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Facial Masculinity of Corporate Executives and Corporate Governance: UK Evidence

by

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Thesis for the degree of Doctor of Philosophy

February 2024

University of Southampton

Abstract

Faculty of Social Sciences

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Degree of Doctor of Philosophy

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There is ample evidence that the facial features of different people are interpreted differently in the political, commercial and military spheres. Whether facial features can predict human behavior is still widely discussed. This paper explores the association between facial width-to-height ratio (fWHR) and corporate governance performance using a sample of images of executives of UK-listed non-financial companies. This study finds that corporate executives with high fWHR are more aggressive and thus have lower accounting conservatism and higher stock price crash risk.

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Acknowledgements

I would like to express my gratitude to all those who helped me during the writing of this thesis. I gratefully acknowledge the help of my supervisors, Dr. Peng Wang and Dr. Maggie Zhang, who has offered me valuable suggestions for academic studies. In the preparation of the thesis, they spent much time reading through each draft and provided me with inspiring advice. Without their patient instruction, insightful criticism, and expert guidance, the completion of this thesis would not have been possible.

I also owe a special debt of gratitude to all the professors at Southampton Business School, from whose devoted teaching and enlightening lectures I have benefited a lot and academically prepared for the thesis.

Last but not least, I would like to thank my parents, for their encouragement and support.

Paper 1: Literature Review：Facial Masculinity, Accounting Conservatism and Stock Price Crash Risk

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1. Facial Masculinity

1.1 Testosterone

1.1.1 Introduction

Testosterone is a steroid from the androstane class and the primary sex hormones in males secreted mainly by testicles. It is critical for the development and maturation of male reproductive tissues as well as the maintenance of secondary sexual characteristics. It functioned by binding to androgen receptors for signaling cascades arousing whose loss can lead to various abnormal phenotype like frailty or regression of the male secondary sex tissues (Nieschlag et al., 2012; Mooradian et al., 1987). In the clinic, testosterones can be served as a therapy for treating hypogonadism, a disease with dysfunctional gonads in hormone production, and breast cancer in women (Nieschlag et al., 2012).

The exist of testosterone was probably recognized way earlier than its official discovery since the impairment of hormone always along with an apparent phenotypical alternation. By having an exposed scrotal position, testes are very susceptible to damage or accident, and the subsequent unusual phenomena can easily facilitate the recognition of the causal relationship between the elimination of testes and the absence of its products. Therefore, the effects of testosterone or lack thereof, have been known for a long time (Nieschlag et al., 2012). Butenandt (1931) was the first to extract a hormone from human urine in Europe, but the knowledge level of the hormone was low, and this new discovery aroused the interest of researchers. Four years later, Ernst Laqueur and his group in Amsterdam had obtained 10mg testosterone from 100kg of testes of bulls (Daivd et al., 1935). They named it testosterone since its hyperactivity as compared to androsterone, and Butenandt and others had discovered its chemical synthesis in the same year and officially initiate the modern pharmacology and endocrinology of testosterone, and male reproductive physiology (Nieschlag et al., 2012).

After the discovery of testosterones, pharmaceutical company had noticed and concerned about it, and then expanded their interests to the general androgens.

Various chemical modification had been done to steroid molecules and screened for derivatives that share similar functions as testosterones（Dorfman and Shipley 1956）. Followed with identification, chemical synthetic or erythropoietic methods of the modified steroid would be developed. Until 1976, the number androgenic steroids had increased to around 1000. One milestone of the androgen market falls onto the commercialization and popularization of intramuscular testosterone undecanoate preparation in 2004, which is the first real testosterone depot preparation. While in the field of pharmacology, people more interested in the function of testosterone like determining sexual preference or influencing aggressive behavior, which haven't been proved until recent (Nieschlag et al., 2012).

1.1.2 The test of testosterone

In the clinic, testosterone is a significant biomarker to represent the health status of patients, especially male. Doctors quantify the testosterone level in the serum or urine for clinical use and each method have its pro and cons. Circulating testosterone can be specifically or non-specifically bound to either hormonebinding globulin (SHBG) (44%) or albumin (Alb) (54%) respectively and 2% of them will be left unbounded. Due to the weak bound between the Alb and Testosterone, non-specifically bounded testosterone can be easily released from the Alb and be utilized by the organs, while specifically bounded testosterone loses their bioactivity by their tight bound with SHBG. We termed Alb bounded testosterone (Alb-T) and free testosterone together as the bioactive testosterone (Bio-T). The level of Bio-T in the blood can be more representative in the clinical situation than the total hormone level in plasma (Vimmeren et al., 1999). Various disease such as cardiovascular disease, osteoporosis, diabetes, metabolic syndrome, atherosclerosis, or mortality risk had been proved in their association with testosterone serum concentrations. Testosterone serum concentration also had been seen to have heritability as the observation between twins in the serum concentration indicates that genetic factors can be responsible for 65% of the serum variation (Ohlsson et al., 2011). For inspecting hirsutism or amenorrhea, females sometimes are required to take testosterone measurements while there aren't valid assays exist for acquiring a

confidential testing result (Kane et al., 2007).

Urine may not as convenient as blood serum for testosterone measurements in clinic owing to the limitation of methodology, while single testosterone serum measurements may not be confidential and representative. Under some circumstances, like screening the patients that would be beneficial from endocrine therapy, urine testosterone measurements can be informative than that taken from blood serum. Testosterone glucuronide level in urine can be constant in long-term aspects so that it is commonly applied as an index of androgen production. The method of urinary testosterone analysis requires precise manipulation and processing in order to obtain data in an outstanding sensitivity and quality (Venturelli et al., 1995).

1.1.3 The Effects of Testosterone

1.1.3.1 The Effects of Testosterone on the Body

Testosterone is significant for the body health. Around 30-40% men aged 40-79 is facing the testosterone deficiency and the prevalence of various disease like obesity, diabetes or hypertension in the population had been noticed. However, the causal relationship of testosterone deficiency to those disease is not scientifically approved, and people more tend to recognize it as a medical comorbidity currently. People had observed a bidirectional inverse relationship between the onset of metabolic syndrome and abnormal testosterone levels。 Besides, a positive association between abnormal testosterone levels and increase mortality and cardiovascular disease risk is also observed. In clinic, patients bearing metabolic disorders and low serum testosterone concentration had been treated with testosterone replacement therapy to restore their testosterone level for three months. During the period, patients are monitored in their disease syndromes and changes in appearance and body parameters, such as changes in desire for sex and the percentage of fat in the blood. The treatment had showed to refine the conditions of patients, relief their syndrome and restore their body function, which proved the practicability of testosterone replacement therapy in defective patients (Traish et al., 2011).

Testosterone can play an integral role in obesity as the frequent observation of low testosterone concentration along with an increasement in body fat and weight, which had been reported by several studies when they compared the concentration of free testosterones, Abl-T and SHBG-T with body weight in different age groups. Testosterone deficiency is also associated with energy imbalance, impaired glucose control, reduced insulin sensitivity and dyslipidaemia, which could be possibly explained by the androgenic effects on relative enzymatic pathways (Kelly and Jones, 2015). Testosterone could impact the metabolism of fatty acid, glucose, and energy utilization cascades, which could differ from tissue and organs based on their texture and regional fat depots. Testosterone replacement therapy is available currently in the clinical as a treatment and proved its efficiency in resolving obesity in patients. Enhanced testosterone concentration could restore the interrupted metabolic pathways to increase the consumption of cumulated adipose tissue or muscle. Besides, in psychological aspects, enhanced testosterone concentration in the blood could boost the mood of patients and motivate them to exercising, enjoying life, and involving in more activities. For a better therapeutic effect, long-term treatment is necessary (Kelly and Jones, 2015).

The impact of testosterone on brain is controversial where both positive and negative impacts had been investigated and proposed. One important role of testosterone on brain have been reported as its protective function on neuron cells in hippocampal region by preventing apoptosis (Ciocca et al., 2016). The difference in spatial recognition and age-related decline in cognition and mood between male and female had proposed to be a result of testosterone difference between genders. Testosterone could control the cortical network, the ventral processing network, when spatial recognition is in progress. An increased testosterone concentration could improve the perform of patients in spatial cognition (Zitzmann, 2006). Interestingly, some research actually showed a negative correction between the spatial cognition and testosterone when patients were conducting simple tasks, which may be due to the inference with concentration. Depression was also proposed to be associated

with the regression of testosterone one concentration. A study conducted by Rancho Bernardo had shown a valid relationship between reduced bioactive testosterone concentrations, due to ages, and increased depression syndromes in patients. By treatment replacement treatment, depression mood can be relief and patients can be more positively involved in their life.

1.1.3.2 The Effects of Testosterone on Social Relationships

Low testosterone concentrations can induce depression, while high concentration may induce aggression. People had discovered that high level of testosterone concentration is always along with aggressive populations. Animal study had showed the effects of testosterone on aggressive behavior on birds where birds bearing high testosterone concentration were more prone to attack and anger (Archer, 1991). Neuroimaging techniques in adult males had shown that the activity of amygdala had been aroused by testosterone binding and the control from pre-frontal had been weaken (Batrinos, 2012). In adults, comparison between groups having either high or low aggressive behaviors revealed that high group has high concentration of testosterone. Scientifically, the casual correlation between aggression and high testosterone may not be statistically significant while positive overall for trait measurements. One suitable location for sampling can be the prison where majority of the population in prison have shown to be aggressive. In 1972, the first experiment to prison had been conducted by Kreutz and Rosel and they have found that adolescence has even higher testosterone levels than aged population, which could indicate the age can be a factor to be considered when evaluating the effects of testosterone. Although various studies had indicated the positive correlation between high testosterone and aggression, negative correlation had also been reported by some groups, or no impacts. Several factors could possibly explain such deviation of results (Book et al., 2001). The first explanation falls onto the reliability of testosterone measurement methodology which could bring in cofounding factors and error. Another explanation falls onto the fluctuation of testosterone periodically, so that the time of measurement is important. Testosterone level is circadian and has a substantial variation over 8-20 daily cycle (Doering et al., 1975). Those factors can

contribute to the result deviation since a single sampling had been conducted by researchers rather than multiple time sampling (Book et al., 2001).

Due to the psychological impact of testosterone on individuals, it is reasonable to correlate it with the social status maintenance. Neuroscientists have found that testosterone could directly or indirectly control the brain region regulating social behaviors (Eisenegger et al., 2011). A placebo-controlled experiment (N=243) with testosterone treatment had been conducted to men and their desire of status brand and products had been recorded. The results showed an increased in preference on status brand and product on testosterone treated group as compared to the others. Besides, if the brand or product were described as status-enhancing, the interests from men in testosterone treated group would significantly increase, but not when the products were described as power-enhancing or high quality (Nave et al., 2018). High social status can increase the chance in success mating, promote access to resources, reduce life stress and increase the social impact, which can be the reason of their attractiveness for testosterone-drived individuals. Testosterone levels have also been linked to implicate motivation and attentions. People have found that individuals with high testosterone levels more tends to have power implicitly. Van Honk et al. (1999) have found that baseline testosterone was positively correlated with the attention to anger face rather than neutral face, which means people having high testosterone can be more sensitive to things that are threatening to their status and then correspond in accordingly to protect their social status (Newman et al., 2005)

1.2 Facial Features

1.2.1 introduction

Face expression can be informative, and people can gain a lot of socially relevant information from face when they see others in person and then make a proper social interference with each other. Some transient emotional status like surprising or fear can be indicated by noticing face expression. Although sometimes face expression can be deceptive, it is still reasonable to utilize it as a reference for indicating

emotions or moods (Kramer and Ward, 2010). In some cases, physical attractiveness, or physical features, including appearance, can be utilized to predict your earning in a group or even election outcomes (Tingley, 2013). Besides that, personality can also be predicted or evaluated by facial expressions. One experiment had shown that internal features of the face, specifically the area around the eyes, nose and mouth can be informative on evaluating body health and four of the Big Five personality factors: agreeableness, extraversion, neuroticism, intellect/imagination. For utilizing face expression to predict heath, traditional Chinese medicine can serve as a convictive example. Facial observation is a significant step in diagnostics where doctor would observe for your complexion in different regions of face, and different conditions would represent different kinds of health issues like a red color at your nose may indicate inflammation in your liver or dark color at your ophryon may indicate a severe disease. However, some reports had concluded that the health rating can be more accurate if the effects of appearance are excluded. Additionally, it is also reported that external features can contribute to accurate identification of health and personality, they may actually impact the accurate judgement to the image ability or intellectual levels of an individual (Kramer and Ward, 2010). An argument about the capability of facial status as an indicator for health is ongoing in the scientific field (Kramer and Ward, 2010).

Face can provide a visible sign for health, or we actually adapted to this trait for the purpose of guiding mate choice. It is thought that people who are capable of presenting health conditions by their face is more prone to inherit their genes by increasing their attractiveness to others and during the mating process, people are more prone to choose individuals having a health appearance (Kramer and Ward, 2010). Experience in life could potentially impact the attractiveness or preference to certain type of individuals, like your childhood or previous relationship, and may serve as a confounding factor, perception of attractiveness is still thought, at least in a great degree, to be a human evolutionary heritage Carré and McCormick (2008). While facial expression can be predictive for various factors, one disadvantage could be the consequent empirical stereotypes. For example, a standard stereotyping

models suggests that racial-category membership may be inferred from Afrocentric features, and category-based stereotyping could be ensured on that basis (Blair et al., 2004).

1.2.2 The Measurement of Facial Features

For a scientific way to quantitively measure the facial features or facial expression, scientists had come up with a concept called facial feature points, which is also known as facial land markers or facial fiducial points. Points are mainly located around the around the assigned facial components (eyes, nose, mouse, ears, or chains) and we monitor the pattern of the point and manually label and track them in images, which is referred as facial feature point detection (FFPD). FFPD usually started with using a face detector to generate a rectangular bounding box for facial locating and initializing the positions of facial feature points (Wang, 2016). Cootes et al (1995) suggested that facial feature points can be simplified into three types where the first type labels the points in the parts of faces with application-dependent significance, such as the center of eyes or the sharp corners of a boundary; the second type labels the point in the parts of face with application-independent elements, such as the highest point on a face in a particular orientation or the highest points along the bridge of nose; the third type labels the points that are interpolated from points of the previous two types, such as points along the chin. Different numbers of facial feature points can be grouped into different number of models (17,29,68) based on the application scenarios. Several common should be covered in all models including eyes, nose, or mouth since they contain the most important information for both discriminative and generative purpose (Carré and McCormick, 2008). The sensitivity of the FFPD depends on the number of collected facial feature points while times-consumption is a tradeoff. In general, there are two types of FFPD methods, the parametric shape model-based methods and non-parametric shape model-based methods. The first method goes from parts to the whole. Initially, Points were detected around several regions and then those points would be constrained by a global shape model. The second method abandon the shape or regional distribution criteria. However, this doesn’t mean that the processing is totally free

from the shape constraints, which can be implicitly embedded in the model. Such implicated shape constraints can be in the form of a graphical structure (graphical model-based methods) or a deep structure (deep-learning-based methods.

1.2.2.1 Facial Width-to-Height Ratio (FWHR)

Another scientific way to measure the facial features is the facial width-to-height ratio (FWHR) or the bizygomatic width divided by upper-face height. FWHR was first described by Weston et al. in 2007 as “a sexual dimorphism in the structure of the face that was independent of body size, from a morphometric analysis of an ontogenetic series of skull”, and such concept had been further investigated by Carre and McCormic in 2008. However, detailed evidence to supporting the sexual dimorphism is lacking, as well as the impact of age and the relationship between such dimorphism and perceived aggressiveness. Width-to-height facial dimorphism that is independent of increased body size and has a greater ratio in men than in women occurs during the puberty of individuals. Males and females were found to have different trajectories and diverge their bizygomatic width but not for upper facial height. The sex different in the facial width-to-height ratio raised in the end of the puberty, more specifically, when sex differences in facial structure related to body size appear. The possible explanation for the arise of sex difference in FWHR could falls onto the difference in testosterone concentration at puberty in males (Verdonck et al. 1999). Larger FWHR associated with males occurs mainly during their young age. As for aged populations (over 40), females actually showed a larger FWHR instead (Summersby et al., 2022). With the sight of natural selection theory, sexual dimorphism could be a result of natural intra and inter sexual selection. During the evolution progress, men with masculine facial feature may be favor over other individuals who lacking such characteristics and obtains more valuable sources that are important for survival and reproduction. They had a high change in living and their genes were inherited and spread in the population and eventually generate sexual dimorphism (Carré and McCormick, 2008). FWHR has been found to be a facial metric which significantly correlates to a range of behavioral traits in male population. Both negative or positive behaviors can be predicted by analyzing

FWHR, which including aggression, deception and untrustworthiness or achievement striving and self-sacrifice towards the in-group. Indicated by several other studies, people indicated that FWHR can also be used to predict the tendency of others in being aggression or being trustworthy (Carré and McCormick, 2008). Age plays a role for the perceived aggressiveness between genders as the relationship is strongest for males at 27-33 and females at 34-61 (Summersby et al., 2022).

1.2.2.2 The Relationship between Facial Width-to-Height Ratio and Testosterone

As indicated previous, testosterone concentration could explain the difference FWHR between genders around the end of their puberty as testosterone concentration controls the sexual characteristics and FWHR is sexual dimorphism. However, controversial conclusion exists report that the relationship between testosterone and FWHR can be either positive or negative, with positive relationship as the most reported. Man having high levels of testosterone can also have high FWHR and females always has low FWHR since they have low levels of testosterone. A study conducted by Dr. Pound had proved a positive correlation between circulating levels of testosterone and facial structure in young adulthood. Since testosterone can cause craniofacial growth, a long-term exposure of individuals to large and frequent testosterone can cause a greater accumulation of hormone's masculinizing effects, which increase the growth of facial structure. While at the same time, an increased exposure to competitive situation will also further induce the effect of hormone's masculinizing effects as they may stimulate the secretion of testosterone in the body. Such phenomena are similar to that between postprandial blood glucose spikes and tissue damage where intermittent spikes in hormone levels may have more pronounced effects than chronic exposure to a steady hormone level (Pound, 2008). Another experiment conducted by Ronan et al. also reported a positive correlation between testosterone level and perceived facial masculinity in men. A moderate correlation (r=.34) between ratings of masculinity in natural, unmodified faces and baseline testosterone levels had been reported. One experiment used a forced-choice paradigm also reported a weak but significant association between testosterone levels and facial masculinity in men (Lefevre et al., 2013).

Testosterone mediates the association between FWHR and behavior by controlling the facial structure growth and neural cells respectively. The effect of testosterone on bone growth leads to the structural difference between genders since men have a significant high concentration of testosterone than women. Besides that, intra-sex difference also exists as testosterone concentration differ among men and testosterone can be a major impact factor. For women, different factors may be responsible for the intra-sex difference since they are low in testosterone. Consequently, differential effects of testosterone on bone growth may be unique for men and the facial structure can reflect the exposure pattern (amount or frequent) of testosterone during the growth period or life of a man. As indicated above, testosterone can impact the behavior of an individual, and combined with the effect of testosterone on bone growth, we can explain the phenomena where masculine man (high FWHR) more tends to be aggressive. FWHR can be the best replacement measurement for testosterone levels when doing the testing since along with the behaviors, we can reflect the testosterone levels of a man in the present and past.

The testosterone mediated correction between facial structure and behavior had also been confirmed by other scientific method. Other than FWHR, second-to-forth digit ratio, which is a putative proxy measure of in-utero testosterone exposure-has been utilized to quantify the facial structure. This index had been showing a link to levels of both self-reported and lab-induced aggression by Millet and Dewitte. They also showed that, by having different 2D:4D(putative marker for prenatal testosterone), individuals' response differently to certain stimuli. After viewing an aggressive music video, men with more masculine (lower) 2D:4D ratio give a more aggressive response to a series of hypothetical provocation scenarios, while at the same time, not for individual with high 2D:4D ratio (Lefevre et al., 2013).

Thus, the testosterone mediated correction between facial structure and behavior had been demonstrated from different aspects and by different experiments. However, some people reflect such corrections as they demonstrate a negative

correction between FWHR and testosterone. Some people suggested that FWHR is neither associated with salivary baseline testosterone in either sex, nor with competition-induced testosterone reactivity (measure in men only) or hair testosterone (measure in women only).People who objectively studying the global facial masculinity rejected its correction with testosterone measurement (Pound, 2008). In group applying the 2D:4D methods, they reported that the 2D:4D ratio is not associated with perceived facial masculinity in a large set of study population (Ferdenzi et al., 2011).

1.2.2.3 Sample Selection and Measurement Methods for the Facial Width-to-Height Ratio

1.2.2.3.1 Sample Selection

Taking photos is the most straightforward way to get a sample of people. In biological and sociological research, the acquisition of human samples is often relatively easy to access. For example, Linke et al. (2016) took facial shots of 48 men with a Nikon camera when studying the relationship between male appearance and social success. In order to reduce the influence of different cameras on the research, Lefevre et al. (2012) used three different cameras and a 3D printer to take pictures of the facial appearance. When taking photos, the researchers will ask the people being photographed to look forward and use it to ensure that the researchers get the correct facial information correctly. All retrieved face images are looking straight ahead, with neutral expressions, looking directly at the camera.

Finding photos from databases and the Internet is also widely used by researchers to acquire samples in researches. For some photo sample collections of celebrities and particularly large-scale people, it seems impractical to take photos on the spot. In the absence of live photographs of players, Tsujimura and Banissy (2013) collected facial photographs of Japanese professional baseball infield and outfield players and measured their fWHR. Use of photos obtained from the web is considered very reliable (Carré and McCormick, 2008). Lewis et al. (2012) used photos of previous US presidents found on the Internet, measured their fWHR and found a positive

correlation with the achievement drive during their tenure. It is worth noting that the study of fWHR is not limited to biology and sociology, and more researchers have substituted fWHR into the study of corporate governance. In the study of corporate governance, researchers can basically only obtain sample photos from the Internet (Jia et al., 2014; Re and Rule, 2016; He et al., 2019; Kamiya et al., 2019; Cleary et al., 2020), because it is basically impossible to take photos that meet the requirements on the spot. The main ways to obtain photos of company executives from the Internet are through Google Photos, the company's official website and the company's annual report. Getting samples from Google Photos is widely used by researchers, and for some celebrities (Lewis et al., 2012; Ahmed et al., 2018; Kamiya et al., 2019; Mills and Hogan, 2020), photos from various angles can be found here. Biographies on company websites and personal photos in company annual reports tend to be more formal, and this researcher provided a high-quality sample source (Jia et al., 2014; He et al., 2019). In addition, researchers can also find a large number of personnel photos in a short period of time through databases, such as the Securities Association of China (SAC) database used by He et al. (2019) and the publicly-available database of Re and Rule (2015).

In order to better measure the fWHR of the people in the sample photos, all researchers will have requirements for the quality of the photos when selecting samples. Carré and McCormick's (2008) first described that when taking a sample photo of a person, the person must look forward and be able to clearly see the facial features. In addition, it is equally important to keep the character's expression in a neutral position (Jia et al., 2014; Kramer, 2016). Race and genders also influence fWHR measurements, as the effects of testosterone on craniofacial growth have been found to vary by genders and ethnicities (Kramer, 2015). Therefore, in the study of corporate governance, researchers prefer to use samples of the same gender, or samples of the same race (Cleary et al., 2020; Mills and Hogan, 2020).

1.2.2.3.2 Measurement methods

Most of the photos need to be processed before fWHR can be measured. Whether in

the field of biology or corporate governance, researchers prefer to use ImageJ software for photo editing. This software was developed by the National Institutes of Mental Health Research Services Division of the National Institutes of Health (https://imagej.net/Welcome). Carre, McCormick, and Mondloch (2009) were the first to describe the procedure for measuring fWHR using ImageJ, where they converted each image into an eight-bit image with a standard height of 400 pixels prior to measurement. In addition, turning the photo into black and white will make it easier to identify the edges of the face, which is more conducive to measuring length. The software and procedures are widely recognized by other researchers and used in research (Jia et al., 2014; Linke et al., 2016; Hahn et al., 2017; He et al., 2019; Cleary et al., 2020). Psychomorph software and Adobe InDesign were also used by the researchers to measure fWHR (Re and Rule, 2015; Mills and Hogan, 2020).

To make the fWHR measurement more neutral, the researchers preferred to have multiple people measure the same photo and take an average. Two research assistants of Rasband (2008) used ImageJ software to measure each image independently for the first time. In addition, the researchers considered that if the difference between the measurements from two observers was less than 5%, the mean of the two measurements was used as the final fHWR. However, if the measurements differ by more than 5%, then the facial structure measured by a third research assistant is less than 5% different from either of the first two measurements. If it continues to be greater than 5%, the sample is discarded. For studies with a large sample size, researchers tend to use Python to capture facial data information. Kamiya et al. (2019) used Python coding based on the Anaconda platform to mark 68 landmarks with fixed serial numbers for faces. fWHR is the distance between 2 and 16 divided by the distance between the midpoint of 22 and 23 and point 52.

