	0.424	0	1	1
1{Female interviewer}	167	0.611	0.489	0	1	1
1{overconfident}	99	0.687	0.466	0	1	1
CEO age	167	55.515	6.412	48	55	63
CEO tenure	167	6.731	8.311	1	4	15
Fraction of Equity compensation	113	0.770	0.192	0.515	0.827	0.956
VEGA	77	307.54	317.09	0.77	221.93	823.95
DELTA	77	2,710.76	8,361.12	29.78	1,047.15	3,381.14
Stock performance	167	-0.069	0.386	-0.645	-0.088	0.401
ROE	167	0.120	0.218	-0.079	0.122	0.385
Total Assets($M)	167	335,475	673,698	2,979	20,473	1,207,712
idiosyncratic risk	167	0.075	0.033	0.041	0.068	0.129
TARP/Assets	43	.0300	0.023	0.011	0.022	0.064
TARP duration	43	582.372	550.282	187	224	1497

Table 3. First-stage CNBC interview selection regression

Dependent variable:		
No. of Same State Interviews	0.201	***
	(4.72)	
Stock return	0.103	***
	(2.65)	
Firm size	0.262	***
	(21.78)	
Constant	-3.615	***
	(27.54)	
Obs	6682	
Pseudo R2	0.111	

Probit model is used. The dependent variable is a dummy variable that takes a value of one if the CEO had a CNBC interview in the fiscal year, and zero otherwise. T-statistics are reported on every second line in parentheses. Standard errors are clustered at the firm level. *, **, *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. For variable definitions, please see Appendix A.

Table 4. Obtaining residual voice pitch, filtering out the potential mechanical driver of voice pitch within the person

DV: Mean voice pitch of the CEO	(1)	(2)
1{Morning Interview}	-9.207***	-8.671***
	-3.069	-2.939
1{Live Interview}	4.137	5.008+
	1.205	1.448
CEO Age	4.080*	3.640+
	1.749	1.57
CEO Age^2	-0.037*	-0.034*
	-1.923	-1.783
Pitch Variation		0.437**
		2.105
1{Female Host}	0.336	-1.343
	0.108	-0.408
Stock Performance over past 12 month	-1.318	-3.378
	-0.289	-0.739
S&P500 Return on interview day	-1.059*	-0.990*
	-1.795	-1.668
%Fin Negative by CEO	155.300**	111.947+
	2.272	1.651
%Fin Negative by Host	-83.512	-73.868
	-0.957	-0.83
Idiosyncratic Volatility	63.738	48.737
	1.2	0.898
IMR	-12.598**	-12.218**
	-2.151	-2.147
constant	12.814	20.102
	0.177	0.286
Month dummies and Year dummy	Y	Y
N	167	167
Adj. R2	0.138	0.162

OLS regressions are used where dependent variable is the mean voice pitch of the CEO during the first 20 seconds of the interview. T-statistics are reported on every second line. Standard errors are clustered at the CEO level. +, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Table 5. Firm Risk and Vocal Masculinity of the CEO

Unit of observation:	Interview	Interview	Interview	CEO	CEO	CEO
Dependent Variable: ln(total risk)						
Residual Voice Pitch		-0.006***	-0.006***		-0.008**	-0.008**
		-2.949	-3.127		-2.583	-2.359
1{Masculine Face}			0.063			0.125
			0.691			0.878
VEGA	0.001***	0.001***	0.001***	0.001**	0.001*	0.001**
	4.671	4.679	4.658	2.154	1.926	2.089
DELTA	-0.000**	-0.000***	-0.000***	0	0	0
	-2.492	-3.128	-2.894	-1.017	-0.583	-0.63
Pf	-0.035	-0.035	-0.034	-0.009	-0.024	-0.027
	-0.819	-0.832	-0.787	-0.105	-0.298	-0.327
Overconfidence	-0.238+	-0.235+	-0.231+	-0.251	-0.155	-0.162
	-1.689	-1.644	-1.607	-1.082	-0.742	-0.731
CEO age	-0.028***	-0.028***	-0.027***	-0.031*	-0.029*	-0.027*
	-3.038	-3.183	-3.166	-1.945	-1.906	-1.709
CEO tenure	0.021**	0.022***	0.022***	0.015	0.014	0.012
	2.605	2.765	2.782	1.18	1.234	1.075
Size:ln(Total Assets)	0.214*	0.224**	0.233**	-0.066	0.012	0.012
	1.952	2.161	2.19	-0.309	0.07	0.067
Leverage	0.263	0.25	0.251	-0.161	-0.325	-0.303
	0.744	0.752	0.747	-0.478	-0.894	-0.803
Stock performance	-0.580**	-0.603**	-0.591**	-0.491+	-0.375+	-0.359
	-2.102	-2.288	-2.171	-1.552	-1.479	-1.373
ROE	-1.863***	-1.890***	-1.833***	-1.171***	-1.382***	-1.317***
	-3.625	-3.691	-3.71	-2.973	-3.129	-3.081
MTB	0.206***	0.238***	0.226***	0.05	0.087	0.069
	4.166	4.516	3.785	0.675	1.3	0.921
Firm Age	-0.012***	-0.012***	-0.012***	-0.017***	-0.013**	-0.013**
	-3.126	-2.858	-2.849	-3.464	-2.513	-2.389
IMR	1.673***	1.726***	1.790***	-0.122	0.295	0.295
	2.764	3.091	3.134	-0.112	0.333	0.316
constant	-6.386***	-6.669***	-6.865***	-0.389	-1.985	-2.134
	-3.056	-3.429	-3.465	-0.106	-0.672	-0.679