1.2.3 Endogeneity

It is controversial whether male facial features are endogenous. According to research, fWHR is a biological indicator, and this indicator is heritable and cannot be changed at will (Haselhuhn et al., 2013). Jia et al. (2014) compared the

overconfidence index with fWHR and believed that the facial structure of the CEO was measured on his own face, so there is no endogenous result caused by the corporate governance mechanism. Therefore, most researchers believe that endogeneity issues do not need to be considered when fWHR is used as the main research variable. For example, He et al. (2018) believe that genetic characteristics make fWHR less likely to be artificially changed, so they believe that there will be no reverse causality issue. This idea has also been confirmed by other researchers (Jia et al., 2014; Shi et al., 2023; Chan et al., 2020;). In addition, the study by He et al. (2018) also mentioned that the surrounding business environment, economic factors and pubertal development are unlikely to change the male facial bone contour, so fWHR will not be affected by other factors and the possibility of confounding effects was ruled out. Some scholars have further considered whether there is endogeneity in fWHR. For example, Ahmeda et al. (2019) believe that certain bank characteristics may affect both the level of risk-taking and the choice of bank CEOs, so banks may be more inclined to choose a CEO with more male facial features. But Jia et al. (2014) believe that in empirical studies, it is challenging to explain this selection effect because researchers cannot observe the selection variables. At the same time, their research also proposed that by using information from both sides of the match between managers and companies, fWHR should be less affected by the endogenous matching problem.

Although many researchers emphasize that there is no endogeneity issue when studying the relationship between fWHR and business, there are still some other scholars who try to expand research in this area. Shi et al., (2023) believe that the decision to merge and acquire may be endogenous and therefore may lead to omitted variable bias. They include year and industry fixed effects in each regression analysis to correct for omitted variable bias. Other researchers have similar concerns and control for a range of characteristics to reduce the impact of omitted variables (Tian et al., 2022; Nasih et al.,2022). In addition, they believe that the decision of companies to engage in M&A activities may not be random, which may lead to self-selection bias and use the Heckman two-step sample selection model to address this

selection bias. Mills and Hogan (2020) also used two-stage instrumental variable regression to examine possible endogeneity between CEO fWHR and existing firm financial characteristics. However, the resulting coefficient of their test is not statistically significant in the second-stage regression and therefore does not indicate endogeneity in the relationship between CEO fWHR and existing firm financial characteristics. Endogeneity in other areas has also been mentioned. For example, Kozlov et al. (2018) explored fWHR and the risky decision-making of Russian governors and argued that omitted variable bias may occur when the federal government does not appoint governors. They addressed this concern through a proxy approach that controlled decision-making center appointment decisions.

1.2.4 Selected Studies of Facial Width-to-Height Ratio and Corporate Governance

Previous research has involved the important role of fWHR in corporate governance research. This section reviews the literature on fWHR and corporate governance.

Selected Studies of Facial Width-to-Height Ratio and Corporate Governance

Authors	Variables	Sample	Results
Shi et al. (2023)	fWHR, Dominant power, Decision-making processes and Economic outcomes	1,225 chairpersons from Chinese listed companies	1.Chairpersons with high FWHR elicit negative and significant returns for the acquiring firm. 2.Chairpersons with high FWHR destroy the value of acquiring firms in both the short and long term.
Cleary et al., (2020)	fWHR, Coverage choice and Forecast boldness	715 analysts from the US firms	1.High-fWHR analysts are more likely to select firms with low earnings predictability. 2. High-fWHR analysts issue bolder forecasts.
Mills and Hogan (2020)	fWHR, Firm leverage and Cash holdings	968 CEOs and 510 firms from the US	1. Higher fWHR in CEOs will be associated with more aggressive financial policies.

			2. High-fWHR CEOs will have lower cash holdings than low-fWHR CEOs.
Kamiya et al. (2019)	fWHR, Financial risk, Firm risk and Acquisitions	1,162 unique CEOs in the public US firms	1. CEOs' masculinity is associated with more riskiness in the firms. 2. Higher fWHR will be driven by increased financial leverage and acquisitions.
Ahmed et al. (2019)	fWHR and Bank risk-taking	134 individual CEOs and 104 banks from the US	1. CEO facial masculinity is positively associated with banks' risk taking.
He et al. (2018)	fWHR and Forecast characteristics	1,744 Analysts from Chinese firms	1. Analysts with high fWHR issue more accurate earnings forecasts. 2. he positive association between fWHR and performance is more pronounced for analysts with lower status and for firms with higher uncertainty.
Jia et al. (2014)	fWHR and Financial misreporting	763 CEOs and 1,996 listed firms from the US	1. Firms with CEOs with more (less) masculine faces have a higher (lower) incidence of misreporting.

2. Accounting Conservatism

2.1 Conservatism

Conservatism was one of the most influential political philosophies and ideologies of the post-Enlightenment era. Conservatism is a philosophical, cultural, and social movement, the definition of which has been controversial. In theory, 'conservative' is a generic term for 'right-wing views that occupy the political spectrum between liberalism and fascism' (Hamilton, 2019). For the conservative, the ideal is inseparable from the practical. Therefore, conservatism bases its judgment of things on previous experience rather than on reason. Hamilton (2019) also mentioned that conservatism exhibits a paternalistic or authoritarian stance rather than freedom, but most commentators still see it as a modern political philosophy.

Additionally, conservatism considers continuity, community, tradition, and hierarchy as integral parts of a good society and provides a broad philosophical justification for doing so (Skorupski, 2015) There is a pragmatic, down-to-earth attitude that has been called pragmatic conservatism. Pragmatic conservatives believe that it is useful to protect and, if necessary, refresh effective institutions and customs, whatever they may be. They make no universal claims; what works here is what works.

For the reason of the existence of conservatism, it may be necessary to contrast it with liberalism. The liberal project is one of stating universal principles (Gray, 1995). People and communities with different conceptions of the good and different views of the world can accept as a framework condition for peaceful coexistence, which cannot be achieved. As Gray (1995) argues, while liberalism is the political theory of modernity, it is ill-equipped to deal with the dilemmas of postmodern conditions.

Conservatism derives from many forms and has different types of roles, such as cultural conservative, social conservatism, national conservatism, religious conservatism, and accounting conservatism. Here is a brief description of what each of them means. First, cultural conservatives only protect the heritage and culture of their own country or a common culture that is not bounded by national borders

(Seaton, 1996). They do not consider themselves obliged to protect the culture of another country. Additionally, there are some overlaps and seeming similarities between social conservatism and cultural conservatism. However, social conservatives may believe that society is built on a fragile network of relationships that need to be maintained through responsibility, traditional values, and established institutions (Heywood, 2017). Also, National conservatism, which exists mainly in Europe, is more focused on national interests than standard conservatism, as well as the preservation of cultural and national identity (Mandal, 2007). For religious conservatism, conservatism is reflected in the application of the teachings of a particular religion primarily to politics. Sometimes they simply declare the value of these teachings for society, and sometimes through these teachings they also influence the law (Andersen et. al, 2005).

The author will focus on the study of accounting conservatism. Despite persistent criticism of conservatism, conservatism plays an essential role in accounting practice. Conservatism is an integral part of accounting. One of its functions relates to the contractual division of a company's earnings between different claimants (Watts, 2001). Additionally, accounting conservatism requires a high degree of validation before a company can make a legitimate claim on any profit. The general concept is to consider the worst-case scenario for the financial future of the company (Sterling, 1970). A point of particular note is that income is only recorded when it is certain to be received, but liabilities are recorded when they are discovered. Watts (2001) also mentioned that conservatism evolved from the contractual role of accounting but was also influenced by the regulatory environment. Both contracts and regulations provide support for accounting conservatism.

2.2 Application of Financial Statements

A financial statement is an official record showing the financial activities and position of a business, individual or other entity (Fraser et al., 2016). A financial statement is used by lenders and investors to check the financial position and profit potential of a business. Because a financial statement provides a clear picture of the company's

financial position, it enables informed business decisions to be made.

The advantages and disadvantages of the financial statement can be summarised as follows. Financial statements provide users with decision-useful accounting information about the financial position, results of operations, and changes in a financial position that is useful for economic decision-making (Shuli and Perri, 2010; Asllanaj, 2008). As different statement users have different information needs and are influenced by the economic, legal, political, and social environment; financial statements provide only the generic accounting information required by statement users and do not provide all the information. It is also limited in that it reflects the accounting information of one company and does not represent the industry as a whole. Moreover, much of the accounting information is derived from approximate measures and is not necessarily accurate (Charles et al., 2012; Asllanaj, 2008). Finally, it refers to the flow of information relating to the value stream and is not all the information required for decision-making.

There are different types of financial statements. In brief, a balance sheet shows activity at a single point in time, whereas an income statement, statement of changes in equity, and cash flow statement each show activity for a defined period. A balance sheet reports information about a company's assets, liabilities, and owners' equity at a specific point in time (White et al., 2002). The contents of this financial document contain a quantification of the company's assets, current liabilities, and owner's equity, showing most directly the amount of money the company has, the amount it owes, and the amount invested by shareholders. The balance sheet does not show anything other than a summary of the company's performance. However, if the balance sheet is viewed in conjunction with a cash flow statement, or other financial documents, it can provide additional financial information.

In addition, an income statement reports information about the operations of a company, including sales and the various expenses incurred during the period in question (White, et al., 2002). The income statement provides information, such as

revenues, expenses, income before tax, cost of goods sold (COGS), and EBITDA (earnings before interest, taxes, depreciation, and amortization). The income statement, also known as the profit and loss account (P&L), summarises the cumulative effect of income, expenses, gains, and loss transactions for any given period (Das, 2010). Unlike a balance sheet, this statement alone shares insights into financial trends, and business activities (income and expenses) and provides comparative data.

It is worth noting that a statement of equity is a statement that reflects the changes in the components of shareholders' equity over the period. (White et al., 2002). The company's annual earnings are reflected in this statement as 'retained earnings'. This financial document indicates whether the company has engaged in any past activities that would affect shareholders' equity, such as share buy-backs, warrants, and options. This should provide a comprehensive picture of changes in shareholders' equity over a while, including not only increases or decreases in total shareholders' equity but also important structural information on changes in shareholders' equity, in particular, gains and losses that are taken directly to shareholders' equity.

Finally, a cash flow statement reports the cash flow activities of a company, in particular, it is operating, investing, and financing activities over a while (Griffin and Mahajan, 2019), which could be short or long-term. The statement divides cash flows into three categories, including operating activities, investing activities, and financing activities. Although cash flow and profit are important figures to know in financial analysis, they are not the same and there are significant differences between them. This is because cash flow is simply the money coming into the company and the money leaving the company, whereas profit is what is left after expenses are deducted. Cash flow showing a positive number indicates stable earnings and is usually the result of operating income exceeding net income, but this result does not equate to profitability.

Ruch and Taylor (2014) examined the impact of conservatism on users of financial

statements. They divided the users into three groups, namely equity market users, debt market users, and corporate governance users. Their research provides evidence that, firstly, accounting conservatism can lead to noisy, biased, and inefficient earnings forecasts. Secondly, it is demonstrated that both lenders and borrowers are in a debt-contracting situation. Finally, conditional conservatism benefits corporate governance by providing earnings that are more relevant to compensation decisions and by leading management to make better investment decisions. Therefore, the findings suggest that conditional conservatism mitigates information asymmetry for equity market users but reduces analysts' forecasting accuracy.

2.3 Accounting conservatism

2.3.1 Conditional conservatism

Conditional conservatism is a particular feature of the accounting system which means the asymmetric timeliness of the recognition of unrealized losses and gains in reported earnings (Gotti, 2007). In other words, in terms of conditional conservatism, book values are not written down in favorable circumstances (the conservative behavior), but they are written down in sufficiently unfavorable circumstances (Beaver and Ryan, 2005). According to Lara et al. (2020), for example, lower cost or fixed asset impairment accounting is known as a conditional conservative. Therefore, the main feature of this type of conservatism is that the company will impose a higher verification threshold on the recognition of earnings, due to the timely recognition of impending probable economic losses.

2.3.2 Unconditional conservatism

Unconditional conservatism is another particular feature of the accounting system. In terms of unconditional conservatism, an undervaluation of the book value of net assets is due to the intended aspects of the accounting process (Beaver and Ryan, 2005). For example, unconditional conservatives would immediately expense certain intangible assets, such as accelerated depreciation on property and equipment. In addition, examples of unconditional conservatism include the immediate expensing of

the cost of internally generated intangible assets and the amortisation of long-lived assets at a rate above the expected economic amortisation rate (Zhong and Li, 2017). Higher equity volatility assumptions and lower expected pension asset returns are also exampling of unconditional conservatism (Shaw and Whitworth, 2022). Beaver and Ryan (2005) show unconditional conservatism affects the asymmetry of current and lagged returns. This conclusion has been proven by their simulation studies. Unconditional conservatism introduces randomness into decisions based on financial information, which only reduces contractual efficiency and is also often considered to be a form of bias of unknown magnitude (Ball and Shivakumar, 2005; Ball et al., 2006).

2.3.3 Measurement of accounting conservatism

2.3.3.1 Book-to-market-based measures

A book-to-market-based measure of accounting conservatism is used to determine the value of a company's equity relative to its accounting book value. This is based on the premise that the market value of a company's equity reflects investors' expectations of the company's future profitability, while the accounting book value reflects the reported value of the company's assets and liabilities (Wang et al., 2008). These measures are based on the theory that companies that are more conservative in their financial reporting are likely to have a lower market value relative to their book value, and vice versa. While book-to-market value-based measures are useful in determining the impact of accounting conservatism, they also have limitations. For example, they are predicated on hypotheses that might not hold in all situations regarding the relationship between market value and accounting book value.

Many studies have used book-to-market-based measures to investigate the impact of accounting conservatism on financial reporting and analysis. For example, Feltham and Ohlson (1996) first find that auditor conservatism is positively associated with book-to-market equity, suggesting that auditors are more likely to be conservative in assessing firms with lower market values relative to their book values.

Similarly, firms with higher audit quality and more conservative financial reporting have a lower cost of equity, suggesting that investors value conservatism in financial reporting. However, Beaver and Ryan (2000) state that only the bias component can be used as a measure. They developed it further and it has been used quite extensively in the literature. This refinement decomposes the BTM ratio into a bias component and a lag component (Beaver and Ryan, 2000). Since then, the bias component of the BTM has been considered by Beaver and Ryan as a measure of accounting conservatism.

2.3.3.2 Accrual-based measures

The accrual-based measures represent the accounting adjustments to revenue or expense recognition in the financial statements before cash changes hands (Wang et al., 2008). This is an important part of financial reporting because they help to provide a more accurate picture of a company's financial position by matching expenses and revenues to the period in which they are incurred or earned. The net change in expected future benefits in the accrual basis of accounting is the total change in non-cash assets less the total change in liabilities, the final result being the consolidated accrual for the period (Larson et al., 2018). In general, companies that use a large amount of accrued expenses are usually seen as more conservative because they are more prudent in recognizing and disclosing financial information.

The accrual accounting process involves the accounting for non-cash assets and liabilities. Therefore, before the accrual basis of accounting can be defined, cash and non-cash asset accounts as well as liability and equity accounts need to be distinguished. Larson et al. (2018) define cash to include cash and short-term investments, while classifying other financial assets, such as long-term investments in marketable securities, as non-cash assets. In addition, the definition of equity includes only the equity of ordinary shareholders. Other types of mixed equity, such as preference shares and minority interests, are therefore treated as liabilities to calculate accruals (Dechow and Dichev, 2002). Changes in non-cash assets equal changes in expected future benefits, while changes in liabilities equal changes in

expected future obligations.

However, Larson et al. (2018) then provide some improvements to the modeling of accruals. First, it is shown that the impact of firm growth on accruals depends primarily on the net capital intensity at the beginning of the period. Second, additional derivatives and lags of cash flows beyond one year can provide additional explanatory power for accruals, especially for long-term operating accruals. Third, we introduce a variable from market to lagged book as a new and parsimonious way to model conditional conservative accruals.

2.3.3.3 Cash-flow-based measures

Cash-flow-based measures of accounting conservatism are indicators of the extent to which a company's financial reporting practices incorporate asymmetric treatment of gains and losses in its cash flows (Kim et al., 2022). These measures are intended to reflect conservatism in financial reporting, which results in a higher likelihood of loss recognition than gain in the financial statements.

An example of cash-flow-based measures that can be used to assess the degree of accounting conservatism is the cash flow variability (CFV) measure (Shen et al., 2021). CFV captures the degree of variability in a company's cash flows and is based on the notion that companies with more variable cash flows are more likely to be conservative in their financial reporting practices. Thus, a higher CFV score indicates more conservative financial reporting practices. The reason for this result is loss aversion, which suggests that individuals tend to experience more psychological distress as a result of losses than as a result of gaining pleasure.

Another cash-flow-based measure is from Ball and Shivakumar (2005) who developed the Asymmetric Accrual to Cash-flow Measure (AACF) to estimate the degree of accounting conservatism in private companies. Ball and Shivakumar (2005) use the accrual component of total earnings because, in their view, accounting conservatism mainly affects the accrual component of earnings rather

than the cash-flow component.

Subsequently, Wang et al. (2008), based on Ball and Shivakumar's (2005) and theory, obtained the result that the AACF indicator uses operating cash flow as a proxy for news and the AACF indicator selects only the accrual component of total earnings.

2.3.3.4 Basu-based measures

Basu-based measures of accounting conservatism are metrics that capture the degree to which firms' financial reporting practices incorporate the conservative treatment of gains and losses in their earnings (Basu, 1995). These measures are based on the notion that firms tend to recognize losses more quickly and more fully than gains in their financial statements, due to loss aversion.

According to Basu(1997), conservatism in accounting is described as recognizing earnings more promptly for bad news about future cash flows than for good news. In an efficient market, stock returns are symmetrical and quickly reflect all publicly available 'news'. Therefore, Basu(1997) uses returns to measure 'news'. His findings suggest that the simultaneous sensitivity of returns to negative returns is two to six times greater than the simultaneous sensitivity of returns to positive returns. The results are robust across multiple specifications. The conclusion is that earnings are more timely in reporting public 'bad news' about future cash flows than 'good news'. Both Brooks and Buckmaster (1976) and Elgers and Lo (1994) suggest that positive earnings changes tend to persist, while negative earnings changes show a clear trend toward reversal, which is consistent with Basu's findings.

Furthermore, Basu(1997) argues that the sensitivity of earnings to concurrent negative returns has increased over the past three decades relative to the sensitivity of earnings to concurrent positive returns, suggesting that conservatism has increased over time. The increase in conservatism coincides with an increase in the risk of auditor legal liability.

2.3.3.5 Other measurement

In accounting conservatism, balance sheet measures, income statement measures, and earnings/stock return relation measures are used to assess the degree of conservatism in financial reporting (Zhong and Li, 2017).

Common balance sheet measures include total assets, current assets, current liabilities, and shareholder's equity. Balance sheet measures focus on the conservative valuation of a company's assets and liabilities such as the use of lower-of-cost-or-market inventory valuation and the recognition of asset impairments. These measures are important for understanding a company's liquidity, solvency, and overall financial strength. Some examples of balance sheet measures used in research on accounting conservatism, including the conservatism index (Basu, 1997) and the balance sheet conservatism index (Givoly and Hayn, 2000)

Common income statement measures include gross profit, operating profit, net profit, and earnings per share (EPS). These measures are important for evaluating a company's profitability and the effectiveness of its business operations. Income statement measures include revenue recognition policies that defer the recognition of revenue until it is realized, as well as expense recognition policies that recognize expenses sooner rather than later. (Zhong and Li, 2017). The earnings response coefficient and the timeliness of earnings (Watts, 2003) are examples of income statement measures used in research on accounting conservatism.

Earnings/stock return relation measures examine the relationship between accounting earnings and stock returns, with the assumption that conservative accounting practices will result in a weaker relation. Examples of Earnings/stock return relation measures include the correlation between earnings and returns (Ball and Shivakumar, 2005), and the conservatism correction factor (Kothari et al., 2009). Common measures used in this analysis include the price-to-earnings (P/E) ratio, earnings yield, and price-to-book (P/B) ratio. These measures help investors

evaluate the market's expectations for a company's future earnings and the potential for future growth.

2.3.4 Application of Accounting Conservatism

2.3.4.1 Application fields

Accounting conservatism requires accountants and financial managers to exercise caution and avoid exaggerating a company's financial position or performance, especially in situations of uncertainty or ambiguity, which is important for financial performance, corporate governance, and stock markets. On the one hand, it not only reduces surplus management, financial distress, and agency costs and improves surplus quality and governance practices; on the other hand, it reduces information asymmetry, increases liquidity, and reduces the cost of capital.

Accounting conservatism has been shown to have a significant impact on financial performance. Several studies have found that higher levels of accounting conservatism lead to lower levels of surplus management and higher surplus quality (Kordlouie et al., 2014; Yuan et al., 2022). Accounting conservatism has also been found to reduce the likelihood of financial distress and insolvency.

Accounting conservatism is important for corporate governance. According to Nasr and Ntim (2018), board independence is positively related to accounting conservatism. In contrast, board size and auditor type are negatively related to accounting conservatism, while the separation of the roles of chairman and CEO is not significantly related to accounting conservatism. García (2009) uses a large sample of US companies between 1992 and 2003 and finds that companies with stricter corporate governance rules are more conservative. Corporate governance mechanisms can have a moderating effect on the relationship between accounting conservatism and earnings quality (Zadeh et al., 2022). Specifically, conditional conservatism is significantly higher for companies with low levels of anti-takeover protection and low levels of CEO involvement in board decisions. Board independence and more effective internal control systems. Also, accounting conservatism has been shown to reduce agency costs by aligning the interests of

managers and shareholders (Xu, 2012).

Accounting conservatism has been shown to have a significant impact on the stock market. Some studies have found that higher accounting robustness leads to lower information asymmetry, which in turn leads to less volatile share prices and higher liquidity (Zhong and Li, 2017). In addition, accounting robustness reduces the cost of capital, which leads to higher share prices and higher shareholder returns (Kim and Pevzner, 2010). On a risk management level, by using conservative accounting practices, companies can better prepare for potential economic downturns, unforeseen events, or other risks that could affect their financial performance. This helps to reduce risk and ensure the long-term stability of the company, which is attractive to investors. Finally, the stock market will also show a positive trend. Kim and Pevzner (2010) contribute to the growing literature investigating the role of conditional conservatism in stock markets. Kim and Pevzner (2010) first test whether higher levels of conditional conservatism are associated with a reduced likelihood of future bad earnings and dividend news. In addition, Kim and Pevzner (2010) test whether levels of conditional conservatism affect the stock market's general response to good and bad corporate news. The results are some weak evidence that the stock market responds more strongly to good news from more conditionally conservative firms and weaklier to bad news from these firms.

2.3.4.2 Relevant groups

Different groups apply accounting conservatism for different reasons, and three groups are described below, including governments, investors, and business managers. There are some reasons why governments apply accounting conservatism. First, the government can provide a degree of assurance that its finances are being managed effectively and transparently (Xu et. al., 2012). This pressure can increase in times of economic uncertainty when the public is particularly concerned about the government's financial stability. As a result, governments may use accounting conservatism to demonstrate that they are being fiscally prudent and not taking unnecessary risks. Second, accounting conservatism may improve the

financial accountability of governments. This is because by presenting a more conservative financial picture, governments are more likely to be accountable for their spending and subject to scrutiny by external auditors and the public. Baloria (2022) uses an earnings return model and a proxy for persistent negative accruals to explore the accounting conservatism relationship between US politicians and firms and demonstrates that political relationships moderate the impact of conservatism. Third, accounting conservatism can also be used as a way of promoting fiscal responsibility in government. By presenting a conservative financial position, the government is less likely to engage in risky financial practices such as over-borrowing or overspending. The government uses accounting conservatism to maximize tax revenue (Halim, et al., 2022), which suggests that the government can even maximize its interests through accounting conservatism where it makes sense to do so, in favor of the country's economy.

Investors use accounting conservatism for several reasons, including risk reduction, and improved financial reporting quality. First, Accounting conservatism can reduce financial risk for investors by providing a more realistic and conservative estimate of a company's financial performance. Investors can make more informed decisions and avoid unexpected losses due to the recognition of potential losses and liabilities. Although Ball and Shivakumar (2005) argue that accounting conservatism reduces the incentive for management to make negative NPV investments. This does not sound like good information, yet Kravet (2014) investigates research based on this theory and finds that under more conservative accounting management, managers make less risky acquisitions, and firms with accounting-based debt covenants drive this link. Therefore, accounting conservatism reduces the risk of overpayments in transactions because it provides a more conservative estimate of the future performance of the company to the target. Second, improving the quality of financial reporting by reducing the potential for manipulation or misrepresentation of financial statements is also one of the benefits of accounting conservatism. Kordlouie et al. （2014） indicate that companies focusing on conservatism will eventually reduce their non-operating liabilities. Accounting conservatism can reduce the likelihood that

managers will manipulate financial results to meet earnings targets by recognizing losses and liabilities earlier.