N	89	89	89	34	34	34
Adj.R2	0.551	0.579	0.575	0.534	0.598	0.59

OLS regressions are used. The dependent variable is ln(total risk), which total risk is measured by daily stock return volatility over the fiscal year that ended immediately before the CNBC interview. For the initial three regressions, which are denoted as "Interview" columns, our unit of observation is all the interviews that have valid VEGA and DELTA: i.e., the sample in Execucomp data (N=89). However, some CEOs run multiple interviews during our sample period. Therefore, for the last three regressions, denoted as "CEO" columns, we restrict the sample to the last interview of each CEOs (N=34). T-statistics are reported on every second line. Standard errors are clustered at the CEO level. +, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Table 6. Percentage of Equity Compensation and Vocal Masculinity of the CEO

Dependent variable: % Equity Compensation	
Residual Voice Pitch	-0.002**
	-1.99
1{Masculine Face}	-0.067
	-1.263
Pf	-0.002
	-0.082
CEO Narcissism	1.733**
	2.423
1{overconfidence}	0.022
	0.456
Stock performance	-0.093**
	-2.089
ROE	0.187+
	1.504
idiosyncratic risk	1.472
	1.329
Size:ln(Total Assets)	0.011
	0.246
MTB	0.031*
	1.868
CEO age	0.005
	0.77
CEO tenure	-0.009*
	-1.918
IMR	-0.057
	-0.221
constant	0.256
	0.251
N	99
Adj.R2	0.263

OLS regression is used. The dependent variable is percentage of equity compensation, which is calculated by equity compensation (TDC1-salary-bonus) divided by total compensation (TDC1). T-statistics are reported on every second line. Standard errors are clustered at the CEO level. +, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Table 7. Forced CEO Turnover and Vocal Masculinity of the CEO

Unit of Observation	Interview Logit	Interview Logit	Interview Logit	CEO Logit	CEO marginal effect
DV:1{Forced}					
Residual Voice Pitch	-0.036**	-0.045***	-0.053***	-0.170***	-0.003+
	-2.274	-2.953	-3.299	-2.804	-1.587
1{Masculine Face}			1.525**	4.610***	0.327*
			2.237	3.301	1.91
1{SAB: Good performance b/c me}		0.083	-0.063	1.723	0.056
		0.14	-0.111	0.893	0.593
1{SAB: Bad performance b/c industry}		1.738**	2.193***	8.930***	0.937***
		2.192	2.591	4.262	13.145
CEO Narcissism			13.945	132.660***	2.428*
			0.836	3.098	1.815
Pf	-0.537**	-0.448+	-0.27	-0.276	-0.005
	-2.171	-1.611	-1.148	-0.455	-0.441
CEO age	0.008	-0.013	-0.041	0.048	0.001
	0.058	-0.094	-0.3	0.565	0.553
CEO tenure	-0.019	-0.006	0.007	0.037	0.001
	-0.341	-0.111	0.117	0.559	0.493
Stock performance	0.877	1.491	1.536	2.739**	0.05
	0.782	1.26	1.34	1.966	1.33
ROE	-0.229	0.281	0.743	3.91	0.072
	-0.069	0.11	0.289	1.279	1.409
Size:ln(Total Assets)	0.520*	0.618**	0.655**	1.482***	0.027*
	1.936	2.259	2.519	2.61	1.798
idiosyncratic risk	28.151**	32.305**	33.127**	91.813***	1.680*
	2.011	2.398	2.552	3.362	1.892
TARP/Assets	55.748**	45.787*	36.241	54.392	0.996+
	2.445	1.944	1.434	1.25	1.559
IMR	1.785	1.642	1.349	5.959	0.109+
	1.045	0.952	0.866	1.362	1.492
constant	-12.207	-12.774	-12.703+	-47.687***	
	-1.285	-1.366	-1.455	-3.091	
N	167	167	167	72	72
Pseudo R2	0.211	0.253	0.284	0.635	0.635