Business managers use accounting conservatism for several reasons, including reducing the potential for financial distress and improving access to capital markets. First, accounting conservatism can reduce the likelihood of financial distress by providing more accurate and reliable financial information. Xu (2012) finds that the association between accounting conservatism and capital expenditure is significantly positive when internal capital is insufficient for investment, suggesting that conservatism can expand the level of investment by reducing information asymmetry and the cost of capital; and vice versa. This suggests that conservatism can reduce the level of investment by mitigating conflicts of interest between management and external shareholders and reducing agency costs, which is beneficial to business managers governing the firm (Garanina and Kim, 2023). Biddle et al., (2020) also confirmed this through research on U.S. non-financial companies, that is, unconditional and conditional accounting conservatism can help reduce the risk of bankruptcy. Glover and Xue (2022) argue that the accruals introduced by conservatism increase each manager's stake in the future of the relationship, hence the positive role of accounting conservatism in cultivating an ideal corporate culture. Second, accounting conservatism improves access to capital markets by providing investors with more reliable financial information (Lin and Tian, 2012). This is because accounting conservatism can help users to recognize losses and liabilities earlier, thereby improving the credibility of financial statements. This can increase investor confidence and improve access to capital markets.

2.3.5 Selected Studies of Accounting Conservatism

Previous research has addressed the important role played by accounting conservatism. This section reviews the literature on accounting conservatism.

Selected Studies of Accounting Conservatism			
Authors	**Variables**	**Sample**	**Results**

Garanina and Kim (2023)	Accounting conservatism and CSR disclosure index	1,125 firm-year observations from 223 public companies listed on the MSE	1. CSR disclosure that helps Russian companies to enhance their legitimacy and extend stakeholder relations is positively associated with accounting conservatism. 2.Russian state-owned enterprises have a negative moderating effect on the relationship between CSR and accounting conservatism
Zadeh et al. (2022)	Accounting conservatism, Modified Jones mode and Dechow and Dichev's model	The companies listed on the TSE.	1.There is a significant negative relationship between accounting conservatism and earnings quality. 2.The ownership of the large shareholders can moderate the relationship between accounting conservatism and earnings quality
Biddle et al. (2020)	Accounting conservatism, unconditional risk score and bankruptcy risk conditioned on distress	34,897 firm-years observations from 4,621 nonfinancial firms in the US	1.Accounting conservatism is negatively related to subsequent bankruptcy risk. 2. Accounting conservatism can reduce subsequent bankruptcy risk through the cash enhancement and earnings management mitigation channel.
Lobo et al. (2019)	Accounting conservatism, Share repurchase plans and	59,365 firm-years observations from Compustat and	1.Firms with higher accounting conservatism are less likely to repurchase their own shares.

	Actual repurchases	CRSP	2.The relation between share repurchase and accounting conservatism is stronger when free cash flows are higher.
Liu (2019)	Accounting conservatism, State ownership and managerial shareholders	1,738 listed firms with 9046 firm-year observations from CSMAR	1.Managerial ownership is negatively related to accounting conservatism. 2.State ownership and control affects accounting conservatism.
Sugiarto and Fachrurrozie (2018)	Accounting conservatism, Financial Distress, Leverage, Investment Opportunity Set and Managerial Ownership	143 listed companies from IDX	1.Financial distress and accounting conservatism are positively related. 2.Managerial ownership is negatively related to accounting conservatism.

3. Stock price crash risk

3.1 stock market development

3.1.1 World stock market development

In February 1171, impacted by the war, the administrators of Venice of Italy faced financial issues and began to draft and publish a series of measures, in order to increase government revenue (Michie, 2006). One of the measures was to force wealthy citizens to take loans; This is considered to be a sign that global securities market is starting (Michie, 2006). This act of charging interest with forced loans is already a very typical financial activity. However, due to the occurrence of wars and natural disasters, the people of that era generally relied on deposits and had very limited demand for cash, thus, the above-mentioned activities did not promote the formation of large-scale market transactions (Michie, 2006). In 1602, the Dutch East India Company was founded in Amsterdam. In response to the market needs, the enterprise introduced shares with the feature of strong transferability (Petram, 2014). Market dealers held very positive attitude towards shares and started trading shares in a very short period of time (Prakash, 2014). The above situation formed the earlier stock market worldwide (Prakash, 2014). Astonishingly, the market participants of that era had already carried out a series of trading activities, which are very similar to the modern stock trading market such as futures, options, and bear raids (Petram, 2014). In the second half of the 17th century, the secondary market for East India Company stocks developed to be the innovative securities market that provided investors with the above-mentioned benefits (Petram, 2011). The public can purchase and sell stocks under the supervision and evaluation of the Dutch government; this means that buying and selling activities started appearing in the stock market (Gelderblom et al., 2013).

In the first decade of the 19th century, Denmark intended to increase state revenue through the issue of bonds; Denmark intended to find one novel trading market, in order for replacing the existing market located at Amsterdam (Ward, 2009). Further, Britain, France and Germany respectively created national trading market in the financial centers of their countries such as the capital (Michie, 2006). It should be

noted that, at the end of 18th century, Conflicts and wars broke out between France and the Netherlands (Poell, 2012). The war spread to the capital of Netherlands, resulting in the destruction of a considerable number of finances related facilities (Poell, 2012). This significantly reduces and dilutes the leading status of the capital of the Netherland in the field of finance and securities worldwide (Poell, 2012). Impacted by the wars, the financial status of Amsterdam and other European cities weakened; in contrast, Britain and London were not involved in wars, relatively peaceful and stable environment improved the financial status of London (Schubert, 1988; Neal, 1987). In this context, many investors regard London as a safe haven for funds; accordingly, a large number of businessmen and financial funds flowed from Amsterdam to London, in order to continue stable international trade transactions, (Schubert, 1988; Neal, 1987). In financial markets, there is a positive correlation between volatility and trading volume; as the volume of business increased significantly, the London stock market shouldered increasingly pressure in terms of volatility (Michie, 1999; Michie, 2006). Daily volatility in financial markets brings huge business opportunities, which has huge appeal to UK and international investment participants (Michie, 1999; Michie, 2006). At the beginning of the 19th century, the London Stock Exchange was formally founded; this was a milestone event in the world's financial history because it innovatively and theoretically put forward a series of relevant measures to regulate financial transaction business as well as physically offering one securities market center (Michie, 1999; Michie, 2006). The above-mentioned situation help London to develop into a new financial leading region in the world (Michie, 1999; Michie, 2006). Michie (2006) believed that the London Stock Exchange is a model for the development of global stock exchanges; this suggest the so-called London model is more advanced Paris or Berlin models.

3.1.2 US stock market development

On May 17, 1792, fed up with auction monopoly, a group of brokers signed a document in New York, which is known as the Buttonwood Tree Agreement (Eisenstadt, 1994). This agreement is the first document in the history of the New York Stock Exchange, which marks the establishment of the New York Stock

Exchange (Eisenstadt, 1994). In specific, twenty-four brokers signed the agreement, in order to form one independent, privileged securities trading federation. During the period when the agreement was in effect, stock trading volumes were sluggish; the stock trading was dominated by government stocks and bank stocks (Eisenstadt, 1994). At the end of 1810s, with a collaboration between the New York Stock Exchange cooperated and the Philadelphia Stock Exchange, a more advanced set of norms that are more adapted to the latest market conditions has been formulated; the purpose of launching new set of norms is to make the trade process more regular and standardized (Teweles and Bradley, 1998). However, with the impact of the sharp drop in land sales prices and the outbreak of war within the United States, the exchange failed to successfully finish the American governmental authority's economic regulations as originally planned (Teweles and Bradley, 1998). The ability of the exchange in the following two aspects is obviously insufficient and lacking. The first is to offer one sustainable and prosperous market, and the second is effective management ability (Teweles and Bradley, 1998). In the middle of 1970s, under the impetus of American president Ford, the Securities Act Amendment was passed and formally implemented; this made the development of the US securities market system more in line with legal and compliant market needs States (Gillis, 1975; Peacock, 1976). The amendment Act represents the most comprehensive securities legislation in the history of the United States (Gillis, 1975; Peacock, 1976).

3.2 stock price crash risk characteristics

3.2.1 stock price crash risk

Some scholars studied existing academic studies and summarized that, generally speaking, concerning stock return distribution, the negative skewness occupies a dominant trend; in other words, significant positive stock returns or stock price increases are much rarer than significant negative stock price declines (Chen et al., 2001; Hong and Stein, 2003). In the context, many scholars have paid lot of attention to the issue of the sharp decline in stock prices and conducted rich discussions. While corporations' administrators recognize that participants in stock investment and stock analyzing experts have more anticipation on stock decline, they will pay special

attention to strengthening the supervision of stock prices; in other words, corporation managers' priority is to minimize the risk of a stock price crashing (Conrad et al., 2013). It should be noted that, during the stock trading process, the greater the liquidity of the stock, the higher the risk of crash; this means that liquidity can be regarded as an important factor or indicator used to evaluate or forecast the risk of a stock market crash; under such circumstances, participants in investment activities can refer to the frequent level of transaction activities, in order to reasonably analyze and minimize risks (Chang et al., 2017). Some scholars have made very interesting research and discoveries in the following two aspects. First, it is found that there exists a certain relationship between portfolio theory and crash risk; second, it is discovered that crash risk has some correlative impact on asset and option pricing models（Habib, 2018; Kim and Zhang, 2016）. From the perspective of participants with small-scale investment, compared with making investment in large corporations and making investment in small corporations, they are more inclined to choose the latter（Habib， 2018; Moloney, 2010）. One of the reasons is that they lack comprehension of the actual situation and internal information related to large corporations（Habib， 2018; Moloney, 2010）. However, it cannot be ignored that the negative and sharp fluctuations in the stock prices of these small corporations probably will cause greater losses for these participants who make small-scale investment (Habib, 2018; Moloney, 2010). In this context, the players involved in small-scale investment need to be more cautious of stock price fluctuations and more accurate in predicting stock price crashes. Around this topic, some scholars have also done some related research. Some scholars have found that there is a strong relationship between crash performance and trading price; in other words, trading price can be utilized as one significant predictor to predict a possible crash (Chen et al., 2001). Other scholars innovatively propose that some negative news generated by the corporation' internal decision-making mistakes are closely related to the negative fluctuation of the corporation's stock price (Jin and Myers, 2006). Thus, many researchers believe that the concealment of bad news by corporation managers has become the main reason for stock price crashes. When a company's

administrator successfully prevents unfavorable news from spreading to the stock market, the stock return will show an asymmetrical state and distribution (Hutton et al., 2009; Kothari et al., 2009).

Jin and Myers (2006) made outstanding contributions in academic research in the field of finance; the agency theoretical framework introduced by them is commonly accepted and referred to in the studies of stock price crash risk (Habib， 2018 ; Jin and Myers , 2006). While one corporation operates within one nation whose legal norms remain to be further improved, the corporate administrators may take advantages of loopholes in laws and regulations, and conceal part of information or financial activities without fully disclosing to external investors; in this situation, external investors may make unwise investment decisions based on incomplete disclosed information (Jin and Myers, 2006). According to this agency theory framework proposed by Jin and Myers, the more asymmetric information about a company held by the external investors and internal administrators of the company, the higher risk of the company's stock price collapse (Jin and Myers, 2006). While internal managers have greater authority over unmonitored cash flows, there is more possibility for them to dispose assets incorrectly and have to hide bad news. Callen and Fang (2015) agree with Jin and Myers (2006) and point out that administrators working in companies that lack transparency have opportunities to conduct some illegal financial activities without supervision, and then deliberately hide negative information; this eventually leads to panic of investors. Therefore, to reduce the possibility of a stock market crash, it is necessary to meet the following two conditions: the government's regulatory intervention and transparency of accounting regulations. Dang et al. (2018) and DeFond et al. (2014) also emphasize the significance of accounting rules with high transparency for standardized and highly transparent administration of corporations; to a large extent, this is expected to make investors more confident and help the corporation achieve continuous and prosperous development; under such circumstances, the company's stock price is deem to be more appeal to future investors. Besides the factors discussed above, some scholars further pointed out that the tenure of auditors is also one of the factors

that influence the risk of a corporation's stock price crash (Callen and Fang, 2016). They find that there exists negative correlation between auditor tenure and stock price crash risk one year in advance. The reason is that auditors are able to fully utilize the knowledge by of clients accumulated during their working period, and make timely wise judgments based on this knowledge to avoid generating and accumulating negative information and finally achieve the goal of minimizing the risk of stock crashes. In addition, some scholars also found that administrators who firmly believe in certain religion and have strong sense of social responsibility are less likely to hide negative or true corporation information from the public (Dang et al., 2018; Callen and Fang. 2015b).

3.2.2 Stock price crash risk and corporate governance

Enterprise administrators have motivations to overstress fiscal result via delaying and diluting negative information, releasing and promoting positive information in advance with strategic approaches (Kim and Zhang, 2016). Enterprise administrators expect that outstanding performance in the future can largely make up for the currently unsatisfying performance. The delay and dilution of negative information by administrators over a long period of time will probably result in backlog of bad news in the internal environment of one corporation (Kim and Zhang, 2016). When the accumulation of negative information approaches a certain breaking point, the bad news is likely to be revealed all within a short period of time; that will generate a catastrophic negative impact on the company’s stock price (Jin and Myers 2006; Hutton et al., 2009; Kim and Zhang, 2016). The above-mentioned abnormal reveal motivation originates from various elements, and two core elements seems to be high salary of managers and futural career aspirations (Ball, 2009; Kothari et al., 2009). According to the research made by Graham et al. (2005), when corporation managers face economic value and high stable income, 78% of executives surveyed would consider the latter as priority. Executives would usually get more benefits and income when the following two conditions are satisfied simultaneously: the profit level in the financial statements increases and the stock price is higher. This also stimulate them to focus on how to increase the company's stock price and profitability and hide

unfavorable news to a maximum extent. Further, managers of enterprises who earn satisfying salary hold the viewpoint that, it reasonable to sacrifice part of the company's economic interest in exchange for their personal stable income and the realization of economic aims (Kim and Zhang, 2016). Stable earnings or the achievement of proposed financial goals could enhance investors' confidence in the company in the long term. Graham et al.（2005）argue that, compared with cash flows, accounting earnings have more information content about firm value. This is justified by the fact that the company's financial reports released to society on a regular basis have a certain influence on the company. In contrast, there is also a body of opinion arguing that some executives overemphasize the role of cash flow and ignore the significance of accounting earnings. There exists positive correlation between the dependence of corporate activities on internal cash flow and the importance of the CFO (Nwaeze et al., 2006). This indicates that when companies must rely on the CFO to pay off debt, dividends, and make various investment, cash flow outperforms accounting earnings.

Enterprise administrators could delay and dilute negative information, speed up release and promotion of positive information with strategic approaches (Kim and Zhang, 2016). Patel and Wolfson (1981) first verified that when the stock market opens, good news is more likely to be released than bad news; the latter is more likely to be frequently released after the closure of trading. This also proves that company executives are inclined to dilute or delay the release of bad news. This is mainly justified by the fact that the sensitivity and actual reaction of stock prices to positive news is weaker than that of negative news (Kothari et al., 2009). Administrators' the potential behavior of hiding, delaying or diluting negative information from external investing parties might have serious consequences such as higher crash risks or negative return skewness (Kim and Zhang, 2016, McNichols 1988). Furthermore, to certain corporations with three features (a large proportion of R&D investment, large sum of the market shares of leading companies in the industry, low analyst coverage), positive and negative information own more apparent capability of forecasting futural crash risks; this is primarily justified by the fact that

the model of corporations value the release of true news (Kim and Zhang, 2016). Generally, A sharp drop or collapse in stock prices caused by negative information is caused by the following two situations: the number of negative news has exceeded the high-risk red line, the original motivation of company managers to conceal or delay revealing negative information have significantly weakened or broken down (Hutton et al. 2009). While the hidden or delayed negative news or unsatisfying performance are finally released and exposed, people will notice the phenomenon of the stock price plummeting (Bleck and Liu 2007; Benmelech et al., 2010).

3.3 measurement method

Stock price crash risk reflects the tendency of individual companies to experience extreme negative returns. Morck et al. (2000) explored that in some places where the financial sector is underdeveloped and utilitarian management is lacking, the value of R2 is relatively high. In 2006 Jin and Myers were the first to use firm-specific weekly returns to calculate an alternative measure of crash risk. The premise of measuring stock crash risk is to measure the company's weekly return (Jin and Myers, 2006). Hutton et al. (2009) developed a model that uses each firm's weekly returns over a fiscal year to estimate firm-specific weekly returns, which is widely used by other researchers (Kim et al., 2011; Piotroski et al., 2015; Kim and Zhang, 2016; Dang et al., 2018; Fu and Zhang, 2019; Luo and Zhang, 2020).

There are two ways to calculate the risk of a stock crash given the weekly returns for a particular company: the negative conditional skewness of firm-specific weekly returns (NCSKEW) and the down-to-up volatility (DUVOL) respectively (Chen et al., 2001; Kim et al., 2011). NCSKEW is calculated by taking the negative of the cubic moment of the firm-specific weekly return for each year and normalizing it by the standard deviation of the firm-specific weekly return raised to the third power. NCSKEW is calculated by taking the negative of the cubic moment of the firm-specific weekly return for each year and normalizing it by the standard deviation of the firm-specific weekly return raised to the third power. The standard deviation of firm-specific weekly returns is calculated separately for each of these two groups,

with DUVOL being the natural logarithm of the ratio of the standard deviation of "down" weeks to the standard deviation of "up" weeks.

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Paper 2: Facial masculinity of corporate executives and accounting conservatism: UK evidence

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1. introduction

My research will explore the relationship between the facial features of British company board members and other company features. In previous studies, especially in the fields of psychology and biology, it has been proved that the facial width-to-height ratio (fWHR) of men can reflect the behavioral characteristics of men, such as being more aggressive and also discusses the economic consequences of physical characteristics important to capital market participants. Mayew et al. (2013) found that the voice level of CEOs can predict their salary levels and the possibility of misreport. In addition, Addoum et al. (2017) showed that the height and obesity of company executives will affect their investment portfolio choices. It is worth noting that the field of fWHR is widely discussed and studied. When a man has a higher testosterone, he has a higher fWHR, and that will affect his decision-making. Showing more male behaviors may be due to the fact that testosterone simultaneously affects facial structure and behavior (Carré and McCormick, 2008). Therefore, it is particularly important to explore the relationship between fWHR and corporate governance. In previous studies, researchers have linked company performance, company policies, and investment performance with the fWHR of company executives. My research will try to explore the relationship between the fWHR of the company's board of directors (CEO, CFO, and Chairman) and the company’s accounting conservatism. If company executives have stronger facial masculinity, their aggressive behavior to win may be achieved through accounting means, which will make accounting behavior more conservative. Based on the conclusions drawn by most of the literature on this subject that high testosterone levels lead to high fWHR and increased aggressiveness, I expect that the high fWHR of company executives will be associated with lower accounting conservativeness. Company executives with a higher degree of masculinity may be classified into companies that have shown proactive financial policies and disclose more internal information in order to seek higher returns for the company. My research will use four methods to measure the company’s accounting conservatism. They are Accrual-based measure, Asymmetric timeliness, C_Score and market-to-book ratio. My research sample involves 417 UK FTSE350 non-financial companies and 1345

corporate executives (CEO, CFO and Chairman). The issues explored in my research are as follows: Does the British CEO's face aspect ratio have a positive impact on the company's business performance? Will companies with good financial positions hire British CEOs with high-fWHR? Will the British CEO with high-fWHR increase the company's leverage ratio (financial risk)? Is british CEOs with high-fWHR are more accounting conservatism? My question involves corporate finance and corporate governance, which will more fully reflect whether the more masculine British CEO has an impact on their company.

The first hypothesis of this study tests that corporate executives with high fWHR will lead to lower corporate conservatism. This hypothesis was supported after using a sample of 1,345 CEOs, CFOs, and Chairmen. The second hypothesis tested whether high-fWHR firm executives would increase financial risk using the same firm executives and found evidence consistent with this hypothesis. In order to ensure the accuracy of the research, this study used artificial intelligence technology to calculate the fWHR of company executives and conducted a robustness test, achieving consistent results. A series of research results demonstrate that when corporate executives have more aggressive male facial features, they are more inclined to non-conservative accounting policies.

My research will involve the executives of British companies and the financial status of British companies. In previous studies, the subjects studied were usually American companies and American CEOs, which led to a gap in European exploration in this field. Beltman (2018) first tried to explore the relationship between the fWHR of European CEOs and company performance and found that there may be significant differences in the way CEOs influence company performance across continents. Therefore, it has high significance for the British corporate managers and British companies as research objective. This study makes several contributions. First, this study adds to the literature on corporate governance and accounting conservatism. This article adds to the literature on accounting conservatism by exploring a new important determinant, facial aspect ratio. This study contributes to the literature by

demonstrating that innate personal characteristics are related to decision-making. Second, this study combines facial masculinity with accounting conservatism. Biologically based research suggests that different men have different standards for facial masculinity and behavioral demeanor but has yet to link this trait to corporate governance. Therefore, interdisciplinary research will provide more topics for biology and business research. Third, this study completes a series of tests and demonstrates across multiple samples that corporate executives' fWHR is negatively related to conservatism. In addition, this study also proves that corporate executives' fWHR is positively related to financial leverage. Therefore, this study is economically and statistically significant. Finally, the results of this study can help corporate executives and investors better understand the facial characteristics of corporate executives and corporate accounting policies. Investors can learn about the accounting policies of company executives based on their facial features and adjust their investment strategies.

2. Literature review

2.1 Facial width-to-height ratio (fWHR)

A person’s appearance can affect many aspects of life. The first impression of a stranger often affects the future interaction with the person and is strongly influenced by appearance (Mayew et al. 2013). In 1974, Efran's research proved the correlation between people's appearance and judicial fairness and proposed that the appearance of criminals has a significant impact on the outcome of the trial. On the personal level, facial expressions and beauty level affect personal income, salary, and status in the organization (Graham et al., 2013; Hamermesh and Biddle, 1994). In addition, the voice pitch, height and obesity from company executives can also predict their salary levels and likelihood to misreport (Mayew et al. 2013; Addoum et al. 2017). Hosoda et al. (2003) studied the physical characteristics of people and their leadership and got a positive correlation. But the physical characteristics of the effectiveness of human appearance are still uncertain areas (Wong et al., 2011). It is worth noting that the attractiveness of appearance of company executives will have

an impact on company performance (Rule and Ambady， 2008). Higher attractiveness and capabilities may differentiate corporate leaders from leaders in other fields, such as the sports industry (Olivola et al., 2014). In interpersonal relationships, people with good looks will gain trust and play a role in decision-making. In previous studies, it has been confirmed that different gender (Farrell and Hersch, 2005), ages (Huang et al., 2012) and beauty (Graham et al., 2016) will affect people's choices and judgments.

Researchers generally believe that high testosterone levels will make men more aggressive and more likely to succeed. Stirrat and Perrett (2012) believe that men with high testosterone will show self-sacrifice to promote the cooperation of their teammates in group matches. Tsujimura and Banissy (2013) found a strong positive correlation between fWHR and home runs in a sample of Japanese professional baseball players. This success can be attributed to higher levels of testosterone, which can make athletes more aggressive and therefore successful. Previous researches assume that the effect of testosterone on male behavior is caused by autonomic arousal, which leads to innate masculine behavior (He et al., 2019). However, more studies have shown that testosterone is more closely related to motivation to pursue achievement (Eisenegger et al., 2011). Testosterone affects decision-making and behavior by affecting neural mechanisms (Mehta and Beer, 2010). Most studies on this relationship have found that respondents' testosterone levels are positively correlated with their risk tolerance and risk-taking behavior. It is certain that testosterone levels are related to financial risk-taking behavior. Apicella et al. (2008) tested male testosterone through saliva and arranged them to participate in investment simulation games and found that men with high testosterone are more likely to bear financial risks. Stanton et al. (2011) also measured testosterone levels in the saliva of respondents and found that different testosterone can lead to differences in decision-making in gambling tasks in Iowa, USA. Cronqvist et al. (2016) used sample controls from European countries and found that differences in testosterone explained differences in financial decisions later in life. A study by Coates and Herbert (2008) compared the testosterone levels of respondents on

different dates and found that the day when the testosterone content of the 17 businessmen was the highest, they got the highest trading profit. This discovery proves that male testosterone will make it easier to take risks in the financial field and managers with higher testosterone seem to be more likely to reach their goals.

Face width and height have been shown to replace testosterone levels (Lefevre et al., 2013). The effect of this hormone on the growth of lateral cheekbone during puberty, which causes this growth to increase the width of the face, thereby increasing fWHR (Verdonck et al., 1999; Carré et al., 2013; Lefevre et al., 2013). Many previous studies have investigated the relationship between facial appearance and testosterone levels. Penton-Voak and Chen (2004) found that male subjects with higher testosterone levels are considered to have more masculine faces than men with low testosterone. Carre and McCormick (2008) also proved that male testosterone can explain the connection between fWHR and certain behavioral characteristics. Therefore, it is reasonable for researchers to explore the relationship between managers' fWHR and company performance. Most of the literature only focuses on the measurement of fWHR of male managers, because the fWHR-behavior relationship does not hold for women (Carre and McCormick, 2008). For corporate finance, certain factors of corporate financial success seem to be expressed through the facial expressions of the CEO (Rule and Ambady, 2008). CEOs with high fWHR and a higher degree of masculinity may also be hired by companies that have shown proactive financial policies (Kamiya et al., 2018). In addition, companies managed by CEOs with high fWHR have higher leverage and lower cash holdings (Gomulya et al., 2017). Another commonly used surrogate indicator of testosterone levels is the ratio of the length of the index finger to the length of the ring finger, called the 2D:4D ratio. The 2D:4D ratio is a sexual dimorphism and is considered representative of prenatal androgen exposure. Manning et al. (1998) studies have shown that 2D:4D is negatively correlated with testosterone levels in both males and females, and positively correlated with estrogen levels. There is evidence that 2D:4D is associated with fWHR, because men with lower 2D:4D tend to have higher facial width (Fink et al., 2005). In addition,

Dreber and Hoffman (2007) observed a negative correlation between 2D:4D and financial risk in a sample of men and women of the same race. The reason why the method of 2D:4D ratio is not used in this study is because the finger length data of company executives cannot be obtained.