Logistic regressions are used. The dependent variable takes the value of one if the CEO was forced out after the interview until 2012 and zero otherwise. The unit of observation in the first three regressions, denoted as "Interview logit" columns, is each interview in our sample. The unit of observation in the last two columns, denoted as "CEO logit" columns, is the CEO. For the CEOs that had multiple interviews, we use the last conducted interview per CEO. T-statistics are reported on every second line. Standard errors are clustered at the CEO level. +, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Table 8. TARP Duration and Vocal Masculinity of the CEO

Panel A. OLS regression

Sample:	TARP receivers		TARP receivers & no CEO turnover	
Dependent Variable: TARP Duration (days)				
Residual Voice Pitch	9.710**	10.669**	9.500*	9.198*
	2.319	2.608	2.191	2.003
1{SAB: Good performance b/c me}		-208.965**		-42.703
		-2.608		-0.57
1{SAB: Bad performance b/c industry}		64.561		7.62
		0.528		0.108
CEO Narcissism		11122.737***		1617.433
		3.647		0.442
Pf	-186.829	-129.517	15.611	17.904
	-1.469	-1.47	0.218	0.256
ROE	-1310.023**	-1086.187***	110.349	-582.802
	-2.755	-3.87	0.035	-0.15
idiosyncratic risk	-3956.051	-1212.97	1070.148	315.637
	-1.143	-0.384	0.224	0.059
Size:ln(Total Assets)	-50.305	-66.393	-30.913	-37.202
	-0.651	-1.241	-0.427	-0.5
MTB	264.886	258.565+	30.789	81.262
	1.463	1.562	0.125	0.283
CEO age	54.831**	63.112***	82.140**	80.350*
	2.476	4.452	2.383	2.182
CEO tenure	-14.816	-18.461*	-5.875	-4.346
	-1.033	-1.996	-0.356	-0.237
IMR	-475.466	-677.231*	-231.308	-333.387
	-0.935	-1.879	-0.439	-0.643
constant	-1470.686+	-2431.800***	-3712.425*	-3505.543+
	-1.56	-3.298	-1.944	-1.792
N	43	43	31	31
Adj.R2	0.608	0.719	0.722	0.68

OLS regressions are used. The dependent variable is TARP duration, measured in days. The unit of observation is the interviews. T-statistics are reported on every second line. Standard errors are clustered at the CEO level. +, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Panel B. Cox Proportional Hazard Models

Sample: TARP receivers						
Dependent Variable: Hazard of Repaying TARP						
Residual Voice Pitch	-0.082	***	-0.086	***	-0.101	***
	-4.124		-3.684		-2.968	
1{Masculine Face}					5.244	**
					2.528	
1{SAB: Good performance b/c me}			0.317		0.648	
			0.317		0.381	
1{SAB: Bad performance b/c industry}			0.617		0.42	
			0.871		0.335	
CEO Narcissism					-26.763	
					-0.706	
Pf	3.252	***	3.494	***	4.246	***
	4.989		3.649		3.012	
ROE	23.623	***	23.831	***	35.311	***
	5.651		5.031		3.965	
idiosyncratic risk	238.753	***	242.596	***	304.477	***
	5.526		5.152		3.486	
Size:ln(Total Assets)	-0.89	***	-0.964	**	-1.059	
	-2.62		-2.065		-1.576	
MTB	-0.555		-0.649		-1.241	*
	-0.776		-0.818		-1.723	
CEO age	-0.034		-0.037		-0.014	
	-0.363		-0.394		-0.098	
CEO tenure	-0.138	**	-0.148	**	-0.185	
	-2.472		-2.135		-1.56	
IMR	-0.806		-1.065		0.052	
	-0.409		-0.419		0.016	
N	20		20		20	
PseudoR2	0.509		0.515		0.545	