A large number of studies have confirmed the correlation between a person's face size and company performance. Facial width to height ratio (fWHR) is the most important method for measuring face size with different characteristics, such as self-perceived advantages, anti-social behavior, sensitivity to attacks, risk control, and reproductive success (Linke et al., 2015; Carré and McCormick, 2008; Tsujimura and Banissy, 2013; Loehr and O'Hara, 2013). fWHR is related to positive behavior and outcomes. The CEO is the executive who can influence the company's performance the most. Therefore, previous studies have explored the relationship between CEO's fWHR and company performance (Wong et al.,2011; Stirrat and Perrett, 2010; Beltman, 2018). This supports the theory of Wong et al. (2011) that fWHR and performance are interrelated. Carre and McCormick (2008) pointed out that male CEOs with high-fWHR behave more aggressively. Although this aggressive attack is often described as socially unwelcome, male CEOs with high-fWHR will lead the company out of trouble and improve benefit. In addition, men with larger faces will have a higher sense of self-sacrifice to promote teamwork among all members (Stirrat & Perrett, 2010). Recent literature also supports the view that companies with higher fWHR CEOs in the United States have higher firm value and salaries (Halford and Hsu, 2020). It is worth noting that there are also regional differences in the relationship between fWHR and company performance. He et al. (2019) pointed out that because of cultural background, company executives in East Asia need to be more modest. In addition to this, there are obviously differences between American companies and European companies. The main difference between companies from the United States and Europe is individualism and collectivism and long-term positioning (Triandis et al., 1988; Hofstede, 2016). This also leads to a stronger positive correlation between CEO’s fWHR and company performance according in the United States. Executives of European companies tend to be more collective and

long-term oriented, showing a lower positive correlation (Alrajih and Ward, 2014). Brodbeck et al. (2000) proposed that European management systems share common characteristics, but there are sociocultural diversity and management style diversity among various regions. Therefore, the study of a single area is very important. The sample for this study will look at the UK.

Although the link between fWHR and behavior has been fully demonstrated, the exact underlying neural mechanism of fWHR is still subject to controversy in the field of neuroscience (He et al., 2019). In addition, some scholars do not agree with the rationality of fWHR. This relationship is limited to companies with a simple leadership structure (Wong et al., 2011). According to the contingency theory of leadership (Thompso and Vecchio, 2009), company leaders should not change their choices due to specific facial stereotypes under certain circumstances (Olivola, Eubanks, etc., 2014). Wong et al. (2001) also pointed out that in previous studies, researchers have neglected to consider other factors of the company. His article proposed that the previous research was exploring the relationship between the CEO's fWHR and company performance while ignoring the analysis of the company's management structure. Jia et al. (2014) believe that high-fWHR managers will not lead to more efficient company management. On the contrary, high-fWHR CEOs are related to financial false reports, because they may tamper with internal transactions and become criminals. In addition, the use of fWHR has also been questioned. Cleary et al. (2020) believe that the use of face aspect ratio as a measurement standard is limited, because fWHR is a noisy and imperfect proxy for individual risk preference and only focus on one gender and race, namely white male analysts in their research. Stoker et al. (2016) believe that one-dimensional measurement methods cannot fairly represent a person’s facial features. They performed more complex measurements on the faces of the CEOs of Fortune 500 companies and believe that the CEO fWHR has played a role in leadership, but it does not determine the effectiveness of leadership. Hofstede (2016) also believes that adventurous spirit has nothing to do with effective leadership.

2.2 Accounting Conservatism

Whether accounting conservatism is one of the characteristics of financial statements has been discussed by experts for a long time. In the analysis of financial reports, more and more information with accounting conservatism is involved, and people's analysis of the consequences of accounting conservatism has gradually increased. Previous research results show that the financial reports of many countries and companies are conservative (Basu, 1997). Bliss (1924) first proposed the definition of conservatism, namely: expecting no profit but expecting all losses, which provides support for subsequent conservatism research. Devine (1963) further explained accounting conservatism. He believes that conservatism is a rule with lower average expectations for goal achievement and should be used and valued by accountants and company leaders. Zhong and Li (2017) believes that the early definitions were constructive, but they did not consider the economic environment at that time and in the future, nor did they distinguish between different types of conservatism. In 1997, Basu proposed a new concept of accounting conservatism and designed an easy to understand and insightful model to measure it. This model is favored and widely used by researchers. He divides accounting conservatism into good news and bad news and believes that accountants need to have a stronger ability to distinguish good news. This established his position in the field of accounting conservatism (Zhong and Li, 2017). Ball et al. (2000) pointed out that the definition actually defines conservatism as the degree to which current accounting income is asymmetrically included in economic losses relative to economic gains. It is worth noting that accounting conservativeness has changed accounting standards, including historical costs and realization conventions for centuries (Basu, 1997). For example, in the United Kingdom, the concept of accounting conservatism is involved in accounting standards.

Researchers divide accounting conservatism into two types: ex-post conservatism and ex-ante conservatism. Ex-ante conservatism is based on the balance sheet and accounting methods. Therefore, the impact of ex-ante conservatism on earnings streams is huge (Yunos et al., 2009). In addition, investors can analyze the impact of

ex-ante conservatism on future earnings based on the disclosure of company information, which is more predictable for investors. Ex-ante conservatism can also be called unconditional conservatism (Beaver and Ryan, 2005). Basu's definition of accounting conservative in 1997 is considered by researchers to be ex-post conservatism, that is, conservatism is the asymmetric response of earnings to economic gains and losses. Ex-post conservatism can also be called conditional conservatism (Ball and Shivakumar, 2005). Accounting frameworks usually define conservatism as the identification of uncertainty, which requires standards for identifying good news, so that the revenue generated can reflect bad news in a timely manner (Lara et al., 2008). Conditional and unconditional accounting conservatism may convey completely different information to investors about the quality of the company's current and future earnings (Yunos et al., 2009). Ball and Shivakumar (2005) believe that companies with stronger corporate governance mechanisms will show more conditionally conservative accounting information. On the other hand, Beaver and Ryan (2005) believe that unconditional conservatism constitutes a form of "accounting slack", thus avoiding the application of conditional conservatism. In other words, unconditional conservatism can limit conditional conservatism.

Financial reports can be used by company executives for performance evaluation or investee valuations. Therefore, the conservatism of financial reporting is concerned by researchers. Watts (2003) proposed four interpretations for conservatism: a litigation explanation, a contracting explanation, an income tax explanation and a regulatory explanation. Zhong and Li (2017) believe that conservatism is mainly manifested in four aspects: debtholders, shareholders, auditors and regulators. In the relationship between debtholders and conservatism, the information obtained between debtholders and shareholders is biased, which will lead to certain debt problems. It is generally believed that this phenomenon is caused by the disunity of ownership and management. Zhang and Li (2017) proposed that only by using the accounting information in the contract in a timely manner can the debtholder's interests be protected in the debt contract. Therefore, the conservative treatment of accounting can distinguish the income and debtholders whether there is any breach

of contract (Basu, 1997). Such a relationship can protect the rights and interests of debtholders and prevent the loss of wealth. Debtholders will prefer conservatism. From the perspective of Shareholders, they are more inclined to choose accounting conservatism in order to avoid legal risks and reduce the losses caused by the resignation of executives. Accounting conservatism helps shareholders to alleviate this agency problem through timely loss recognition (Kothari et al, 2009). In addition, shareholders also hope to reduce taxes to increase wealth (zhong and Li, 2017). Conservatism can provide shareholders with a timelier recognition of losses, which can promote the value of the company. In addition, auditors are responsible for the reliability and verifiability of financial reports, and their professional characteristics make them demand conservatism (Palmrose and Scholz, 2000). When the company suffers from financial fraud, the auditor will face great legal risks. Research by Basu et al. (2001) shows that when auditors need to bear greater legal responsibilities, their behavior is more conservative. Finally, regulators will also face huge public opinion pressure and legal risks if the company goes bankrupt. Therefore, the government needs to enact detailed bills to limit the occurrence of fraud and protect the wealth of investors. For example, the United States enacted the Sarbanes-Oxley Act after Enron went bankrupt. However, Lambert (2010) believes that conservatism leads to discrepancies in financial reports and is not suitable for equity valuation. He suggested that the regulatory agencies' support for conservatism should be reviewed and removed from Generally Accepted Accounting Principles

The relationship between accounting conservatism and corporate governance has been studied by many researchers. Conservatism can limit the speculative behavior of managers, so accounting conservatism is considered to improve contract efficiency (Zhong and Li, 2017). In the company's board of directors, the proportion of independent directors and professionalism are more likely to lead to a decrease in the company's conservativeness because internal information can be delivered to the market more quickly (Beekes et al., 2004). Ahmed and Duellman (2007) also agree with this view and verify that conservatism is negatively correlated with the proportion of internal directors. In other words, companies with better internal corporate

governance have higher accounting conservativeness. In previous studies, researchers have focused on the relationship between accounting conservatism and investment. Unconditional conservatism can change the investment strategy of investors and reflect on whether it is necessary to discard existing investment projects (Watts, 2003). Investors can reduce investment in negative NPV projects based on the company's conservative nature (Zhong and Li, 2017). Ahmed and Duellman (2011) found that more conservative companies not only have higher gross profit margin and cash flow, but also have corresponding special project expenses after acquisition. It is worth noting that Zhong and Li (2017) summarized the international differences of conservatism in their article. They believe that although companies or organizations in some regions use the same accounting standards, differences in accounting conservativeness are due to the different economic and political environments in which companies and organizations are located. Ball et al. (2000) studied and compared whether the influence of politics on accounting in code law countries and common law countries will affect conservativeness. They believe that the conservativeness and timeliness of code law countries are generally lower than that of common law countries. Common law countries are more inclined to disclose accounting information to reduce information asymmetry.

3. Hypotheses development

According to previous literature, corporate executives such as CEOs are positively related to corporate risks (Carré and McCormick, 2008; Cain and McKeon, 2011). Bernile et al. (2017) pointed out that CEOs with higher fWHR showed more aggressive behavior. Wong et al. (2011) found that more masculine CEOs have higher return on assets (ROA), especially for companies with cognitively complex. To a certain extent, company executives can influence the company's risk level because they can influence the final outcome in financing or investment decisions. A high leverage ratio will increase the company's financial risk (Hamada, 1972) Chava and Purnanandam (2010) proved that CEO's behavior will affect the company's capital structure. In addition, Mills (2014) also found that fWHR has a positive correlation with financial leverage. Kamiya et al. (2019) also explored the relationship between

CEO and financial leverage and added factors such as total risk and mergers. It is worth noting that the data results in Europe and the United States seem to be different. Beltman (2018) believes that the relationship between executives of European listed companies and company performance is not obvious. However, the study lacks the support of a large amount of data and the lack of research on specific areas. This study will use CEOs in the UK as the sample source to make the study more representative. And define company executives as CEO, CFO and chairman. On the other hand, in the market-based accounting literature, Basu (1997)'s research laid the foundation for this field. His hypothesis is that the effect of conservatism is that stock returns trigger both good news and bad news returns and are timely in identifying bad news. The universal dominance category of conservatism means that, during periods of good news, the difference between the set of information shared by returns and returns in the same period has greatly increased (O'connell, 2007). In particular, conservatism is seen as a mechanism to curb management opportunism in the report to solve the agency problem between internal personnel and external investors (Lobo et al., 2019).

Based on the above arguments, corporate executives of non-financial listed companies in the UK are negatively related to accounting conservatism. Male company executives will make different risk behaviors based on different testosterone levels, which may lead to differences in accounting conservativeness. Therefore, this leads us to make the following hypothesis:

H1: *There is a negative relationship between fWHR of CEO, CFO and Chairman and accounting conservatism for non-financial listed companies in the UK.*

Corporate executives can influence conservatism by changing financing or investment decisions. Leverage ratio is the best measurement method for financing decisions. This study will use leverage ratio to measure financing decisions. The improvement of the company's financial risk is inseparable from a higher leverage ratio (Hamada, 1972) and higher benefits. When a company executive makes a

decision to improve the company's interests, it is likely to be achieved by increasing the company's financial leverage (Huang and Kisgen, 2013). Excessive financial risk will reduce corporate conservatism. Therefore, this research hypothesizes the following:

H2: *The masculine CEO, CFO and chairman will increase financial risk.*

4. Data and variables

4.1 Explanation of data collection

My research will be quantitative, and data will be quantitative data. Quantitative data makes the measurement of various variables controllable because of the easy mathematical derivation attached to them. The reason I use quantitative research is because I can use statistics or calculations to collect observable data to answer research questions. My research will mainly involve British company executives' fWHR and company performance, which means that I will collect clear photos of British company executives and financial data or operating data of the company they belong to. Determining the exact number of managers and companies will make research more accurate. Finding photos of executives and measuring them is the only way to obtain fWHR data. In addition, it is reliable and convincing to obtain executive salaries and other financial data based on the financial information disclosed by their company. By seeking the relationship between quantitative data fWHR and financial data, this can finally provide support for my research.

First of all, I will use the Datastream database to determine the final number of UK companies in the year that I need to research, because Datastream has UK listed company data from 1996 to 2019. After that, based on the list of UK companies, I will use BoardEx_UK database to find the name list of company executives and financial data. BoardEx database merges public domain information related to the boards and senior executives of public companies and large private companies. The BoardEx_UK database contains all board information and financial information of listed companies in the UK, such as the names of company executives, salaries,

bonuses and incentives. In addition, stock prices are updated every day at BoardEx_UK because stock prices affect salary information, such as incentive compensation. This ensures that the data I will obtain is accurate and true. Google Images Search is the main method used to collect photos of company executives. A large number of photo sources for fWHR research are Google Image Search (Ahmed et al., 2018; Wong et al., 2011; He et al., 2019; Colombo et al., 2020).

Google Image Search can study many different pictures of the same CEO, which allows researcher to throw out some pictures that may be manipulated. I will use ImageJ to measure fWHR with the photos of British company executives I searched. ImageJ is a java-based public image processing software that is often used by psychology and business researchers. Carre and McCormick (2008) first used this software to measure the fWHR of CEOs and it has been widely used in research later (Wong et al., 2011; Jia et al., 2014: Kamiya et al., 2016). As in Figure 1, I will follow the method of Carré and McCormick (2008) and Mayew et al. (2013) to turn the picture into black and white before measuring fWHR. Finally, I will use STATA for data analysis. STATA is the preferred software for regression analysis and is a powerful statistical software that allows me to analyze, manage and generate graphical visualization of data.

In using the database Datastream and BoardEx, the biggest disadvantage is the lack of data. For example, you cannot find the salary level and acquisition information of a certain CEO. The solution is to search the company's annual report or the company's official website according to the category of missing information after finding all the required data in the databases. When using Google Image Search to search for facial photos, researchers may be troubled by the quality of the photos searched. First, I will follow the method of Carre and McCormick (2008) and Kamiya et al. (2016) to ignore all photos whose size is less than 120×150 pixels. Secondly, I need to set standards to improve the quality of the photos when searching for photos. For example, the face photos of all faces must leak out two ears to ensure that the face faces forward. Finally, I can score the collected facial photos that meet the

requirements to ensure the accuracy of the research (Kamiya et al. 2016). The use of ImageJ is a key step to obtain fWHR. When using ImageJ, I will need to understand the rules of the software and record the data completely. The software is very convenient to use and can accurately obtain facial contour information and fWHR during measurement.

It is reasonable to select British companies and executives of British companies as the research samples. Company executives have proven that their behavior is inseparable from company performance (Wong et al., 2011; Ormiston and Haselhuhn, 2011; Kamiya et al., 2016). As the company's management, their decisions and perceptions of the company will have a profound impact on the company's development. Such a role is unmatched by other positions. Therefore, it is of great significance to use company executives, such as CEO and chairman, as samples to explore their impact on company performance.

All my data sources will be secondary data. Therefore, my research does not produce ethical issues, will not cause any physical or psychological harm to the subjects, and will not infringe on their privacy. The data in the database can be used legally and reasonably, and the photos in the Google image search can be downloaded and analyzed.

4.2 Firms sample collection

In previous studies, a large number of scholars used US listed companies as a sample source in the researching field of fWHR and corporate governance (Wong et al., 2011; Yim, 2013; Mobbs and Cook, 2014; Halford and Hsu, 2020; Kamiya et al., 2018). In common law countries, a large amount of information disclosure can make the required research information more comprehensive and complete, and it is very representative (Ball et al., 2000). Research on fWHR from some European countries has also received attention from researchers. For example, Beltman (2018) used 43 European companies as a research sample and found that the CEO's fWHR in the sample was not related to the company's business performance. This is inconsistent

with the results obtained by the researcher using North American sample. This also proves the importance of data selection diversity. In addition, emerging markets and developing countries have also received extensive attention from researchers. China is a developing country that has received the most attention from researchers in this field (Chan et al., 2020; Cao et al., 2019; He et al., 2019). He et al. (2019) used a large number of graphical samples of Chinese financial analysts to verify that fWHR has a strong and obvious positive correlation with performance, which fills a gap in the field of research in developing countries.

Following Beltman (2018) recommendations, researchers should try to focus the research sample in one European country and expand the sample size. In order to explore the relationship between the fWHR of company executives and corporate governance, I decided to use UK non-financial listed companies as a sample source. As an important economy in the European and world, researchers using UK listed companies as samples in essay in field of fWHR and coporate governance can also be found. The research sample of Alrajih and Ward (2014) comes from UK FTSE 100 companies. They found that the average fWHR of CEOs of UK-listed companies was 2.04, which was different to the 1.95 of US-listed companies (Wong et al., 2011). They also provided evidence for a link between fWHR and business leadership and they have established that social dominance may be the mediating psychological trait (Alrajih and Ward, 2014). It is worth noting that in previous studies, the sample source of British listed companies was basically FTSE 100 (Alrajih and Ward, 2014) and other smaller UK company data sources (Beltman, 2018). My research will use listed companies in FTSE 350 as a sample source, which will contribute more accurate data to research in this field. Secondly, in the database Datastream, the earliest available data about FTSE 350 listed non-finance company is from 1999, so the companies in the sample are from FTSE 350 between 1999 to 2019. The expanded sample size can make the research results more accurate and convincing. Finally, according to previous studies, a large number of researchers have eliminated financial companies from the data because the governance and risk characteristics of electronic financial institutions are very different from those of non-financial

companies (Kamiya et al., 2018). Therefore, my sample will be non-financial listed companies from FTSE 350 from 1999 to 2019.

I use the DataStream database to find all FTSE 350 non-financial companies from 1999 to 2019. In these 21 years, a total of 7392 samples were found. These samples refer to the total number of companies that appear in the FTSE 350 index each year. After removing the duplicate data, there are a total of 1,008 companies, which means that a total of 1,008 companies have appeared on the FTSE 350 index in the past 21 years. It is worth noting that 100 samples were deleted because the company name and DataStream identity number could not be found. Secondly, a total of 236 financial companies were found out of 908 companies. This accounts for 25.9% of the total sample. Therefore, my research sample will come from 672 UK non-financial listed companies. After removing the data that did not meet the requirements in BoardEx, the company's sample size was finally 417. The industry standard for the UK sample selected in this study is based on the Industry Classification Benchmark (ICB) (Table.1). The ICB is a universal standard used to classify and compare companies by different industries and sectors (FTSE Russell, 2020). Use ICB to meet the requirements of the London Stock Exchange for the classification of listed companies.

[Insert Table 1 about here]

Among the searched samples, the Consumer Discretionary industry has the largest number, accounting for 27.5% and followed by the industrial sector, accounting for 20.5%. It is worth noting that the Utilities industry and the Telecommunication industry have the lowest proportions, 4% and 4.16% respectively. The remaining Technology, Real Estate, Consumer Staples, Basic Material, Energy and Health Care industries accounted for 10.4%, 8%, 7.3%, 6.8%, 6.1% and 5.1%, respectively.

4.3 fWHR sample collection

4.3.1 Collection of executive samples

In this study, the sample of board members is limited to CEO, CFO and Chairman. The previous literature regards the CEO of a listed company as the focus of fWHR research in corporate governance (Mills et al., 2020; Momtaz, 2020; Colombo et al., 2020; Mobbs and Cook, 2014). Scholars generally believe that the CEO is the person in a company most capable of influencing the company's decision-making. Rule and Ambady (2009) believe that people's perceptions of the CEO's ability and leadership can predict the profitability of the world's leading companies. Opponents believe that the company may hire CEOs who ''look the part'' even if the appearance does not match their capabilities (Deaner et al., 2012). Wong et al. (2011) first link the CEO's fWHR to company performance. Their research shows that at the social level, although men with higher facial WHR may be aggressive and distrustful in interpersonal interactions, the success of organizations and companies may compensate for personal faults. Therefore, a CEO with a high face WHR may indeed have faces that only investors can like. Apart from this, their research proved that the relationship between CEO's facial WHR and company performance is stronger, which provides a reference for the subsequent research of other researchers, leading most researchers to focus only on the CEO's fWHR.

Although the CEO's fWHR has been discussed and studied by many researchers, based on the expansion of the company sample data based on this research, the CEO's fWHR is still representative. It is worth noting that the influence of CFO and Chairman on corporate governance is also huge. Jia et al. (2014) first measured the fWHR of the CFO and the fWHR of the CEO of the same company and explored their impact on the company's financial risks. Research reports show that there is a positive correlation between the facial structure of CEOs and CFOs and the likelihood of being classified as opportunistic traders. Research reports show that there is a positive correlation between the facial structure of CEOs and CFOs and the likelihood of being classified as opportunistic traders. Taking CFO as one of the measurement objects can expand the deficiencies of previous research and provide support for future research. In 1992, the Cadbury Commission recommended separating the roles of CEO and chairman of the board, which allowed 90% of the

UK's largest companies to follow a dual strategic leadership model (Higgs, 2003). The chairman of the board also plays an increasingly important role in the corporate governance of UK listed companies. Therefore, it is very important to use Chairman as sample sources. There is evidence that there are detectable differences in fWHR between the sexes (Lefevre et al., 2013), but not within the same sex across ethnicities and regions. Therefore, the measurement of fWHR can ignore racial and regional factors.

In order to measure the fWHR of senior management members of the board of directors, the BoardeEx database was used in this study when collecting the list of board members. The BoardEx database consolidates public domain information related to the boards and senior managers of public companies and large private companies (Bingham and Kit, 2003). The data of 672 companies obtained from the DataStream database is transferred to BoardEx, and the board information in each company can be searched, especially the board member information. After removing the sample of female directors and missing data, this study removed data that did not meet the roles of CEO, CFO, and Chairman based on the 'boardrole' in the BoardEX. There is a total of 49 categories that meet the standards, and a total of 1,345 board executives have been recognized (Table.2). Among the 1,345 company executives, there are a total of 774 chairmen, accounting for 57.5%, followed by 491 CEOs, accounting for 36.5%. The number of CFOs is the least, there are 95, accounting for 7.1%.

[Insert Table 2 about here]

Wong et al. (2011) proved the feasibility of using photos to measure the fWHR of people. They are the first study to use web photos to measure the CEO's fWHR and received support from researchers. Beltman (2020) approved this method and directly used the research data from Wong et al (2011). Alrajih and Ward (2014) first identified the source of photo data as Google Images. Other research literature also uses Google Image as the source of CEO photos (Gomulya et al., 2017; Lu and Teo,

2018; Ahmeda et al., 2019; Kamiya et al., 2019). Kamiya (2019) believes that searching for sample photos from Google Image is reliable, because such manipulation tends to not search for results, and it is difficult to believe that the modifiers of venture companies are deliberately distorting face photos. In this study, I select 2 photos of each company executive to measure fWHR and take the average of the two fWHRs to determine the company executive's fWHR. The quality requirements of the sample photos in this study follow the regulations: 1. Researchers must be able to clearly see the ears of the people in the photos. 2. The person in the photo must face forward. 3. The pixels of the photo must not be less than 400. ImageJ software has been used by a large number of researchers to measure fWHR. This study will also use this software for measurement (Wong et al., 2011; Alrajih et al., 2014; Kamiya et al., 2016; Beltman, 2018; Cleary et al., 2020).

4.3.2 ImageJ software measure of fWHR

Carré and McCormick (2008) first proposed a method for measuring CEO's fWHR using online photos, and it was supported by Mayew (2013). This method is to measure the distance between the left and right zygion (bizygomatic width) divided by the distance between the upper lip and the midpoint of the inner end of the eyebrows (the height of the upper face). This study followed Jia et al. (2014) and Lefevre et al. (2013) measure the upper facial height in a different way in that they measure the distance between the upper lip and the heights point of the eyelids. According to the literature, this study converts pictures of all sizes into standard grayscale pictures with a height of 400 pixels and uses ImageJ software to measure fWHR (Carré and McCormick, 2008). Figure 1 shows how this study used ImageJ software to manually measure the fWHR of the CEO, CFO, and Chairman. Pixels are counted by the bizygomatic distance and the height of the upper face.

Figure 1. Measuring the fWHR of Boris Johnson and ImageJ software

He et al. (2019) asked the other two research assistants to measure the fWHR of the research sample and obtain the intermediate value. In order to make this research more accurate, I randomly selected 200 from 2,690 of the collected sample photos for my supervisor team to measure and observe whether the results differed by more than 5% from my results. The difference of 5% between two results by different people is acceptable and considered as the high quality of the fWHR sample (He et al., 2019). The difference between the 200 fWHRs measured by the two supervisors and my result is all less than 5%. Table 5. shows a summary of fWHR for 1,345 samples and Table 3. in appendix Is summary statistics in fWHR with different industries.

[Insert Table 3 about here]

4.3.3 AI-based measure of fWHR

The advent of image processing and artificial intelligence technology has made it easier to measure photos. This research will use AI-based measure for robustness testing. The first step in using a computer to automatically calculate fWHR is to detect the faces and facial features needed to determine the corners of the fWHR Box that can locate the face in the photo. The computer can not only recognize the face in any given picture, but it can also recognize 68 different and uniquely numbered "landmarks" among the recognized faces in the photo (see Figure 3). "Landmarks" are calculations from the Python package (named "Face Recognition"),

based on the most advanced Dlib face recognition algorithm built using deep learning. These important points can be used to measure the length and width of the face. According to the developer, the project has an accuracy rate of as high as 99.38%, but the accuracy of the recognition of children and Asian faces needs to be improved (Github, 2019). The samples in this research are all adults and come from the United Kingdom, so this study will obtain a higher accuracy rate using Face Recognition. Figure 2 shows an example of a CEO's face picture in which the landmarks are identified. The figure shows an example of face detection and identification of 68 landmarks using Python code from Face Recognition. Figure 3 shows the 68 landmarks of a face with a fixed sequence number. It shows which landmarks are used for fWHR computation. fWHR is the distance between 1 and 15 divided by the distance between the midpoint of 21 and 22 and point 51. In this study, I use the same 2 photos of company executives as manual measurements to measure fWHR and take the average of the two fWHRs to determine the fWHRAI of the company executive.

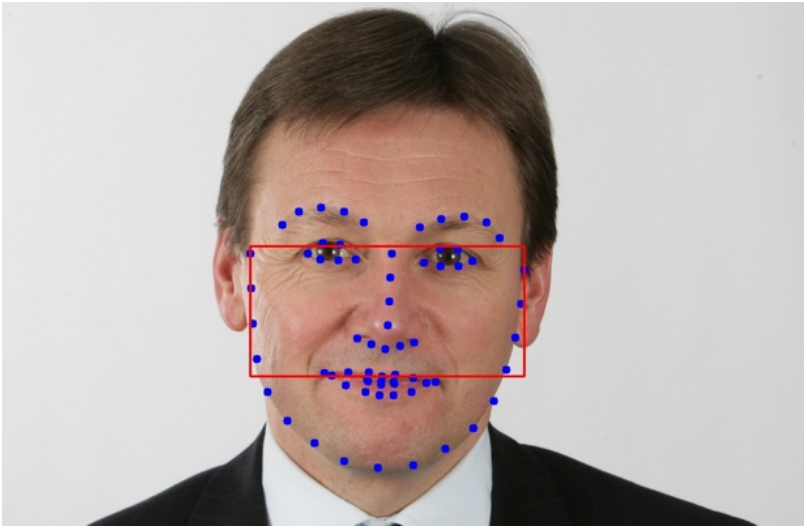

Figure 2. Charles Hammond's 68 landmarks via fWHR Box and Face Recognition

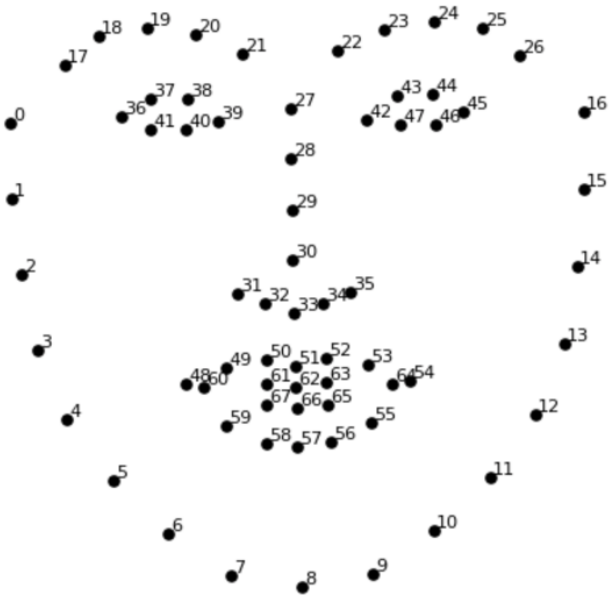

Figure 3. 68 landmarks via Face Recognition (Github, 2019)

I input 2,690 high-quality CEO pictures into the Python algorithm. These photos are similar to the sample photos I used to measure fWHR using ImageJ, which ensures the accuracy of robustness testing. It is worth noting that the algorithm does not recognize 14 photos. This is because Facial Recognition fails to recognize the correct position of the face in the photos and displays 68 landmarks. Therefore, the number of photos finally recognized by Facial Recognition is 2,662. Table 5 shows a summary of fWHR calculated using a computer. We get the average fWHR calculated by the computer to be 2.159. This is similar to the results measured with ImageJ, with a mean of 0.046 greater. The correlation coefficient between the sum measured by ImageJ and the fWHR measured by the computer is 0.843 (Table 6. In appendix).

4.4 Accounting conservatism collection

Accounting conservatism can be measured in several ways. The measurement methods frequently used in the previous literature include market-to-book value, earning, accruals/cash flows relation and earnings/stock return relation measures (Zhong and Li, 2017). In order to alleviate the multicollinearity concern, this study will use three methods to measure accounting conservatism, namely: Accrual-based

measure, Asymmetric timeliness measure and C_Score measure.

4.4.1 Accrual-based measure

Givoly and Hayn (2000) believe that there are many reasons why accruals continue to be negative, and corporate conservatism is one of them. It is worth noting that accounting conservativeness is manifested in average negative accruals (Yunos et al., 2009). An average of a few years will mitigate the impact of any temporary large accruals, because the accruals may reverse within one to two years (Richardson et al., 2005). In 2005, Ball and Shivakumar proposed using the accrual/cash flow relationship to calculate corporate conservatism. This method improves the ability of earnings to measure company performance by eliminating the negative serial correlation of cash flow (Zhong and Li, 2017). Therefore, accruals are negatively correlated with operating cash flow (Dechow, 1994). The proposal of two methods makes researchers begin to pay attention to Accrual-based measure.

This research will follow the calculation method of Givoly and Hayn (2000) to use Accrual-based measure. This measure is computed as income before extraordinary item and discontinued operations plus depreciation expenses minus operating cash flows and deflated by total asset. The accrual value is then averaged over 5 years centered in year t and is multiplied by -1. The higher the accrual value, the higher the conservatism. The regression model is:

$$CONACCA_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + control\ variables + \varepsilon_{i,t} \qquad (1)$$

4.4.2 Asymmetric timeliness measure

Basu (1997) proposed the use of the earnings/stock return relationship to measure corporate conservatism. This method is by far the most used in corporate governance conservatism research (Zhong and Li, 2017). In his research, the proof studied the preferences of accountants and explained the need for a higher ability to recognize good news in the company's financial statements. He emphasized the importance of earnings containing good news and bad news. In addition, he referred

to negative stock returns and positive stock returns as "bad news" and "good news" respectively for estimating accounting conservatism. Stock returns not only reflect earnings information, but also reflect information from other sources (Zhong and Li, 2017). Share returns are used as a proxy for news about firm performance that is publicly available (Yunos et al., 2009). Timeliness in earnings is measured using reverse-regression between earnings and contemporaneous return that capture the difference in the effects of negative returns and positive returns on earnings (Yunos et al., 2009). Effective market hypothesis means that over time, stock returns can fully reflect all kinds of information (Dietrich et al., 2007). The method proposed by Basu (1997) allowed researchers to start using accounting methods to measure corporate conservatism. In this method, the regression model proposed by Basu (1997) is:

$$\frac{E_{i,t}}{P_{i,t-1}} = \beta_0 + \beta_1 \times R_{i,t} + \beta_2 \times D_{i,t} + \beta_3 \times R_{i,t} \times D_{i,t} + \varepsilon_{i,t} \qquad (2)$$

Where：

$\frac{E_{i,t}}{P_{i,t-1}}$ = Net income before extraordinary items divided by beginning of aggregated year market value of equity;

β_0= the intercept across all firms and years;

$R_{i,t}$= Annual stock returns;

$D_{i,t}$= Dummy variable equal to 1 if returns are negative and 0 otherwise;

The sensitivity of earnings to good news is measured by β_1 estimate while sensitivity of earnings to bad news is measured by $\beta_1 + \beta_3$. The value of β_3 reflects the incremental sensitivity of earnings to bad news compared to good news and the coefficient β_3 is asymmetric timeliness. In the case of greater conservatism, compared to good news, earnings will have higher sensitivity to bad news (Basu, 1997). Therefore, under greater conservatism, β_3 is expected to be more positive.

In order to explore the relationship between the fWHR of corporate executives and

corporate accounting conservatism, $fWHR_{i,t}$as an independent variable should interact with dependent variable $\frac{E_{i,t}}{P_{i,t-1}}$ and other dependent variables in this model, as shown in equation 3. The coefficient of the interaction, namely β_7, between $R_{i,t} \times D_{i,t}$ and variable represents the influence of each variable on asymmetric timeliness (Basu, 1997). This means that if company executives with high fWHR have higher conservatism, the coefficient β_7 should be positive and higher. Similar interactions were made with the remaining independent variables, but are not shown for clarity purposes:

$$\frac{E_{i,t}}{P_{i,t-1}} = \beta_0 + \beta_1 \times R_{i,t} + \beta_2 \times D_{i,t} + \beta_3 \times R_{i,t} \times D_{i,t} + \beta_4 \times fWHR_{i,t} + \beta_5 \times R_{i,t} \times fWHR_{i,t} + \beta_6 \times D_{i,t} \times fWHR_{i,t} + \beta_7 \times R_{i,t} \times D_{i,t} \times fWHR_{i,t} + control\ variables + \varepsilon_{i,t} \quad (3)$$

It is worth noting that the benefits and returns in the original Basu specification are based on one year, which is considered by researchers of accounting conservatism to reduce the accuracy of conservatism (Pae et al.,2005). Asset changes are cyclical, and the increase or decrease of recorded assets will affect conservatism (LaFond and Watts, 2008). In order to resolve the asymmetry caused by the time lag between earning and return, researchers have accumulated earning and return over the past three years (LaFond and Watts, 2008; Ahmed and Duellman, 2007; Yunos et al., 2010). This research will use this approach.

4.4.3 C_Score method

Khan and Watts (2009) proposed the C_Score method based on the asymmetric timeliness method proposed by Basu (1997). The standard Basu (1997) regression is rewritten as:

$$X_{i,t} = \beta_0 + \beta_1 \times D_{i,t} + \beta_2 \times R_{i,t} + \beta_3 \times D_{i,t} \times R_{i,t} + \varepsilon_{i,t} \quad (4)$$

where, $X_{i,t}$ is the annual earnings deflated by the market capitalisation at the beginning of the year, $R_{i,t}$ is stock returns and $D_{i,t}$ is a dummy variable which takes the value of one for firms with negative stock returns and zero otherwise, and $\varepsilon_{i,t}$ is

the regression residual. The coefficient β_3 captures the incremental timeliness for bad news relative to good news.

Based on the equation, Khan and Watts (2009) express β_2 and β_3 as linear functions of three company-specific characteristics that change over time: size, market-to-book ratio, and leverage. The study of Khan and Watts (2009) uses the timeliness of good news (G_Score) and the timeliness of bad news (C_Score) as functions. In the model from Buse (1997), a stronger correlation between benefits and bad news means that bad news is easier to identify than good news. They expressed the timeliness of good news (β_2 or $\mathrm{G\_Score}_{i,t}$) and the incremental timeliness of bad news (β_3 or $\mathrm{C\_Score}_{i,t}$) as a linear function of the company-specific market-to-book ratio, company size, and leverage ratio over time and use it into the Basu (1997) model.

$$\mathrm{G\_Score}_{i,t} = \beta_2 = \mu_0 + \mu_1 \times SIZE_{i,t} + \mu_2 \times MTB_{i,t} + \mu_3 \times LEV_{i,t} \qquad (5)$$

$$\mathrm{C\_Score}_{i,t} = \beta_3 = \lambda_0 + \lambda_1 \times SIZE_{i,t} + \lambda_2 \times MTB_{i,t} + \lambda_3 \times LEV_{i,t} \qquad (6)$$

λ_i and μ_i are constant across firms but vary over time. The final equation is the annual cross-section regression model where coefficients λ_0 to λ_3 are used to estimate $\mathrm{C\_Score}_{i,t}$. Replacing β_2 and β_3 from equations (5) and (6) into regression equation (4) yields:

$$X_{i,t} = \beta_0 + \beta_1 \times D_{i,t} + R_{i,t} \times (\mu_0 + \mu_1 \times SIZE_{i,t} + \mu_2 \times MTB_{i,t} + \mu_3 \times LEV_{i,t}) + R_{i,t} \times D_{i,t} \times (\lambda_0 + \lambda_1 \times SIZE_{i,t} + \lambda_2 \times MTB_{i,t} + \lambda_3 \times LEV_{i,t}) + (\delta_0 \times SIZE_{i,t} + \delta_1 \times MTB_{i,t} + \delta_2 \times LEV_{i,t} + \delta_3 \times D_{i,t} \times SIZE_{i,t} + \delta_4 \times D_{i,t} \times MTB_{i,t} + \delta_5 \times D_{i,t} \times LEV_{i,t}) + \varepsilon_{i,t} \qquad (7)$$

This study will use equation (7) to calculate $\mathrm{C\_Score}_{i,t}$, which is consistent with Khan and Watts (2009). we measure $X_{i,t}$ as net income before extraordinary items scaled by market value of equity at the beginning of the fiscal year, $R_{i,t}$ as annual return after the fiscal year end, $SIZE_{i,t}$ as the natural log of market value of equity, $MTB_{i,t}$

as market value of equity divided by the book value of equity at the end of the fiscal year and $LEV_{i,t}$ is the sum of long-term and short-term debt divided by market value of equity.

4.5 Control variables

This article will use 7 control variables, namely BVLEV, SIZE, PROF, ROA, MTB, SGROW and Age. The difference in BVLEV shows the conservatism of different companies. Companies that demand more conservatism tend to have higher leverage in order to reduce conflicts between asset holders and debt holders. The company's adoption of conservatism can effectively reduce the conflict between debt holders and shareholders, which will ultimately greatly reduce the cost of debt (Ahmed et al., 2002). The research results from LaFond and Roychowdhury (2008) and Kamiya et al. (2019) also proves this. Size not only reflects the cost difference between companies with different sizes, but also reveals the information asymmetry between companies. Political costs may be affected by information asymmetry effects caused by different company sizes (Watts and Zimmerman, 1978). Therefore, researchers believe that companies with greater political costs may adopt more conservatism. Generally speaking, the larger the company, the more likely it is to disclose more information and provide reference for the public, so it suffers less information asymmetry (LaFond and Watts, 2008). The research results from Givoly et al. (2007) prove that the information asymmetry of small companies is much higher than that of larger companies. This is because small companies usually have no need to release information to the public and therefore have low conservatism. Therefore, larger companies have greater political costs and therefore need higher conservatism to reduce the consequences of costs. On the contrary, small companies pay lower costs and do not need higher conservatism. PROF controls the differences in accounting conservatism of companies with different profit levels. Companies with lower profits will not choose conservatism, because too high conservatism will further reduce profits (Ahmed et al., 2002). In addition, ROA is also a useful indicator to measure the net profit created per unit of assets and to evaluate the profitability of a company relative to its total asset value. Yuying et al. (2012)

believed that using PROF and ROA together as a control variable can better measure the relationship between profitability and conservatism. MTB is applied to the asymmetric timeliness model because changes in growth opportunities can lead to asymmetric timeliness changes that have nothing to do with accounting conservatism (Roychowdhury and Watts, 2007). LaFond and Roychowdhury (2008) pointed out that MTB is used to control the impact of the initial equity value composition on the asymmetric timeliness in the future. Ahmed et al. (2002) believes that SGROW will affect accruals such as inventory and accounts receivable, so it should also be controlled in the return of conservatism. CEO's age can temporarily increase the company's risk (Clayton et al., 2005). Due to the lack of data in BoardEx, there are no salary and tenure variables in this study. Definitions of all variables are listed in Table 4. in appendix.

[Insert Table 4 about here]

5. Empirical models and results

5.1 Descriptive statistics

Table 5. in appendix reports descriptive statistics for a complete sample of 21 years of observations from 417 companies used to run three conservatism models and robustness tests. To minimize the effect of outliers, we indented all continuous variables at the 1st and 99th percentiles. The average value of $CONACCA_{i,t}$ is -0.061, which is lower than the result of 0.01 for the US sample used by Ahmed and Duellman (2007) and Krishnan and Visvanathan (2008). This means that compared to American companies, British companies have relatively low conservatism in this model. Compared with the ownership structure widely held by American companies, the ownership structure of British companies is relatively more concentrated, so the difference in ownership structure and other institutional factors may lead to differences. $CONACCA_{i,t}$ is similar to the data from Yunos et al. (2012) with Malaysia sample, both of which are negative. Both $\frac{E_{i,t}}{P_{i,t-1}}$ and $\mathrm{C\_Score}_{i,t}$ are positive, which indicates that British companies are more conservative in these two models. it is

worth noting that the $\frac{E_{i,t}}{P_{i,t-1}}$ value is larger, which seems to be caused by the increasing conservatism in financial reports over the past few decades (Givoly and Hayn, 2000). Over time, the higher the earning of British companies, the higher the conservatism they choose (Ahmed et al., 2002). With regard to main conservatism measure, $\mathrm{C\_Score}_{i,t}$, we find that the mean value is 0.067, which lower than those of Khan and Watts (2009) (mean 0.105). In this study, the mean of $fWHR_{i,t}$ measured by ImageJ is 2.108, which is basically consistent with the mean of 2.013 from Jia et al. (2014) using ImageJ for the first time to measure the $fWHR_{i,t}$ of the company's CEO. Kamiya et al. (2019) measured the $fWHR_{i,t}$ of CEO and CFO from the Execucomp database and got an average value of 2.015, which is also similar to the data in this research. The accuracy of the algorithm is as high as 99.38% after excluding samples of Asians and children. This study uses a very small proportion of Asian executives from British listed companies, so the accuracy of the results in this article is very high.

[Insert Table 5 about here]

Table 6. shows the correlation between independent variables, dependent variables and control variables. This article predicts that high $fWHR_{i,t}$ and more masculine company executives will adopt low conservatism. Therefore, the value of $fWHR_{i,t}$ should have a negative correlation with $CONACCA_{i,t}$, $\frac{E_{i,t}}{P_{i,t-1}}$ and$C_Score_{i,t}$. $fWHR_{i,t}$ and $CONACCA_{i,t}$,and $C\_Score_{i,t}$ are negative coefficients, but $fWHR_{i,t}$ and $\frac{E_{i,t}}{P_{i,t-1}}$ are positive coefficients. However, simple correlation should be interpreted with caution, because it does not consider the joint effects from other variables and therefore will be affected by the bias of the omitted variable.

[Insert Table 6 about here]

5.2 Empirical models

This research will use 3 regression models, respectively:

$$CONACCA_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times BVLEV_{i,t} + \beta_3 \times SIZE_{i,t} + \beta_4 \times PROF_{i,t} + \beta_5 \times MTB_{i,t} + \beta_6 \times ROA_{i,t} + \beta_7 \times SGROW_{i,t} + \beta_8 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (8)$$

$$\frac{E_{i,t}}{P_{i,t-1}} = \beta_0 + \beta_1 \times R_{i,t} + \beta_2 \times D_{i,t} + \beta_3 \times R_{i,t} \times D_{it} + \beta_4 \times fWHR_{i,t} + \beta_5 \times R_{i,t} \times fWHR_{i,t} + \beta_6 \times D_{i,t} \times fWHR_{i,t} + \beta_7 \times R_{i,t} \times D_{i,t} \times fWHR_{i,t} + \beta_8 \times BVLEV_{i,t} + \beta_9 \times R_{i,t} \times BVLEV_{i,t} + \beta_{10} \times D_{i,t} \times BVLEV_{i,t} + \beta_{11} \times R_{i,t} \times D_{i,t}\ BVLEV_{i,t} + \beta_{12} \times SIZE_{i,t} + \beta_{13} \times R_{i,t} \times SIZE_{i,t} + \beta_{14} \times D_{i,t} \times SIZE_{i,t} + \beta_{15} \times R_{i,t} \times D_{i,t} \times SIZE_{i,t} + \beta_{16} \times PROF_{i,t} + \beta_{17} \times R_{i,t} \times PROF_{i,t} + \beta_{18} \times D_{i,t} \times PROF_{i,t} + \beta_{19} \times R_{i,t} \times D_{i,t} \times PROF_{i,t} + \beta_{20} \times MTB_{i,t} + \beta_{21} \times R_{i,t} \times MTB_{i,t} + \beta_{22} \times D_{i,t} \times MTB_{i,t} + \beta_{23} \times R_{i,t} \times D_{i,t} \times MTB_{i,t} + \beta_{24} \times ROA_{i,t} + \beta_{25} \times R_{i,t} \times ROA_{i,t} + \beta_{26} \times D_{i,t} \times ROA_{i,t} + \beta_{27} \times R_{i,t} \times D_{i,t} \times ROA_{i,t} + \beta_{28} \times SGROW_{i,t} + \beta_{29} \times R_{i,t} \times SGROW_{i,t} + \beta_{30} \times D_{i,t} \times SGROW_{i,t} + \beta_{31} \times R_{i,t} \times D_{i,t} \times SGROW_{i,t} + \beta_{32} \times AGE_{i,t} + \beta_{33} \times R_{i,t} \times AGE_{i,t} + \beta_{34} \times D_{i,t} \times AGE_{it} + \beta_{35} \times R_{i,t} \times D_{it} \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (9)$$

$$C\_Score_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times BVLEV_{i,t} + \beta_3 \times SIZE_{i,t} + \beta_4 \times PROF_{i,t} + \beta_5 \times MTB_{i,t} + \beta_6 \times ROA_{i,t} + \beta_7 \times SGROW_{i,t} + \beta_8 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (10)$$

Where $CONACCA_{i,t}$, $\frac{E_{i,t}}{P_{i,t-1}}$ and $C\_Score_{i,t}$ represents the dependent variable of firm i in year t that we are interested in. $fWHR_{i,t}$ is the face aspect ratio of the CEO, CFO and Chairman of company i in fiscal year t. It is worth noting that each CEO, CFO and Chairman have a fWHR estimate for firm i. In regression models 8 and 10, the remaining variables are control variables. In regression model 9, dummy variable $D_{i,t}$ (D=1 if R stock return is negative) is introduced and interacts with control variables with $R_{i,t}$ (stock return). This research does not apply a fixed effect to the CEO, CFO and Chairman's fWHR because of its time-invariant value. In addition, the turnover rate of CEO, CFO and Chairman is low, then the use of fixed effects will over-control the influence of company executives' masculinity (Kamiya et al., 2019). This study will control the industry and year fixed effects in all regressions.

5.3 Results

5.3.1 Regression results

This research mainly explores whether the masculinity of company executives will affect corporate conservatism. Table 7 reports the OLS regression results used to test Hypothesis 1. $fWHR_{i,t}$ is the CEO's face aspect ratio. All regressions are in the industry control fixed effects and year fixed effects. The t-statistics are based on heteroskedasticity robust standard errors. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. All the variables are winsorized at the 1% and 99% levels. Variable definitions are in table 4. According to the regression results in table 7, the signs of the three coefficients of $fWHR_{i,t}$ for asymmetric timeliness ($fWHR_{i,t}$ and $fWHR_{i,t} \times R_{i,t} \times D_{i,t}$) are all in line with expectations, and they are all negative. It is worth noting that all three coefficients are significant at the 1% level. This means that the more masculine CEO, CFO and Chairman of the company executives will not adopt conservatism. This supports Hypothesis 1.