Cox Proportional Hazard Model is used. The dependent variable is Hazard of repaying TARP. T-statistics are reported on every second line. Standard errors are clustered at the firm level. *, **, *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Table 9. Volatility Ratio Test of CEO Interviews on CNBC during Financial Crisis

Return interval DV: ln(Vol. Ratio)	15 sec	1 min	5 min	10 min	daily
1{Low Res. Voice Pitch}	0.632**	0.414**	-0.04	0.047	0.035
	2.171	2.015	-0.274	0.374	0.802
1{Wide Face}	0.612+	0.02	0.198	0.362*	-0.077*
	1.608	0.093	1.098	1.818	-1.992
Viewership	1.684*	1.582**	-0.683*	-0.614	0.301***
	1.901	2.092	-1.767	-1.211	2.988
1{SAB: Good performance b/c me}	0.055	0.023	-0.057	-0.144	-0.022
	0.115	0.064	-0.285	-0.803	-0.557
1{SAB: Bad performance b/c industry}	0.287	0.153	0.083	0.068	0.056
	0.66	0.563	0.435	0.368	0.816
CEO Narcissism	9.523	10.924*	9.567**	5.309	-2.037+
	0.964	1.918	2.417	1.344	-1.632
%Fin Negative by CEO	7.593	9.911**	5.765**	4.709*	-0.827
	1.271	2.475	2.346	1.712	-0.846
%Fin Negative by Host	-8.127	-4.716	-0.918	-4.313	0.494
	-1.085	-0.762	-0.201	-0.946	0.55
Pf	0.019	0.007	-0.076	-0.054	0.011
	0.111	0.052	-0.543	-0.406	0.373
ln(Idiosyncratic Vol)	-0.530+	-0.192	-0.668***	-0.517***	-0.008
	-1.559	-0.891	-3.753	-3.42	-0.185
Size:ln(Total Assets)	-0.035	-0.012	-0.113***	-0.078*	0.007
	-0.6	-0.232	-2.851	-1.958	0.787
MTB	0.05	0.04	-0.071*	-0.068*	0.009
	0.861	0.589	-1.947	-1.895	0.665
constant	-2.563*	-1.966**	0.265	0.384	0.424**
	-1.894	-2.021	0.403	0.54	2.034
N	129	139	139	139	165
r2_a	0.037	0.036	0.118	0.095	0.044

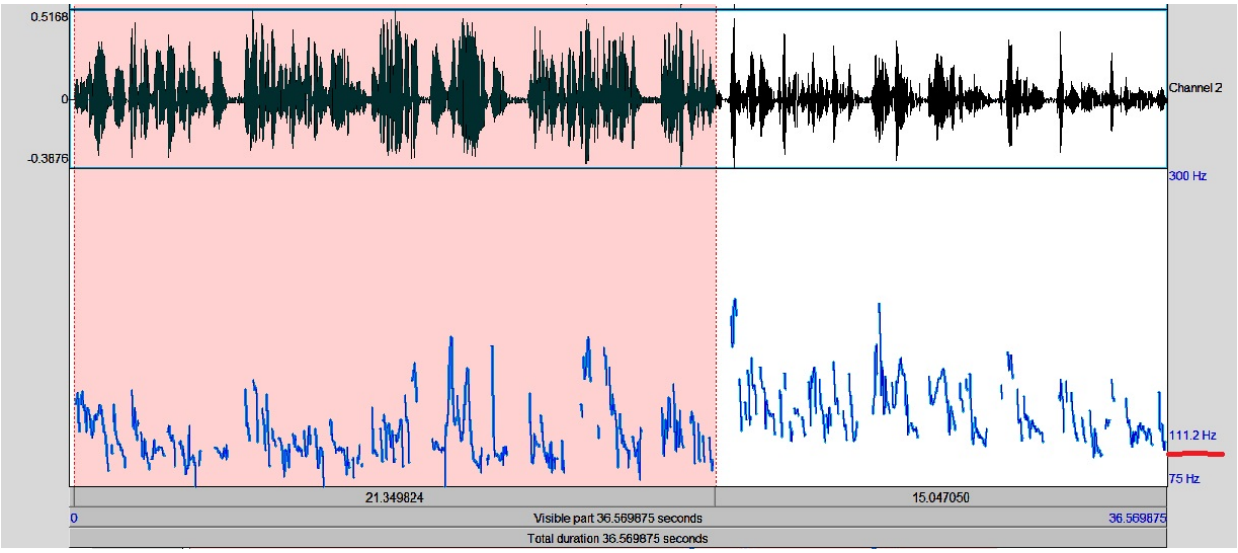
OLS regression is used. The dependent variable is ln(volatility ratio), which is the natural log of the stock return volatility *from* the minute (day) of the interview divided by the volatility *before* the minute (day) of the interview. T-statistics are reported on every second line. Standard errors are clustered at the CEO level. +, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. For variable definitions, please refer to Appendix A.

Table 10. Stock market event study (N=167)

Event Window	CAR	t-stat
[-5,5] minutes	0.41%	1.22
[-8,8] minutes	0.59%	1.49
[-15,15] minutes	0.69%+	1.63
[60,60] minutes	0.91%*	1.66
[0] day	1.22%***	2.69
[-1,1] days	1.54%**	2.07
[0,10] days	1.76%	1.39

+, *, **, and *** denote statistical significance at the 15%, 10%, 5%, and 1% levels, respectively.

Figure 1. Voice pitch of the CEO of Barclays before (Bob Diamond: left) and after (Anthony Jenkins: right) the crisis



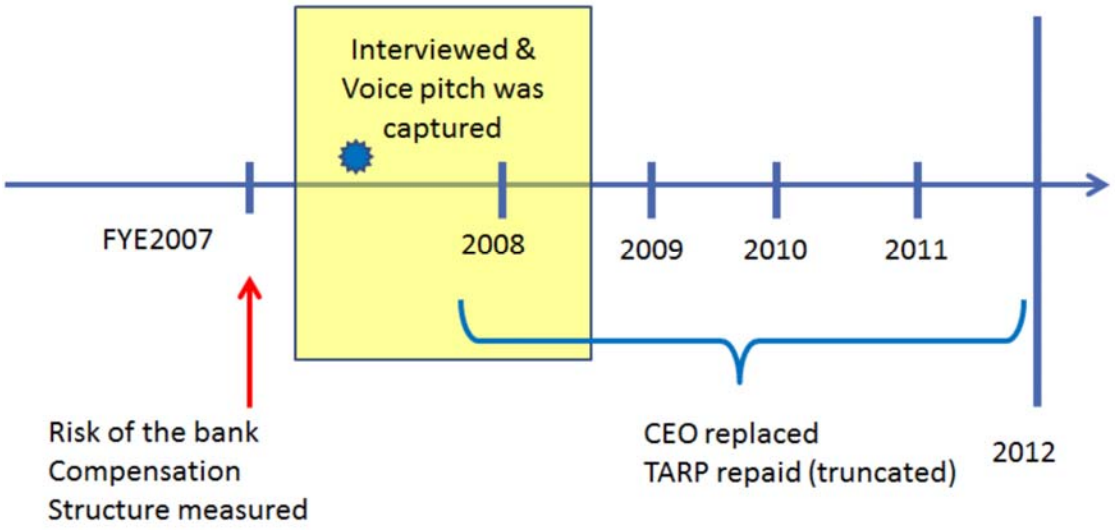
This figure is a screen capture of a voice file (MP3) analysis using Praat software. We first created a video interview file based on two interviews: the first is the interview with Bob Diamond, the CEO of Barclays, before the crisis in 2008, and the second is that of Anthony Jenkins, the CEO of Barclays after the crisis. The first 21.35 seconds of the file is Diamond's conversation. The remaining 15.05 seconds of the file is Jenkins' conversation. Because we hand selected the portion of Diamond's conversation (red/shaded part), Praat gives the mean of the voice pitch in this interval (111.2 Hz on the right hand side – manually underlined). This is the voice pitch of Bob Diamond. The software provides more-detailed numbers of the mean, max, and minimum voice pitch over the selected interval. We obtained Jenkins' voice pitch in the same way (130.3 Hz).