LaFond (2005) and LaFond and Roychowdhury (2008) believe that the negative correlation between ownership and conservatism within a company is a substitution effect. As managers become owners, their interests are aligned with shareholders, so it is necessary to reduce conservative actions Monitoring tools. Managers with masculine characteristics are more ambitious and aggressive (Jia et al., 2014), in order to pursue higher interests, they will increasingly reduce conservatism. In addition, from the perspective of corporate governance, management ownership is a tool for management to consolidate assumptions (Bebchuk et al., 2009). Therefore, major shareholders with masculinity are more likely to reduce conservatism and use it as a defensive effect. In addition, Kothari et al. (2009) believe that the reason for lower conservatism is likely to be caused by management's reduction in expropriation activities. More masculine company executives usually conceal their activities in order to improve management capabilities and circumvent restrictions. Therefore, this study believes that the more masculine company executives are, the lower conservatism is adopted.

The control variable coefficients in this study are not much different from previous literature. It is worth noting that the control variable $SIZE_{i,t}$ has a significant correlation with $CONACCA_{i,t}$ and $C\_Score_{i,t}$, which is consistent with the research results of Hsieh et al. (2018). The control variable $MTB_{i,t}$ has a significant relationship with both $\frac{E_{i,t}}{P_{i,t-1}}$ and $C\_Score_{i,t}$, similar to the literature (LaFond and Watts, 2008; Lara et al., 2020). In addition, the variables $ROA_{i,t}$ also show a significant relationship with $CONACCA_{i,t}$ and are similar to previous literature (Biddle et al. 2020; Kang et al. 2017).

5.3.2 Masculinity and financial risk

The masculinity of company executives can affect the company's conservatism, largely because of the company's executives' decisions on financial leverage (Ben-David et al., 2013; Huang and Kisgen, 2013). This study also explores the relationship between CEO, CFO, and Chairman's $fWHR_{i,t}$. The leverage ratio based on the book value is regressed to the $fWHR_{i,t}$ of the CEO, CFO and Chairman and controls the industry and year fixed effects in year t. The control variables are the same as those from the main regression except BVLEV, SIZE, PROF, MTB, ROA, SGROW and AGE respectively. In addition, a robustness check is performed by replacing the dependent variable with a leverage ratio based on market value. Those two regression models are as follows：

$$BVLEV_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times SIZE_{i,t} + \beta_3 \times PROF_{i,t} + \beta_4 \times MTB_{i,t} + \beta_5 \times ROA_{i,t} + \beta_6 \times SGROW_{i,t} + \beta_7 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (11)$$

$$MVLEV_{i,t} = \beta_0 + \beta_1 \times fWHR + \beta_2 \times SIZE_{i,t} + \beta_3 \times PROF_{i,t} + \beta_4 \times MTB_{i,t} + \beta_5 \times ROA_{i,t} + \beta_6 \times SGROW_{i,t} + \beta_7 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (12)$$

The regression results are shown in Columns (4) and (5) of Table 7. The study found that more masculine corporate executives significantly increased the leverage ratio of the companies listed in column (4) of Table 7. According to Table 7, there is a highly positive correlation between the increase in $fWHR_{i,t}$ and the increase in $BVLEV_{i,t}$

(coefficient=1.361, t-stat = 5.347 and p-value <0.01), which shows that the more manly corporate executives will prefer financial leverage. In column (5) of Table 7, this study performed a robustness check by replacing the dependent variable with a leverage ratio based on market value ($MVLEV_{i,t}$) and found the same result. The independent variable and the dependent variable are significantly positively correlated (coefficient=0.568, t-stat = 4.953 and p-value <0.01). This supports Hypothesis 2.

[Insert Table 7 about here]

5.3.3. Fixed effect model

In order to control the two-way fixed effect of individual and time, this study used a fixed effect model to test. Different from the fixed effect of joining time and industry, the fixed effect model of joining time can control the industry and exclude the influence of variables that do not change with time. The regression models used in this section are as follows:

$$CONACCA_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times BVLEV_{i,t} + \beta_3 \times SIZE_{i,t} + \beta_4 \times PROF_{i,t} + \beta_5 \times MTB_{i,t} + \beta_6 \times ROA_{i,t} + \beta_7 \times SGROW_{i,t} + \beta_8 \times AGE_{i,t} + Year\ FE + Firm\ FE + \varepsilon_{i,t} \quad (13)$$

$$\frac{E_{i,t}}{P_{i,t-1}} = \beta_0 + \beta_1 \times R_{i,t} + \beta_2 \times D_{i,t} + \beta_3 \times R_{i,t} \times D_{i,t} + \beta_4 \times fWHR_{i,t} + \beta_5 \times R_{i,t} \times fWHR_{i,t} + \beta_6 \times D_{i,t} \times fWHR_{i,t} + \beta_7 \times R_{i,t} \times D_{i,t} \times fWHR_{i,t} + \beta_8 \times BVLEV_{i,t} + \beta_9 \times R_{i,t} \times BVLEV_{i,t} + \beta_{10} \times D_{i,t} \times BVLEV_{i,t} + \beta_{11} \times R_{i,t} \times D_{i,t} BVLEV_{i,t} + \beta_{12} \times SIZE_{i,t} + \beta_{13} \times R_{i,t} \times SIZE_{i,t} + \beta_{14} \times D_{i,t} \times SIZE_{i,t} + \beta_{15} \times R_{i,t} \times D_{i,t} \times SIZE_{i,t} + \beta_{16} \times PROF_{i,t} + \beta_{17} \times R_{i,t} \times PROF_{i,t} + \beta_{18} \times D_{i,t} \times PROF_{i,t} + \beta_{19} \times R_{i,t} \times D_{i,t} \times PROF_{i,t} + \beta_{20} \times MTB_{i,t} + \beta_{21} \times R_{i,t} \times MTB_{i,t} + \beta_{22} \times D_{i,t} \times MTB_{i,t} + \beta_{23} \times R_{i,t} \times D_{i,t} \times MTB_{i,t} + \beta_{24} \times ROA_{i,t} + \beta_{25} \times R_{i,t} \times ROA_{i,t} + \beta_{26} \times D_{i,t} \times ROA_{i,t} + \beta_{27} \times R_{i,t} \times D_{i,t} \times ROA_{i,t} + \beta_{28} \times SGROW_{i,t} + \beta_{29} \times R_{i,t} \times SGROW_{i,t} + \beta_{30} \times D_{i,t} \times SGROW_{i,t} + \beta_{31} \times R_{i,t} \times D_{i,t} \times SGROW_{i,t} + \beta_{32} \times AGE_{i,t} + \beta_{33} \times R_{i,t} \times AGE_{i,t} + \beta_{34} \times D_{i,t} \times AGE_{i,t} + \beta_{35} \times R_{i,t} \times D_{i,t} \times AGE_{i,t} + Year\ FE + Firm\ FE + \varepsilon_{i,t} \quad (14)$$

$$C\_Score_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times BVLEV_{i,t} + \beta_3 \times SIZE_{i,t} + \beta_4 \times PROF_{i,t} + \beta_5 \times MTB_{i,t} +$$

$$\beta_6 \times ROA_{i,t} + \beta_7 \times SGROW_{i,t} + \beta_8 \times AGE_{i,t} + Year\ FE + Firm\ FE + \varepsilon_{i,t} \quad (15)$$

$$BVLEV_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times SIZE_{i,t} + \beta_3 \times PROF_{i,t} + \beta_4 \times MTB_{i,t} + \beta_5 \times ROA_{i,t} + \beta_6 \times SGROW_{i,t} + \beta_7 \times AGE_{i,t} + Year\ FE + Firm\ FE + \varepsilon_{i,t} \quad (16)$$

$$MVLEV_{i,t} = \beta_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times SIZE_{i,t} + \beta_3 \times PROF_{i,t} + \beta_4 \times MTB_{i,t} + \beta_5 \times ROA_{i,t} + \beta_6 \times SGROW_{i,t} + \beta_7 \times AGE_{i,t} + Year\ FE + Firm\ FE + \varepsilon_{i,t} \quad (17)$$

Table 8 shows the regression results using the fixed effects model. The regression results of models 13 to 17 are similar to models 8 to 12. There is still a significant negative correlation between the three dependent variables ($CONACCA_{i,t}$, $\frac{E_{i,t}}{P_{i,t-1}}$ and $C\_Score_{i,t}$) of accounting conservatism and $fWHR_{i,t}$ (-0.090 vs -0.084, p<0.01; -0.961 vs -0.970, p<0.01; -0.226 vs -0.204, p<0.01 and p<0.05). In addition, the regression results from columns (4) and (5) in Table 8 and Table 7 are also similar, and both are significantly correlated (1.361 vs 1.386, p<0.01; 0.568 vs 0.643, p<0.01). The regression results prove that under the control of the two-way fixed effect of individual and time, the results still haven't changed much.

[Insert Table 8 about here]

5.3.4 Robustness testing

5.3.4.1 AI-based fWHR and accounting conservatism

With the emergence of more and more new technologies, image processing and artificial intelligence technologies are constantly innovating. The computer can not only recognize faces in different pictures, but also mark the recognized faces with 68 uniquely numbered "landmarks" ranging from 0th to 67th (Figure 3). Landmarks can make the computer quickly calculate $fWHR_{i,t}$, and this research will use the result as the variable $fWHRAI_{i,t}$. Similar to using ImageJ to measure $fWHR_{i,t}$, a total of 2,690 photos of 1,345 CEO, CFO and Chairman samples were used in this section. The computer algorithm did not identify the 14 photos, a total of 14 samples were involved, so the final effective sample number was 1,331 and 2,662 photos. The

average $fWHRAI_{i,t}$ obtained in the study was 2.145, and the correlation coefficient between fWHR and $fWHRAI_{i,t}$ was 0.843 (Table 6.). This section replaces $fWHR_{i,t}$ with $fWHRAI_{i,t}$ to test robustness. The regression model is as follows:

$$CONACCA_{i,t} = \beta_0 + \beta_1 \times fWHRAI_{i,t} + \beta_2 \times BVLEV_{i,t} + \beta_3 \times SIZE_{i,t} + \beta_4 \times PROF_{i,t} + \beta_5 \times MTB_{i,t} + \beta_6 \times ROA_{i,t} + \beta_7 \times SGROW_{i,t} + \beta_8 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (18)$$

$$\frac{E_{i,t}}{P_{i,t-1}} = \beta_0 + \beta_1 \times R_{i,t} + \beta_2 \times D_{i,t} + \beta_3 \times R_{i,t} \times D_{i,t} + \beta_4 \times fWHRAI_{i,t} + \beta_5 \times R_{i,t} \times fWHRAI_{i,t} + \beta_6 \times D_{i,t} \times fWHRAI_{i,t} + \beta_7 \times R_{i,t} \times D_{i,t} \times fWHRAI_{i,t} + \beta_8 \times BVLEV_{i,t} + \beta_9 \times R_{i,t} \times BVLEV_{i,t} + \beta_{10} \times D_{i,t} \times BVLEV_{i,t} + \beta_{11} \times R_{i,t} \times D_{i,t} \times BVLEV_{i,t} + \beta_{12} \times SIZE_{i,t} + \beta_{13} \times R_{i,t} \times SIZE_{i,t} + \beta_{14} \times D_{i,t} \times SIZE_{i,t} + \beta_{15} \times R_{i,t} \times D_{i,t} \times SIZE_{i,t} + \beta_{16} \times PROF_{i,t} + \beta_{17} \times R_{i,t} \times PROF_{i,t} + \beta_{18} \times D_{i,t} \times PROF_{i,t} + \beta_{19} \times R_{i,t} \times D_{i,t} \times PROF_{i,t} + \beta_{20} \times MTB_{i,t} + \beta_{21} \times R_{i,t} \times MTB_{i,t} + \beta_{22} \times D_{i,t} \times MTB_{i,t} + \beta_{23} \times R_{i,t} \times D_{i,t} \times MTB_{i,t} + \beta_{24} \times ROA_{i,t} + \beta_{25} \times R_{i,t} \times ROA_{i,t} + \beta_{26} \times D_{i,t} \times ROA_{i,t} + \beta_{27} \times R_{i,t} \times D_{i,t} \times ROA_{i,t} + \beta_{28} \times SGROW_{i,t} + \beta_{29} \times R_{i,t} \times SGROW_{i,t} + \beta_{30} \times D_{i,t} \times SGROW_{i,t} + \beta_{31} \times R_{i,t} \times D_{i,t} \times SGROW_{i,t} + \beta_{32} \times AGE_{i,t} + \beta_{33} \times R_{i,t} \times AGE_{i,t} + \beta_{34} \times D_{i,t} \times AGE_{i,t} + \beta_{35} \times R_{i,t} \times D_{i,t} \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (19)$$

$$C\_Score_{i,t} = \beta_0 + \beta_1 \times fWHRAI_{i,t} + \beta_2 \times BVLEV_{i,t} + \beta_3 \times SIZE_{i,t} + \beta_4 \times PROF_{i,t} + \beta_5 \times MTB_{i,t} + \beta_6 \times ROA_{i,t} + \beta_7 \times SGROW_{i,t} + \beta_8 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (20)$$

Columns (1) (2) (3) of Table 9 show the regression results of models 18, 19 and 20. Similar to the results of using $fWHR_{i,t}$ as the independent variable, $fWHRAI_{i,t}$ is negatively correlated with $CONACCA_{i,t}$, $\frac{E_{i,t}}{P_{i,t-1}}$ and $C\_Score_{i,t}$ and coefficients are very close (-0.090 vs -0.034, -0.961 vs -0.943, -0.226 vs -0.206). $C\_Score_{i,t}$ and $\frac{E_{i,t}}{P_{i,t-1}}$ are significantly negatively correlated with $fWHRAI_{i,t}$ (coefficient=-0.206 and -0.943 respectively, p<0.01). It is worth noting that although$fWHRAI_{i,t}$ and $CONACCA_{i,t}$ are negatively correlated (coefficient=-0.034), they are not significant. The results show that the robustness test of $fWHR_{i,t}$ measured using computer algorithms shows that the relationship between human-measured $fWHR_{i,t}$ and corporate conservatism is robust. In 4.4.3 of this paper, $fWHRAI_{i,t}$ based on computer algorithm measurement

is introduced.

5.3.4.2 AI-based fWHR and financial leverage

This study believes that if company executives are more aggressive, they will be more inclined to finance expansion. As the best way to expand assets, increasing financial leverage will greatly increase the company's financial risk and thereby reduce accounting conservatism. In order to further explore the robustness of channels, masculinity and financial risk, this study also replaced $fWHRAI_{i,t}$ as an independent variable in Model 11 and produced a new model 21:

$$BVLEV_{i,t} = \beta_0 + \beta_1 \times fWHRAI_{i,t} + \beta_2 \times SIZE_{i,t} + \beta_3 \times PROF_{i,t} + \beta_4 \times MTB_{i,t} + \beta_5 \times ROA_{i,t} + \beta_6 \times SGROW_{i,t} + \beta_7 \times AGE_{i,t} + Industry\ FE + Year\ FE + \varepsilon_{i,t} \quad (21)$$

Column (4) of Table 9 in appendix shows the regression results. The coefficient of $fWHRAI_{i,t}$ is 1.071 and the t-statistic is 4.075, which again confirms our previous finding that masculine CEOs, CFOs, and Chairmen maintain leverage at a higher level. In 4.4.3 of this paper, $fWHRAI_{i,t}$ based on computer algorithm measurement is introduced.

[Insert Table 9 about here]

5.4 Endogenous

In other studies, endogeneity is one of the main concerns. In this study, the facial structure of an individual is a predetermined bio-genetic measurement, which means that facial structural features are determined by genes. Therefore, this study is no likely to have the problem of reverse causality, because accounting conservatism is unlikely to affect facial structure. In addition, the fWHR measurement is unlikely to be determined by economic environmental factors, company characteristics, and post-adolescent company executive characteristics, such as work experience, basically eliminating the possibility of confounding effects. It is worth noting that This study was unable to find standards for company executives' fWHR from corporate regulations or

company disclosure documents in different countries. According to the disclosure, the performance and connections of company executives, such as CEOs, are the main criteria considered for their qualifications. The use of fWHR as the appointment criterion has not been adopted by industry, so there is no endogeneity confusion.

6. Conclusions

In this study, we test (1) whether corporate executives with more masculine faces lead to lower conservatism, and (2) whether corporate executives with more masculine faces lead to higher conservatism. to re-examine corporate governance issues. Our conclusions are based on 417 UK non-financial listed firms between 1999 and 2019. First, we tested the difference in conservatism in cross-section and time series and found that corporate executives with more male facial features, that is, high fWHR are less accounting conservatism. Second, this study found that corporate executives with high fWHR will be the reason for expanding investment or financing is to increase financial leverage, thereby abandoning conservative accounting policies. This paper conducts a series of robustness analyzes including the use of AI to estimate fWHR and obtains results consistent with the main findings. This study contributes to the literature on corporate governance. It has long been recognized that the personal characteristics of corporate executives influence the formulation and implementation of corporate policy. In a sense, judgments about the future of corporate policy can be analyzed through the physical characteristics of executives. However, a limitation of this study is that aggressive behavior by corporate executives may be multifactorial, and therefore other types of body hormones may be influencing the results. It is worth noting that there is no evidence to date that other body hormones affect the fWHR of corporate executives.

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Appendix

Table 1. The non-financial listed companies in FTSE 350 based on the Industry Classification Benchmark (ICB) system from 1999 to 2019.

Sectors	Code	Number of companies
Technology	10	47
Telecommunication	15	17
Health Care	20	24
Real Estate	35	36
Consumer Discretionary	40	108
Consumer Staples	45	34
Industrials	50	93
Basic Material	55	25
Energy	60	18
Utilities	65	15
Total		417

Notes: This table shows the industry distribution among the 417 company samples used in this research。The Industry Classification Benchmark (ICB) system has a total of 11 industries, but this study excludes the Financials industry, so this table only shows 10 industries.

Table 2. The CEO, CFO and Chairman of non-financial listed companies in FTSE 350 based on the subdivision of the 'boardrole' under the BoardEx database from 1999 to 2019

Boardrole	Freq.
Acting CEO	1
Acting Chairman	3
Acting Chairman (Independent NED)	2
Acting Chairman (Senior Independent NED)	5
CEO	361
CEO Designate/Division MD	1
CEO/FD	1
CEO/MD	5
CFO	68
CFO/Company Secretary	4
CFO/FD	3
CFO/GFD	1
CFO/Secretary	2
COO/CFO	2
Chairman	35
Chairman (Executive)	99
Chairman (Independent NED)	363
Chairman (Non-Executive)	236
Chairman (Senior Independent NED)	7
Chairman (Shareholder Representative)	1
Chairman/Acting CEO	1
Chairman/CEO	12
Chairman/Chief Executive	1
Chairman/Interim CFO	1
Chief Executive	23
Co-Chairman	2
FD/CFO/Company Secretary	1

Group CEO	54
Group CFO	12
Group Chairman	1
Group Chairman (Independent NED)	1
Group Chairman (Non-Executive)	3
Group Chief Executive	25
Independent Chairman	1
Interim Director/Interim Finance Officer	1
Joint CEO	1
President/CEO	5
Total	1,345

Notes: This table shows the position distribution of 1,345 company executives among 417 companies.

Table 3. Summary Statistics in fWHR with different industries

Industry	N	Mean	Median	Q1	Q3	Min	Max	SD
Technology	125	2.098	2.087	1.981	2.233	1.647	2.483	0.168
Telecommunications	52	2.115	2.119	1.966	2.232	1.852	2.441	0.158
Health Care	84	2.115	2.127	2.003	2.191	1.835	2.460	0.139
Real Estate	95	2.096	2.084	1.964	2.237	1.747	2.464	0.166
Consumer Discretionary	361	2.090	2.091	1.971	2.196	1.451	2.620	0.162
Consumer Staples	111	2.113	2.104	2.007	2.212	1.768	2.647	0.161
Industrials	326	2.121	2.110	2.013	2.224	1.707	2.739	0.162
Basic Materials	96	2.125	2.109	1.993	2.230	1.771	2.523	0.166
Energy	49	2.104	2.104	1.975	2.225	1.776	2.399	0.168
Utilities	46	2.104	2.106	1.970	2.247	1.745	2.483	0.183

Notes: This table shows the distribution of the number of 1,345 company executives in 10 different industries and the descriptive statistics of their fWHR.

Table 4. Definitions of all variables

Variables	Acronym	Measurements
Accrual-based conservatism	CONACCR	Accrual measure = [(Income before extraordinary item and discontinued operation + depreciation - operating cash flow) ÷ total asset] ÷ five years × (-1)
Earnings price ratio	E/P	Net income before extraordinary items ÷ beginning of fiscal year market value of equity
C_Score	C_Score	C_Score, equals to (λ_0+λ_1Size +λ_2MTB +λ_3Lev), is a firm-year measure of the incremental timeliness of bad news over good news or conservatism.
Facial width-to-height ratio with ImageJ	fWHR	Use ImageJ to measure sample photos
Facial width-to-height ratio with Python	fWHRAI	Use computer artificial intelligence to measure sample photos
Book value of leverage ratio	BVLEV	Total liabilities ÷ total assets
Market-value-based leverage ratio	MVLEV	Total debt ÷ (total debt + market value of equity)
Firm size	SIZE	The natural logarithm of the market value of equity
Profitability	PROF	Cash flow from operation ÷ total assets
Return on asset	ROA	Net income ÷ total assets
Market to book ratio	MTB	Market value of equity ÷ book value of equity
Sales growth	SGROW	Annual percentage change in sales
Age of company executives	AGE	Age of CEO, CFO and Chairman

Notes: This table shows the abbreviations and definitions of all variables.

Table.5 Descriptive statistics

Variable	N	Mean	Median	Q1	Q3	Min	Max	SD
CONACCR	5,518	-0.061	-0.064	-0.095	-0.035	-0.659	0.559	0.764
E/P	5,103	0.843	0.661	0.392	1.074	-0.839	5.091	0.855
C_Score	6,008	0.067	0.096	-0.166	0.342	-0.948	1.116	0.433
R	5,103	0.594	0.551	0.202	0.873	-4.156	8.577	1.011
fWHR	1,345	2.108	2.100	1.989	2.210	1.451	2.739	0.163
fWHRAI	1,331	2.154	2.136	2.041	2.270	1.794	2.640	0.170
BVLEV	5,798	0.516	0.252	0.067	0.585	0	5.027	0.846
MVLEV	5,798	0.878	0.996	0.985	0.998	0	0.999	0.303
SIZE	7,632	20.314	20.303	19.370	21.356	15.596	24.146	1.611
PROF	6,161	0.088	0.816	0.040	0.131	15.596	24.146	0.091
ROA	6,022	5.929	6.525	2.980	10.650	-43.510	33.480	10.817
MTB	7,555	3.227	2.070	1.150	3.770	-17.800	43.020	5.972
SGROW (%)	5,997	0.118	0.067	-0.008	0.171	-0.474	1.648	0.288
AGE	1,084	65.819	66	58	74	35.000	91.000	10.692
TO	8,757	3.724	2.300	0.900	4.900	0.100	35.400	4.222

Dummy variables：

C_ScoreD=1 :11.3%

E/PD=1 :9.5%

Notes: This table presents the descriptive statistics.

Table 6. Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 CONACCR	1.000													
2 E/P	0.195	1.000												
3 C_Score	-0.018	0.005	1.000											
4 fWHR	-0.113	0.029	-0.157	1.000										
5 fWHRAI	-0.092	0.041	-0.153	0.843	1.000									
6 BVLEV	-0.030	0.047	-0.042	0.201	0.150	1.000								
7 MVLEV	-0.202	-0.122	-0.136	0.121	0.123	0.179	1.000							
8 MTB	0.005	0.041	0.060	0.003	0.030	-0.063	-0.018	1.000						
9 SIZE	-0.090	-0.200	-0.028	0.002	0.007	-0.030	0.058	0.132	1.000					
10 PROF	-0.245	-0.149	0.012	0.024	0.033	-0.112	-0.025	0.117	0.143	1.000				
11 ROA	-0.279	-0.212	0.006	-0.009	0.005	-0.038	0.025	0.058	0.178	0.581	1.000			
12 SGROW	0.020	0.048	-0.001	-0.008	-0.007	-0.033	-0.017	0.016	-0.037	0.032	0.102	1.000		
13 AGE	-0.044	-0.054	0.003	-0.046	-0.050	0.060	-0.049	0.043	-0.041	-0.012	-0.009	0.015	1.000	
14 TO	-0.091	-0.065	0.014	-0.028	-0.013	0.045	-0.041	-0.024	-0.018	0.062	0.045	0.005	0.267	1.000

Note：This table provides Spearman correlations of key variables employed in our analysis. All variables are defined in Table 4.