Figure 2. S&P 500 index and sample period

The yellow boxed period is the sample period. Solid line shows the S&P 500 index.

Figure 3. Timeline of interview sample and empirical analysis

Panel A. Interviews in 2008 (N=111)



Panel B. Interviews in 2009 (N=56)

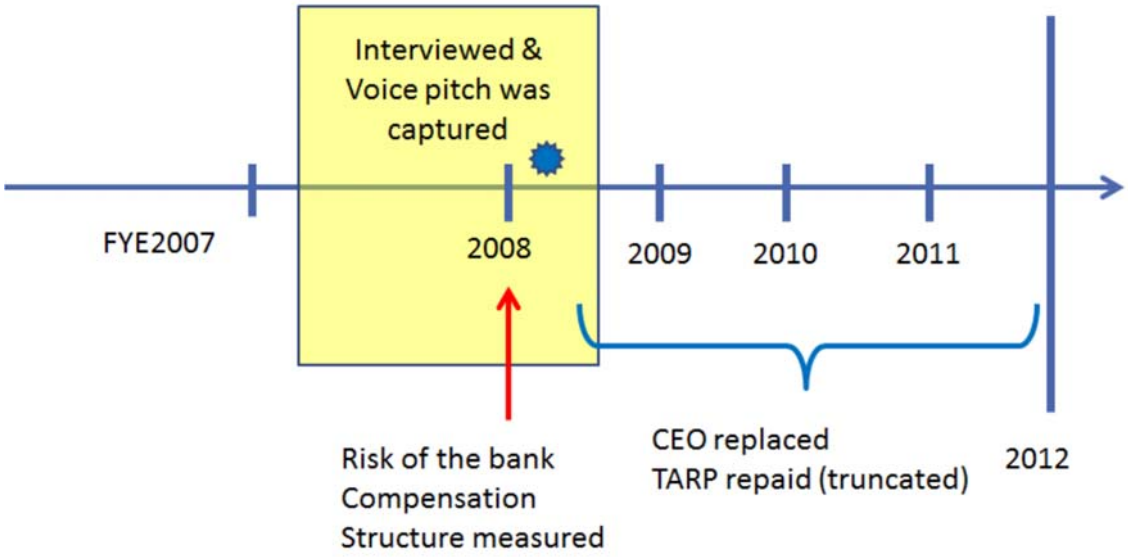
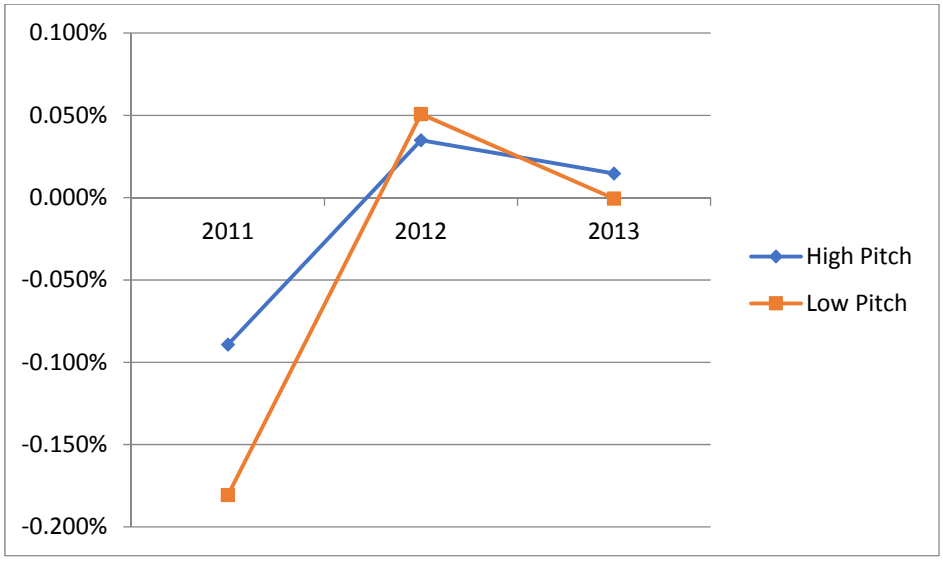


Figure 4. Subsequent performance (Daily Alpha over the fiscal year) after TARP repayment



Daily Alpha is the intercept in the daily market model using the S&P 500 index return over each fiscal year.

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