Table 7. Main regression result

Column	(1)	(2)	(3)	(4)	(5)
Variable	$CONACCA_{it}$	E_{it}/P_{it-1}	C_Score_{it}	$BVLEV_{it}$	$MVLEV_{it}$
D		2.800**			
		(2.223)			
R		-0.156			
		(-1.491)			
D*R		0.629			
		(0.602)			
fWHR	-0.090***	0.074	-0.226***	1.361***	0.568***
	(-2.627)	(0.870)	(-2.935)	(5.347)	(4.953)
fWHR*D		-0.796**			
		(-2.038)			
fWHR*R		0.045			
		(1.468)			
fWHR*D*R		-0.961***			
		(-3.058)			
BVLEV	0.005*	0.000	-0.017*		
	(1.945)	(0.026)	(-1.842)		
BVLEV*D		0.067			
		(0.965)			
BVLEV*R		-0.011			
		(-0.917)			
BVLEV*D*R		0.003			
		(0.064)			
SIZE	0.003***	-0.000	-0.015***	-0.121***	-0.008
	(1.646)	(-0.026)	(-2.957)	(-4.195)	(-1.139)
SIZE*D		-0.040			
		(-0.932)			
SIZE*R		0.004			
		(1.330)			
SIZE*D*R		-0.037			
		(-1.042)			
PROF	-0.019	-0.099	-0.051	-0.311**	0.087
	(-0.553)	(-0.666)	(-0.671)	(-2.022)	(1.197)
PROF*D		1.085*			
		(1.653)			
PROF*R		0.062			
		(1.062)			
PROF*D*R		1.136			
		(1.466)			
MTB	0.000	0.001	0.006***	-0.001	0.000
	(0.615)	(1.396)	(6.339)	(-0.987)	(0.269)
MTB*D		-0.001			
		(-0.214)			
MTB*R		-0.000			

		(-1.355)			
MTB*D*R		0.013***			
		(4.689)			
ROA	-0.001***	-0.001	0.000	0.001	-0.000
	(-2.945)	(-1.135)	(0.196)	(1.592)	(-0.365)
ROA*D		0.004			
		(1.276)			
ROA*R		0.000			
		(0.685)			
ROA*D*R		0.002			
		(0.518)			
SGROW	0.005	0.056**	0.001	0.000	0.015
	(0.956)	(2.080)	(0.058)	(0.001)	(1.123)
SGROW*D		-0.228***			
		(-2.774)			
SGROW*R		0.001			
		(0.058)			
SGROW*D*R		-0.111			
		(-0.968)			
AGE	-0.000	0.000	0.000	-0.001	-0.001
	(1.004)	(0.027)	(0.145)	(-0.514)	(-0.861)
AGE*D		0.005			
		(1.012)			
AGE*R		-0.000			
		(-0.945)			
AGE*D*R		0.009*			
		(1.669)			
_cons	0.080	0.458*	1.304***	0.492	-0.019
	(1.054)	(1.797)	(6.349)	(0.563)	(-0.067)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
N	2,724	2,529	3,029	3,331	3,331
R^2	0.023	0.911	0.609	0.097	0.056

t-statistics in parentheses

* p<.0.10, ** p<0.05, *** p<0.01

Notes: This table shows the regression results for regression models 8 to 12. fWHR is the facial width-to-height ratio of the CEO, CFO and Chairman. All regressions include industry fixed effects and year fixed effects. All variables are winsorized at the 1st and 99th percentiles. For variable definition, please refer to Table 4.

Table. 8 Fixed effects model regression results

Column	(1)	(2)	(3)	(4)	(5)
Variable	$CONACCA_{it}$	E_{it}/P_{it-1}	C_Score_{it}	$BVLEV_{it}$	$MVLEV_{it}$
D		2.831***			
		(8.092)			
R		-0.197*			
		(-1.703)			
D*R		0.678			
		(1.383)			
fWHR	-0.084***	0.007	-0.204**	1.386***	0.643***
	(-4.394)	(0.099)	(-2.367)	(10.816)	(11.893)
fWHR*D		-0.812***			
		(-7.553)			
fWHR*R		0.048			
		(1.175)			
fWHR*D*R		-0.970***			
		(-6.489)			
Control	Yes	Yes	Yes	Yes	Yes
_cons	-0.001	0.562***	1.242***	0.396	-0.162
	(-0.019)	(2.815)	(5.113)	(1.067)	(-1.035)
Year FE	Yes	Yes	Yes	Yes	Yes
N	2,724	2529	3,029	3,331	3,331
R^2	0.027	0.912	0.610	0.098	0.057

t-statistics in parentheses

* p<.0.10, ** p<0.05, *** p<0.01

Notes: This table shows the regression results for regression models 13 to 17. fWHR is the facial width-to-height ratio of the CEO, CFO and Chairman. All regressions include year fixed effects. All variables are winsorized at the 1st and 99th percentiles. For variable definition, please refer to Table 4.

Table 9. Robustness test regression results

Column	(1)	(2)	(3)	(4)
Variable	$CONACCA_{it}$	E_{it}/P_{it-1}	C_Score_{it}	$BVLEV_{it}$
D		2.664**		
		(2.163)		
R		-0.149		
		(-1.312)		
D*R		0.665		
		(0.719)		
fWHRAI	-0.034	0.084	-0.206***	1.071***
	(-1.115)	(1.010)	(-3.025)	(4.046)
fWHRAI*D		-0.748**		
		(-2.185)		
fWHRAI*R		0.040		
		(1.225)		
fWHRAI*D*R		-0.963***		
		(-3.939)		
Control	Yes	Yes	Yes	Yes
_cons	-0.039	0.458*	1.260***	1.107
	(-0.583)	(1.777)	(6.774)	(1.248)
Industry & Year FE	Yes	Yes	Yes	Yes
N	2,701	2,505	3,001	3,303
R^2	0.016	0.910	0.609	0.088

t-statistics in parentheses

* p<.0.10, ** p<0.05, *** p<0.01

Notes: This table shows the regression results for regression models 18 to 19. fWHR is the facial width-to-height ratio of the CEO, CFO and Chairman. fWHRAI is the facial width-to-height ratio of the CEO, CFO and Chairman measured by computer artificial intelligence. All regressions include industry fixed effects and year fixed effects. All variables are winsorized at the 1st and 99th percentiles. For variable definition, please refer to Table 4.

Paper 3: Facial masculinity of corporate executives and stock price crash risk: UK evidence

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1. introduction

Interdisciplinary research has been valued by more and more researchers, among which the combination of social science and biology has been widely used in recent years. Researchers began to tend to explore the problems faced by corporate management from the perspective of sociology. Biological researchers have used a large body of evidence to date to link facial masculinity with Facial width-to-height ratio (fWHR) to high testosterone levels and masculine behavioral traits, including risk perception and enhanced maturation, excessively aggressive decision-making and behavior (Carré and McCormick, 2008; Lefevre et al., 2013; Anderl et al., 2016; Ormiston et al., 2017). This study uses Chief Executive Officer (CEO), Chief Financial Officer (CFO), and Chairman facial features to explore the association between executive masculinity and stock price crash risk.

Researchers who follow the neoclassical model believe that in corporate governance, the different personal characteristics of company managers cannot significantly affect the company (Jia et al., 2014), but when it comes to research on finance and debt, researchers find that different company executives may to different financial reports or different financial problems (Dikolli et al.,2012; Davidson et al., 2013). How human appearance influences behavior is still widely discussed in biology today. It is worth noting that existing evidence can prove that testosterone can affect human behavior, because different testosterone levels in humans will affect the brain to make different judgments, thereby affecting behavior (Zitzmann, 2006; Nieschlag et al., 2012; Celec et al., 2015). And testosterone is strongly associated with masculine facial features (Carré and McCormick, 2008). Similar to this study, eg Jia et al. (2014) found a positive relationship between CEO fWHR and the incidence of financial misreporting and Kamiya et al. (2018) used photos of 2683 CEOs to explore the relationship between executives' fWHR and corporate risk, and believed that the higher the financial leverage ratio, the more likely the CEO would be to engage in aggressive behavior in the company.

To demonstrate a link between facial masculinity and behavior, this study sought to

demonstrate a positive relationship between fWHR of corporate executives and the risk of a company stock price crash. People with higher testosterone tend to be more willing to take risks and take aggressive actions. Therefore, company executives with higher fWHR are likely to be bolder and make reckless investment decisions. If these decisions fail, company executives are more likely to withhold the release of bad news, thereby exacerbating the risk of a stock price crash. This paper uses the CEO, CFO and Chairman of the FTSE 350 non-financial companies in the UK as a sample, and manually measures fWHR using ImageJ. In addition, the stock price crash risk value of the company sample is measured according to the previous literature method. The hypothesis of this paper is based on previous biological studies of the link between facial masculinity and testosterone in humans in the literature. Besides, it is the premise of this study that executives of different companies have different Facial width-to-height ratio and have different behaviors. When different company executives have different testosterone levels, their risk tolerance and aggressive behavior will affect the company's development trend, so this paper believes that it is meaningful to study the impact of the company's masculine characteristics on the company's stock price. The first hypothesis of this study tests that corporate executives with high fWHR will lead to high stock crash risk. This prediction is supported by annual observations of 1,301 CEOs, CFOs, and Chairmen. The second hypothesis tested whether high-fWHR company executives increase financial risk using the same company executives and found evidence consistent with this hypothesis. In order to ensure the accuracy of the research, this study used artificial intelligence technology to calculate the fWHR of company executives and conducted robustness testing and achieved consistent results. It is worth noting that according to the results of this study, it is proved that when company executives have higher fWHR, they will be more inclined to hide bad news when managing the company, which increases the possibility of stock price crash risk. This paper believes that this finding can be further verified in corporate governance, the importance of individual differences in corporate executives to corporate development.

This research makes several contributions. First, this study adds to the literature on

corporate governance and the resulting stock market performance. I enrich the literature on stock crash risk by exploring a new important determinant, namely facial width-to-height ratio. This study contributes to the literature by demonstrating that innate personal characteristics are related to decision-making. Second, this study combines facial masculinity with stock market research. Biologically based research shows that different men have different standards of facial masculinity and behavioral demeanor but has not linked this trait to corporate governance. Interdisciplinary research will therefore provide more topics for biology and business studies. Third, this research completes a series of tests and demonstrates that firm executives' fWHR is positively related to stock crash risk across multiple samples. In addition to this, this research also proves that the fWHR of corporate executives is positively related to financial leverage. Therefore, this study is economically and statistically significant. Finally, the results of this study help corporate executives and investors better understand the facial features of corporate executives and stock market price crashes. For investors who are concerned about stock prices, paying attention to the fWHR of company executives will reduce investment risk. For company executives who want to stabilize stock prices, they can appoint positions based on fWHR.

2. Literature review

2.1 fWHR

Researchers are increasingly exploring male facial features, thanks to interdisciplinary research between sociology, psychology and management. He et al. (2018) argue that male behavior and appearance can be very reliable predictors in this interdisciplinary study. Based on previous studies, researchers have favored the link between fWHR and different manifestations to be due to the hormone testosterone that humans naturally secrete (Pound et al., 2008; Lefevre et al., 2013). Carré and McCormick (2008) were the first to suggest a positive relationship between testosterone and fWHR in humans. Furthermore, in 2009 Carré, McCormick, and Mondloch found that individuals with high fWHR had higher observable aggression. According to research, testosterone hormone is secreted in large quantities and affects male secondary sexual characteristics during puberty (Verdonck et al., 1999;

Freeman et al., 2001; Nieschlag et al., 2012), during which testosterone hormone is accepted by body tissues and grows rapidly. In addition to this, the hormone testosterone affects brain neurons and affects most human behavior after puberty (Book et al., 2000; Sisk and Zehr, 2005; Batrinos, 2012). However, some scholars have different opinions. Kordsmeye et al., (2019) detected that the facial aspect ratio and overall facial masculinity were not positively correlated with testosterone levels based on the tester's salivary testosterone content. Bird et al. (2016) also found no significant positive correlation between fWHR and men's circulating T levels (saliva testosterone test) and post-race reactive T levels in seven different male samples. But it is worth noting that the researchers believe that saliva does not fully reflect the true testosterone level of humans, so scientists prefer to use the testosterone content in blood and urine for research (Vermeulen et al., 1999; Kane et al., 2007; Ohlsson et al., 2011).

2.2 Stock price crash risk

More and more studies have found that the stock price crash risk may be determined by various factors, which reflects the importance attached to this issue by researchers and practitioners in different industries (e.g., Habib et al., 2017). Company executives are managing. Companies often face the dilemma of whether to make public the problems they encounter. Hutton et al (2009) believed that the long-term hoarding of bad news by company executives was the main factor leading to the increase in crash risk. When the company's managers can no longer hide too much bad news and investors discover the truth, panic and distrust will flood the market, which will lead to a sharp decline in share prices. Therefore, in theory, the crash risk is based on managers' long-term backlog of bad news and investors' panic about negative news.

There are a number of factors that contribute to managers' reluctance to face the risk of a collision, thereby preventing the spread of bad news. Most scholars believe that the opacity of financial reporting has become the main reason for the crash risk. When the management aims to maximize its own compensation, it will also hoard a

lot of negative news. Benmelech et al. (2010) used a dynamic rational expectations model with information asymmetry to prove that although stock compensation will prompt corporate managers to increase their efforts to seek investment opportunities for the company, it also provides incentives for managers to try to cover up negative news about the company. When the company's bad news accumulates to a certain amount, the real situation will be released, for example, the company needs to recapitalize and has to release the real financial situation and company inside information, which will cause the stock price to drop sharply. Thus, the ex-ante cost of inducing high management effort comes from suboptimal investment policies after investment opportunities slow down, ultimately leading to undercapitalization and stock price crashes (Benmelech et al., 2010). In addition, the laws and regulations from some countries are not strict on the transparency of corporate management, which will lead company executives to not release real information to investors, resulting in a higher probability of asset price collapse (Myers and Jin, 2006). Bleck and Liu (2007) demonstrate the relationship between market transparency and stock price crashes under historical costing. In countries with less transparent regulations governing business accounting, company executives may have to let a disheartened project go ahead after a misjudgment because managers can use historical cost accounting to combine good and bad projects. So, if these issues are not addressed, the poor performance of these projects can add up and eventually materialize on their final maturity, causing asset prices to plummet.

It is worth noting that in a financial market with high information transparency, it may also cause investors to be skeptical of information. According to the research of Cao et al. (2002), when the value of a company's assets rises, investors are often not all optimistic about the company's stock. This is because investors who know the company well will add to the stock, while other investors will walk away because they don't understand the company's published information fully. When more investors are skeptical of the information, company funds cannot flow in the stock market as expected, thus causing prices to fall. In addition, Habib et al. (2017) believe that another source of crash risk is the volatility feedback effect. Large price changes can

trigger investor pessimism about the market and result in a risk premium. The increase in the risk premium leads to the fact that funds will eventually be withdrawn from the market, so the stock price will plummet. When companies face a higher risk of default, company executives have a higher probability of hiding bad news (Habib et al., 2017). Although decentralized management of the supply chain using revenue sharing contracts and working capital coordination can solve the problem when there is a risk of insolvency and default costs for the company (Kouvelis and Zhao, 2016), managers of companies with a high risk appetite often prefer to increase financial leverage in the early stage to seek financing and expand company size (Kamiya et al., 2019). When a company is at risk of default, managers usually do everything in their power to prevent the spread of bad news, because the company either stays afloat or goes bankrupt.

3. Hypotheses development

This paper focuses on the relationship between the facial features of corporate executives and stock price crash risk and formulates hypotheses by cross-correlating with the above two parts of the literature (i.e., the literature on fWHR and stock price crash risk). The determinant of stock price crash risk is caused by excessive hoarding of bad news, and the link between excessive masculinity behaviors and stock crashes is intuitive, because these behaviors may affect stock prices and earnings. Executives of companies with high fWHR tend to have higher aggressiveness and arrogant behavior, which is in stark contrast to executives of companies with low fWHR. When executives at firms with higher fWHR exhibit more cooperative behaviors toward employees and subordinates, they tend to outcompete with other firms. But it is worth noting that given that fWHR is associated with testosterone, aggression, and social dominance, all of which are closely related to risk appetite, it is timely to look at corporate risk (Epstein, 1979; Funder and Colvin, 1991). When corporate executives are more aggressive, corporate executives will be more inclined to hoard bad news and achieve their goals. When corporate executives are more aggressive, they will be more inclined to hoard bad news and achieve their goals. If more bad news is hoarded, it will lead to a higher probability of stock price

crash risk (Hutton et al., 2009; Callen and Fang, 2015; Kim and Zhang, 2017). This research will try to explore the relationship between fWHR of corporate executives and stock price crash risk. Therfore our first hypothesis is as follows:

H1: *There is a positive relationship between fWHR of CEO, CFO and Chairman and stock price crash risk for non-financial listed companies in the UK.*

Evidence shows that when corporate managers try to increase financial leverage to finance or expand, the risks faced by the firm will increase (Long and Malitz, 1985; Dammon and Senbet, 1988). Therefore, the leverage ratio is the best measure of financing decisions. In addition, the positive correlation between book value and stock return has been confirmed by scholars (Ozdagli, 2012). In front of the public, real financial problems are easily concealed by managers (Ghosh and Jain, 2000). However, long-term and a large number of hidden financial problems, or called bad news, are very likely to lead to the collapse of stock prices (Hutton et al., 2009; Callen and Fang, 2015; Kim and Zhang, 2017). This study believes that when faced with financing and other issues, the top executives of companies with high fWHR tend to expand the leverage ratio, which increases the company's risk and leads to bad news. When there is enough bad news, it can trigger a stock price crash. Therefore, this study proposes the following hypotheses:

H2: *The masculine CEO, CFO and chairman will increase financial risk.*

4. Data and variables

4.1 Explanation of data collection

My research will be quantitative, and data will be quantitative data. Quantitative data makes the measurement of various variables controllable because of the easy mathematical derivation attached to them. The reason I use quantitative research is because I can use statistics or calculations to collect observable data to answer research questions. My research will mainly involve British company executives' fWHR and company performance, which means that I will collect clear photos of

British company executives and financial data or operating data of the company they belong to. Determining the exact number of managers and companies will make research more accurate. Finding photos of executives and measuring them is the only way to obtain fWHR data. In addition, it is reliable and convincing to obtain executive salaries and other financial data based on the financial information disclosed by their company. By seeking the relationship between quantitative data fWHR and financial data, this can finally provide support for my research.

First of all, I will use the Datastream database to determine the final number of UK companies in the year that I need to research, because Datastream has UK listed company data from 1996 to 2019. After that, based on the list of UK companies, I will use BoardEx_UK database to find the name list of company executives and financial data. BoardEx database merges public domain information related to the boards and senior executives of public companies and large private companies. The BoardEx_UK database contains all board information and financial information of listed companies in the UK, such as the names of company executives, salaries, bonuses and incentives. In addition, stock prices are updated every day at BoardEx_UK because stock prices affect salary information, such as incentive compensation. This ensures that the data I will obtain is accurate and true. Google Images Search is the main method used to collect photos of company executives. A large number of photo sources for fWHR research are Google Image Search (Ahmed et al., 2018; Wong et al., 2011; He et al., 2019; Colombo et al., 2020).

Google Image Search can study many different pictures of the same CEO, which allows researcher to throw out some pictures that may be manipulated. I will use ImageJ to measure fWHR with the photos of British company executives I searched. ImageJ is a java-based public image processing software that is often used by psychology and business researchers. Carre and McCormick (2008) first used this software to measure the fWHR of CEOs and it has been widely used in research later (Wong et al., 2011; Jia et al., 2014: Kamiya et al., 2016). As in Figure 1, I will follow the method of Carré and McCormick (2008) and Mayew et al. (2013) to turn

the picture into black and white before measuring fWHR. Finally, I will use STATA for data analysis. STATA is the preferred software for regression analysis and is a powerful statistical software that allows me to analyze, manage and generate graphical visualization of data.

In using the database Datastream and BoardEx, the biggest disadvantage is the lack of data. For example, you cannot find the salary level and acquisition information of a certain CEO. The solution is to search the company's annual report or the company's official website according to the category of missing information after finding all the required data in the databases. When using Google Image Search to search for facial photos, researchers may be troubled by the quality of the photos searched. First, I will follow the method of Carre and McCormick (2008) and Kamiya et al. (2016) to ignore all photos whose size is less than 120×150 pixels. Secondly, I need to set standards to improve the quality of the photos when searching for photos. For example, the face photos of all faces must leak out two ears to ensure that the face faces forward. Finally, I can score the collected facial photos that meet the requirements to ensure the accuracy of the research (Kamiya et al. 2016). The use of ImageJ is a key step to obtain fWHR. When using ImageJ, I will need to understand the rules of the software and record the data completely. The software is very convenient to use and can accurately obtain facial contour information and fWHR during measurement.

It is reasonable to select British companies and executives of British companies as the research samples. Company executives have proven that their behavior is inseparable from company performance (Wong et al., 2011; Ormiston and Haselhuhn, 2011; Kamiya et al., 2016). As the company's management, their decisions and perceptions of the company will have a profound impact on the company's development. Such a role is unmatched by other positions. Therefore, it is of great significance to use company executives, such as CEO and chairman, as samples to explore their impact on company performance.

All my data sources will be secondary data. Therefore, my research does not produce ethical issues, will not cause any physical or psychological harm to the subjects, and will not infringe on their privacy. The data in the database can be used legally and reasonably, and the photos in the Google image search can be downloaded and analyzed.

[Insert Table 1 about here]

4.2 Firms sample collection

In previous studies, a large number of scholars used US listed companies as a sample source in the researching field of fWHR and corporate governance (Wong et al., 2011; Yim, 2013; Mobbs and Cook, 2014; Halford and Hsu, 2020; Kamiya et al., 2018). In common law countries, a large amount of information disclosure can make the required research information more comprehensive and complete, and it is very representative (Ball et al., 2000). Research on fWHR from some European countries has also received attention from researchers. For example, Beltman (2018) used 43 European companies as a research sample and found that the CEO's fWHR in the sample was not related to the company's business performance. This is inconsistent with the results obtained by the researcher using North American sample. This also proves the importance of data selection diversity. In addition, emerging markets and developing countries have also received extensive attention from researchers. China is a developing country that has received the most attention from researchers in this field (Chan et al., 2020; Cao et al., 2019; He et al., 2019). He et al. (2019) used a large number of graphical samples of Chinese financial analysts to verify that fWHR has a strong and obvious positive correlation with performance, which fills a gap in the field of research in developing countries.

Following Beltman (2018) recommendations, researchers should try to focus the research sample in one European country and expand the sample size. In order to explore the relationship between the fWHR of company executives and corporate governance, I decided to use UK non-financial listed companies as a sample source.

As an important economy in the European and world, researchers using UK listed companies as samples in essay in field of fWHR and coporate governance can also be found. The research sample of Alrajih and Ward (2014) comes from UK FTSE 100 companies. They found that the average fWHR of CEOs of UK-listed companies was 2.04, which was different to the 1.95 of US-listed companies (Wong et al., 2011). They also provided evidence for a link between fWHR and business leadership and they have established that social dominance may be the mediating psychological trait (Alrajih and Ward, 2014). It is worth noting that in previous studies, the sample source of British listed companies was basically FTSE 100 (Alrajih and Ward, 2014) and other smaller UK company data sources (Beltman, 2018). My research will use listed companies in FTSE 350 as a sample source, which will contribute more accurate data to research in this field. Secondly, in the database DataStream, the earliest available data about FTSE 350 listed non-finance company is from 1999. However, since the stock price crash risk used in this study cannot obtain relevant data in 1999, therefore the companies in the sample are from FTSE 350 between 2000 to 2019. The expanded sample size can make the research results more accurate and convincing. Finally, according to previous studies, a large number of researchers have eliminated financial companies from the data because the governance and risk characteristics of electronic financial institutions are very different from those of non-financial companies (Kamiya et al., 2018). Therefore, my sample will be non-financial listed companies from FTSE 350 from 2000 to 2019.

I use the DataStream database to find all FTSE 350 non-financial companies from 2000 to 2019. In these 20 years, a total of 7392 samples were found. These samples refer to the total number of companies that appear in the FTSE 350 index each year. After removing the duplicate data, there are a total of 1,008 companies, which means that a total of 1,008 companies have appeared on the FTSE 350 index in the past 21 years. It is worth noting that 100 samples were deleted because the company name and DataStream identity number could not be found. Secondly, a total of 236 financial companies were found out of 908 companies. This accounts for 25.9% of the total sample. Therefore, my research sample will come from 672 UK non-financial

listed companies. After removing the data that did not meet the requirements in BoardEx, the company's sample size was finally 417. The industry standard for the UK sample selected in this study is based on the Industry Classification Benchmark (ICB) (Table.1). The ICB is a universal standard used to classify and compare companies by different industries and sectors (FTSE Russell, 2020). Use ICB to meet the requirements of the London Stock Exchange for the classification of listed companies.

[Insert Table 2 about here]

Among the searched samples, the Consumer Discretionary industry has the largest number, accounting for 27.5% and followed by the industrial sector, accounting for 20.5%. It is worth noting that the Utilities industry and the Telecommunication industry have the lowest proportions, 4% and 4.16% respectively. The remaining Technology, Real Estate, Consumer Staples, Basic Material, Energy and Health Care industries accounted for 10.4%, 8%, 7.3%, 6.8%, 6.1% and 5.1%, respectively.

4.3 fWHR sample collection

4.3.1 Collection of executive samples

In this study, the sample of board members is limited to CEO, CFO and Chairman. The previous literature regards the CEO of a listed company as the focus of fWHR research in corporate governance (Mills et al., 2020; Momtaz, 2020; Colombo et al., 2020; Mobbs and Cook, 2014). Scholars generally believe that the CEO is the person in a company most capable of influencing the company's decision-making. Rule and Ambady (2009) believe that people’s perceptions of the CEO’s ability and leadership can predict the profitability of the world’s leading companies. Opponents believe that the company may hire CEOs who ‘‘look the part’’ even if the appearance does not match their capabilities (Deaner et al., 2012). Wong et al. (2011) first link the CEO's fWHR to company performance. Their research shows that at the social level, although men with higher facial WHR may be aggressive and distrustful in interpersonal interactions, the success of organizations and companies may

compensate for personal faults. Therefore, a CEO with a high face WHR may indeed have faces that only investors can like. Apart from this, their research proved that the relationship between CEO's facial WHR and company performance is stronger, which provides a reference for the subsequent research of other researchers, leading most researchers to focus only on the CEO's fWHR.

Although the CEO's fWHR has been discussed and studied by many researchers, based on the expansion of the company sample data based on this research, the CEO's fWHR is still representative. It is worth noting that the influence of CFO and Chairman on corporate governance is also huge. Jia et al. (2014) first measured the fWHR of the CFO and the fWHR of the CEO of the same company and explored their impact on the company's financial risks. Research reports show that there is a positive correlation between the facial structure of CEOs and CFOs and the likelihood of being classified as opportunistic traders. Research reports show that there is a positive correlation between the facial structure of CEOs and CFOs and the likelihood of being classified as opportunistic traders. Taking CFO as one of the measurement objects can expand the deficiencies of previous research and provide support for future research. In 1992, the Cadbury Commission recommended separating the roles of CEO and chairman of the board, which allowed 90% of the UK's largest companies to follow a dual strategic leadership model (Higgs, 2003). The chairman of the board also plays an increasingly important role in the corporate governance of UK listed companies. Therefore, it is very important to use Chairman as sample sources. There is evidence that there are detectable differences in fWHR between the sexes (Lefevre et al., 2013), but not within the same sex across ethnicities and regions. Therefore, the measurement of fWHR can ignore racial and regional factors.

In order to measure the fWHR of senior management members of the board of directors, the BoardeEx database was used in this study when collecting the list of board members. The BoardEx database consolidates public domain information related to the boards and senior managers of public companies and large private

companies (Bingham and Kit, 2003). The data of 672 companies obtained from the DataStream database is transferred to BoardEx, and the board information in each company can be searched, especially the board member information. After removing the sample of female directors and missing data, this study removed data that did not meet the roles of CEO, CFO, and Chairman based on the 'boardrole' in the BoardEX. There is a total of 49 categories that meet the standards, and a total of 1,301 board executives have been recognized (Table.2). Among the 1,301 company executives, there are a total of 774 chairmen, accounting for 57.5%, followed by 491 CEOs, accounting for 36.5%. The number of CFOs is the least, there are 95, accounting for 7.1%.

Wong et al. (2011) proved the feasibility of using photos to measure the fWHR of people. They are the first study to use web photos to measure the CEO's fWHR and received support from researchers. Beltman (2020) approved this method and directly used the research data from Wong et al (2011). Alrajih and Ward (2014) first identified the source of photo data as Google Images. Other research literature also uses Google Image as the source of CEO photos (Gomulya et al., 2017; Lu and Teo, 2018; Ahmeda et al., 2019; Kamiya et al., 2019). Kamiya (2019) believes that searching for sample photos from Google Image is reliable, because such manipulation tends to not search for results, and it is difficult to believe that the modifiers of venture companies are deliberately distorting face photos. In this study, I select 2 photos of each company executive to measure fWHR and take the average of the two fWHRs to determine the company executive’s fWHR. The quality requirements of the sample photos in this study follow the regulations: 1. Researchers must be able to clearly see the ears of the people in the photos. 2. The person in the photo must face forward. 3. The pixels of the photo must not be less than 400. ImageJ software has been used by a large number of researchers to measure fWHR. This study will also use this software for measurement (Wong et al., 2011; Alrajih et al., 2014; Kamiya et al., 2016; Beltman, 2018; Cleary et al., 2020).

4.3.2 ImageJ software measure of fWHR

Carré and McCormick (2008) first proposed a method for measuring CEO's fWHR using online photos, and it was supported by Mayew (2013). This method is to measure the distance between the left and right zygion (bizygomatic width) divided by the distance between the upper lip and the midpoint of the inner end of the eyebrows (the height of the upper face). This study followed Jia et al. (2014) and Lefevre et al. (2013) measure the upper facial height in a different way in that they measure the distance between the upper lip and the heights point of the eyelids. According to the literature, this study converts pictures of all sizes into standard grayscale pictures with a height of 400 pixels and uses ImageJ software to measure fWHR (Carré and McCormick, 2008). Figure 1 shows how this study used ImageJ software to manually measure the fWHR of the CEO, CFO, and Chairman. Pixels are counted by the bizygomatic distance and the height of the upper face.

Figure 1. Measuring the fWHR of Boris Johnson and ImageJ software

He et al. (2019) asked the other two research assistants to measure the fWHR of the research sample and obtain the intermediate value. In order to make this research more accurate, I randomly selected 200 from 2,602 of the collected sample photos for my supervisor team to measure and observe whether the results differed by more than 5% from my results. The difference of 5% between two results by different people is acceptable and considered as the high quality of the fWHR sample (He et al., 2019). The difference between the 200 fWHRs measured by the two supervisors and my result is all less than 5%. Table 5. shows a summary of fWHR for 1,301 samples and Table 3. in appendix Is summary statistics in fWHR with different

industries.

[Insert Table 3 about here]

4.3.3 AI-based measure of fWHR

The advent of image processing and artificial intelligence technology has made it easier to measure photos. This research will use AI-based measure for robustness testing. The first step in using a computer to automatically calculate fWHR is to detect the faces and facial features needed to determine the corners of the fWHR Box that can locate the face in the photo. The computer can not only recognize the face in any given picture, but it can also recognize 68 different and uniquely numbered "landmarks" among the recognized faces in the photo (see Figure 3). "Landmarks" are calculations from the Python package (named "Face Recognition"), based on the most advanced Dlib face recognition algorithm built using deep learning. These important points can be used to measure the length and width of the face. According to the developer, the project has an accuracy rate of as high as 99.38%, but the accuracy of the recognition of children and Asian faces needs to be improved (Github, 2019). The samples in this research are all adults and come from the United Kingdom, so this study will obtain a higher accuracy rate using Face Recognition. Figure 2 shows an example of a CEO's face picture in which the landmarks are identified. The figure shows an example of face detection and identification of 68 landmarks using Python code from Face Recognition. Figure 3 shows the 68 landmarks of a face with a fixed sequence number. It shows which landmarks are used for fWHR computation. fWHR is the distance between 1 and 15 divided by the distance between the midpoint of 21 and 22 and point 51. In this study, I use the same 2 photos of company executives as manual measurements to measure fWHR and take the average of the two fWHRs to determine the fWHRAI of the company executive.

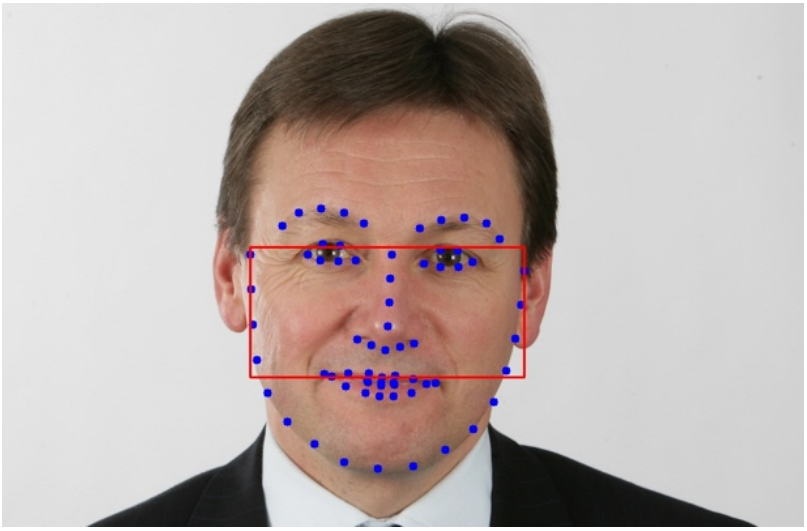

Figure 2. Charles Hammond's 68 landmarks via fWHR Box and Face Recognition

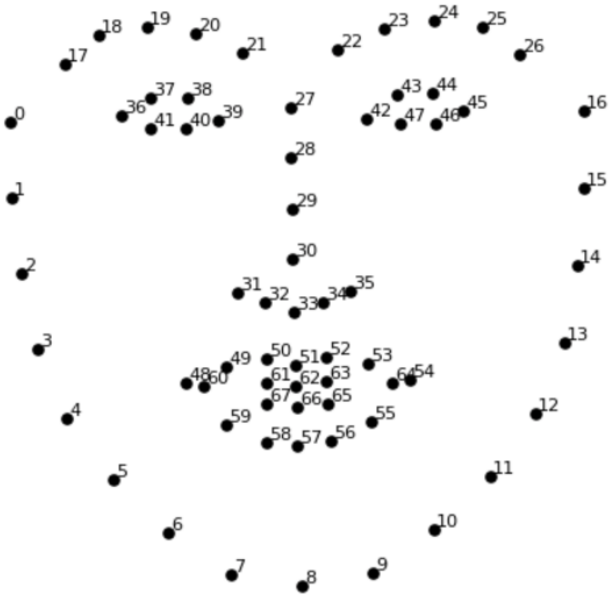

Figure 3. 68 landmarks via Face Recognition (Github, 2019)

I input 2,602 high-quality CEO pictures into the Python algorithm. These photos are similar to the sample photos I used to measure fWHR using ImageJ, which ensures the accuracy of robustness testing. It is worth noting that the algorithm does not recognize 14 photos. This is because Facial Recognition fails to recognize the correct position of the face in the photos and displays 68 landmarks. Therefore, the number of photos finally recognized by Facial Recognition is 2,662. Table 5 shows a summary of fWHR calculated using a computer. We get the average fWHR calculated by the computer to be 2.159. This is similar to the results measured with

ImageJ, with a mean of 0.046 greater. The correlation coefficient between the sum measured by ImageJ and the fWHR measured by the computer is 0.843 (Table 6. In appendix).

4.4 stock price crash risk collection

To measure stock price crash risk, we follow Hutton et al. (2009) and Kim et al. (2011). We use weekly returns within one fiscal year for each firm to estimate firm-specific weekly returns. First, we estimate the following regression model:

$$r_{i,t} = \alpha_i + \beta_{1i} r_{m,t-2} + \beta_{2i} r_{m,t-1} + \beta_{3i} r_m + \beta_{4i} r_{m,t+1} + \beta_{5i} r_{m,t+2} + \varepsilon_{i,t}$$

where $r_{i,t}$ is the return on an individual stock i in week t, and $r_{m,t}$ is the return on the FTSE All-Share Index in week t. Lead and lag returns for the market are included to allow for non-synchronous trading (Dimson, 1979). The residual term from the above regression model is used to calculate firm-specific weekly returns ($W_{i,t}$):

$$W_{i,t} = \ln(1 + \varepsilon_{i,t}) \quad (1)$$

We use two measures to proxy for stock price crash risk. The first, $NCSKEW_{i,t}$; is the negative skewness of firm-specific weekly returns, and is calculated by dividing the negative of the third moment of the firm-specific weekly returns in a fiscal year by the standard deviation of those returns raised to the third power:

$$NCSKEW_{i,t} = \frac{N(N-1)^{\frac{3}{2}} \Sigma W_{i,t}^3}{(N-1)(N-2)(\Sigma W_{i,t}^2)^{\frac{3}{2}}} \quad (2)$$

where N is the number of firm-specific weekly returns of firm i in a fiscal year.

The second, $DUVOL_{i,t}$, measures the down-to-up volatility of firm-specific weekly returns by dividing all the weeks in a fiscal
year into two groups: down-weeks with firm-specific weekly returns below the annual

mean, and up-weeks with firm- specific weekly returns above the annual mean. $DUVOL_{i,t}$ is then calculated as the natural logarithm of the ratio of the standard deviation of firm-specific weekly returns in down-weeks to that in up-weeks, as follows：

$$DUVOL_{i,t} = ln\left(\frac{(N_U - 1)\Sigma W_{iD,t}^2}{(N_D - 1)\Sigma W_{iU,t}^2}\right) \quad (3)$$

where N_U and N_D are the number of up and down weeks in year t, respectively. A higher value of $DUVOL_{i,t}$ indicates greater crash risk. As suggested in Chen et al. (2001), $DUVOL_{i,t}$ does not involve third moments and hence is less likely to be overly influenced by extreme weekly returns.

4.5 Control variables

Based on previous researchers' studies on stock price crash risk, the following control variables were used in this study: Based on previous researchers' studies on stock price crash risk, this study uses the following control variables: Chen et al. (2001) found that firms with high stock turnover were associated with higher stock price crash risk. In order to better control the differences in the beliefs of different investors, this study uses the detrended stock trading volume (DTURN) to measure the different opinions of different investors. To address dynamic endogeneity as well as controlling for the potential persistence of the third moment of stock returns (Fu and zhang, 2019), this study uses lagged values of the negative skewness of past firm-specific stock returns (NCSKEW). The expressive ability of past returns to the future can be explained by the accumulation of past returns, so stocks with higher past returns and volatility are more likely to experience crashes (Jia, 2018). Therefore, the control variables in this paper add company-specific weekly returns mean and standard deviation (RET and STDRET). In addition to this, the study also controls for various fundamental firm characteristics. Company size (SIZE), which is the natural logarithm of a company's market capitalization; market-to-book ratio (MTB); financial leverage (BVLEV), which is the ratio of long-term debt to total assets; and return on assets (ROA). Due to the lack of data in BoardEx, there are no

salary and tenure variables in this study. Detailed variable definitions are provided in Appendix Table 4.

[Insert Table 4 about here]

5. Empirical models and results

5.1 Descriptive statistics

Table 5 in the Appendix reports the descriptive statistics from a full sample of 20 years of observations of 417 companies that will be used to explore the relationship between male facial features of company executives and the risk of a company stock price crash. To minimize the effect of outliers, we indented all continuous variables at the 1st and 99th percentiles. The results of this study show that, on average, the crash risk $NCSKEW_{i,t}$ of UK non-financial firms is -0.346 and $DUVOL_{i,t}$ is 0.304, which is similar to the results in previous studies on price crash risk (e.g., Luo and Zhang, 2020; Wen et al., 2019). The average $fWHR_{i,t}$ measured by ImageJ was 2.113, which was basically consistent with the average of 2.013 by Jia et al. (2014) used ImageJ for the first time to measure the fWHR of corporate CEOs. Kamiya et al. (2019) measured the fWHR of the CEO and CFO from the Execucomp database, and the average value was 2.015, which is also similar to the data in this study. The algorithm was 99.38 percent accurate after excluding Asians and children. This study uses a very small proportion of Asian executives of listed companies in the UK, so the accuracy of the results of this paper is very high. Firm-level characteristics are also consistent with those in previous studies based on the UK market (e.g., Conyon et al., 2019).

[Insert Table 5 about here]

Table 6. Shows the correlations between independent, dependent, and control variables. The results show that the two crash risk indicators, DUVOL and NCSKEW, are significantly positively correlated with $fWHR_{i,t}$, which are 0.248 and 0.242, respectively. This finding tentatively supports our prediction that higher fWHR of

corporate executives will lead to a higher probability of future stock price crashes.

[Insert Table 6 about here]

5.2 Empirical models

This research will use 2 regression models, respectively:

$$DUVOL_{i,t+1} = \alpha_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + \beta_8 \times BVLEV_{i,t} + Year\ FE + Industry\ FE + \varepsilon_{i,t} \quad (4)$$

$$NCSKEW_{i,t+1} = \alpha_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + \beta_8 \times BVLEV_{i,t} + Year\ FE + Industry\ FE + \varepsilon_{i,t} \quad (5)$$

Where i represents the company and t represents the time. $fWHR_{i,t}$ is the face aspect ratio of the CEO, CFO and Chairman of company i in fiscal year t. It is worth noting that each CEO, CFO and Chairman have a fWHR estimate for firm i. The dependent variable is the stock price crash risk of company i in year t + 1. As discussed in Section 4.5, Control is a vector of firm attributes that can affect a firm's stock price crash risk. Year and Industry capture year and industry fixed effects, respectively.

5.3 Results

5.3.1 Regression results

This study examines whether the masculinity of a company's executives affects the company's stock price crash. Columns (1) and (2) in table 7 reports the OLS regression results used to test Hypothesis 1. $fWHR_{i,t}$ is the face aspect ratio of the CEO. All regressions are in industry control fixed effects and year fixed effects. The t-statistic is based on heteroscedasticity robust standard errors. *, **, and *** indicate

statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are indented at the 1% and 99% levels. See Table 4 for variable definitions. According to the regression results in Table 7, the signs of the two coefficients of the asymmetric timeliness $fWHR_{i,t}$ are in line with the expectations of this paper, and both are positive. It is worth noting that all three coefficients are significant at the 1% level. That means a more masculine CEO, CFO and chairman would increase the risk of the company's share price crashing. This result supports Hypothesis 1.

The coefficients of the eight control variables in this result are not much different from other literature. Through the test, it was found that three of the eight control variables were significantly correlated with $DUVOL_{i,t+1}$, while there was no significant correlation with $NCSKEW_{i,t+1}$. The coefficients of RET and DU are significantly correlated, which is similar to most of the literature. The experimental results of Luo and Zhang (2020) show that the relationship between $BVLEV_{i,t}$ and $DUVOL_{i,t+1}$ is significantly positive. Fu and Zhang (2019) also support that size has a significant relationship with $DUVOL_{i,t+1}$.

5.3.2 Masculinity and financial risk

When a company has higher financial leverage, it often faces great risks. When more aggressive corporate executives try to leverage up capital and expand, bad news is often hidden and stocks crash (Hutton et al., 2009; Callen and Fang, 2015; Kim and Zhang, 2017). Therefore, this study explores the relationship between leverage based on book value and $fWHR_{i,t}$ of corporate executives. Furthermore, a robustness check is performed by substituting the dependent variable with leverage based on market value. The two regression models are as follows:

$$BVLEV_{i,t} = \alpha_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + Year\ FE + Industry\ FE + \varepsilon_{i,t} \quad (6)$$

$$MVLEV_{i,t} = \alpha_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + Year\ FE + Industry\ FE + \varepsilon_{i,t} \quad (7)$$

The regression results are shown in columns (3) and (5) of Table 7. Where there is an equity correlation, the results show that more masculine corporate executives significantly increase firm leverage. According to Table 7, the increase of $fWHR_{i,t}$ of company executives is highly positively correlated with the increase of $BVLEV_{i,t}$ (coefficient = 1.194, t-stat = 4.231, p-value <0.01), indicating that the more manly corporate executives prefer financial leverage. In column (4) of Table 7, this study replaces the dependent variable with the market value-based leverage ratio ($MVLEV_{i,t}$) for robustness testing, and the results are the same. The independent and dependent variables were significantly positively correlated (coefficient = 0.553, t-stat = 4.222, p-value < 0.01). This supports Hypothesis 2.

[Insert Table 7 about here]

5.3.3. Fixed effect model

In order to control the two-way fixed effect of individual and time, this study used a fixed effect model to test. Different from the fixed effect of joining time and industry, the fixed effect model of joining time can control the industry and exclude the influence of variables that do not change with time. The regression models used in this section are as follows:

$$DUVOL_{i,t+1} = \alpha_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + \beta_8 \times BVLEV_{i,t} + YearFE + Firm\ FE + \varepsilon_{i,t} \quad (8)$$

$$NCSKEW_{i,t+1} = \alpha_0 + \beta_1 \times fWHR_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + \beta_8 \times BVLEV_{i,t} + YearFE + Firm\ FE + \varepsilon_{i,t} \quad (9)$$

Table 8 shows the regression results using the fixed effects model. The regression results of models 8 and 9 are similar to models 4 to 5. The two scalars of stock price crash risk are still positively correlated with $fWHR_{i,t}$. The regression results prove that under the control of the two-way fixed effect of individual and time, the results still haven't changed much.

[Insert Table 8 about here]

5.3.4 Robustness testing

5.3.4.1 AI-based fWHR and stock price crash risk

With the emergence of more and more new technologies, image processing and artificial intelligence technologies are constantly innovating. The computer can not only recognize faces in different pictures, but also mark the recognized faces with 68 uniquely numbered "landmarks" ranging from 0th to 67th (Figure 3). Landmarks can make the computer quickly calculate $fWHR_{i,t}$, and this research will use the result as the variable $fWHRAI_{i,t}$. Similar to using ImageJ to measure $fWHR_{i,t}$, a total of 2,602 photos of 1,301 CEO, CFO and Chairman samples were used in this section. The computer algorithm did not identify the 13 photos, a total of 13 samples were involved, so the final effective sample number was 1,288 and 2,576 photos. The average $fWHRAI_{i,t}$ obtained in the study was 2.162, and the correlation coefficient between $fWHR_{i,t}$ and $fWHRAI_{i,t}$ was 0.842 (Table 6.). This section replaces $fWHR_{i,t}$ with $fWHRAI_{i,t}$ to test robustness. The regression model is as follows:

$$DUVOL_{i,t+1} = \alpha_0 + \beta_1 \times fWHRAI_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + \beta_8 \times BVLEV_{i,t} + YearFE + IndustryFE + \varepsilon_{i,t} \quad (10)$$

$$NCSKEW_{i,t+1} = \alpha_0 + \beta_1 \times fWHRAI_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + \beta_8 \times BVLEV_{i,t} + YearFE + IndustryFE + \varepsilon_{i,t} \quad (11)$$

Columns (1) (2) of Table 9 show the regression results of models 10 and 11. Similar to the results of using $fWHR_{i,t}$ as the independent variable, $fWHRAI_{i,t}$ is negatively correlated with DUVOL and NCSKEW and the coefficients are very close. The results show that the robustness test of $fWHR_{i,t}$ measured using computer algorithms shows that the relationship between human-measured $fWHR_{i,t}$ and corporate conservatism is robust. In 4.4.3 of this paper, $fWHRAI_{i,t}$ based on computer algorithm measurement is introduced.

5.3.4.2 AI-based fWHR and financial leverage

This study believes that if company executives are more aggressive, they will finance expansion by increasing financial leverage. However, excessive expansion of capital will increase the company's financial risks and will most likely eventually lead to a significant decline in stock prices. In order to further explore the robustness of channels, masculinity and financial risk, this study also replaced $fWHRAI_{i,t}$ as an independent variable in Model 6 and produced a new model 12:

$$BVLEV_{i,t} = \alpha_0 + \beta_1 \times fWHRAI_{i,t} + \beta_2 \times TURN_{i,t} + \beta_3 \times RET_{i,t} + \beta_4 \times STDRET_{i,t} + \beta_5 \times SIZE_{i,t} + \beta_6 \times MTB_{i,t} + \beta_7 \times ROA_{i,t} + Year\ FE + Industry\ FE + \varepsilon_{i,t} \quad (12)$$

Column (3) of Table 9 in appendix shows the regression results. The coefficient of $fWHRAI_{i,t}$ is 1.122 ($p<0.01$) and the t-statistic is 3.337, which again confirms our previous finding that masculine CEOs, CFOs, and Chairmen maintain leverage at a higher level. In 4.4.3 of this paper, $fWHRAI_{i,t}$ based on computer algorithm measurement is introduced.

[Insert Table 9 about here]

5.4 Endogenous

In other studies, endogeneity is one of the main concerns. In this study, the facial structure of an individual is a predetermined bio-genetic measurement, which means

that facial structural features are determined by genes, which is also consistent with He et al. (2018). Therefore, this study is no likely to have the problem of reverse causality, because accounting conservatism is unlikely to affect facial structure. In addition, the fWHR measurement is unlikely to be determined by economic environmental factors, company characteristics, and post-adolescent company executive characteristics, such as work experience, basically eliminating the possibility of confounding effects. It is worth noting that This study was unable to find standards for company executives' fWHR from corporate regulations or company disclosure documents in different countries. According to the disclosure, the performance and connections of company executives, such as CEOs, are the main criteria considered for their qualifications. The use of fWHR as the appointment criterion has not been adopted by industry, so there is no endogeneity confusion.

6. Conclusions

In this paper, I explore the effect of corporate executive male facial features on firm-specific stock price crash risk. If corporate executives with high masculine facial features are more aggressive and thus display more bad news hoarding behavior, we would expect that corporate male appearance characteristics are associated with higher stock price crash risk. The study used a sample of non-financial UK companies between 2000 and 2019 and found that company executives with high masculine faces were associated with a higher risk of future stock price crashes. In addition, this paper uses firm fixed effects to address endogeneity and the results are still robust. The findings of this paper advance researchers' understanding of how the corporate governance of UK listed companies, and in particular corporate executives, affects their performance in capital markets. In particular, our findings help managers of UK-listed firms gain a more complete understanding of the consequences of their decisions on capital expansion. However, a limitation of this study is that aggressive behavior by corporate executives may be multifactorial, and therefore other types of body hormones may be influencing the results. It is worth noting that there is no evidence to date that other body hormones affect the fWHR of corporate executives.

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Appendix

Table 1. The non-financial listed companies in FTSE 350 based on the Industry Classification Benchmark (ICB) system from 2000 to 2019.

Sectors	Coda	Number of companies
Technology	10	47
Telecommunication	15	17
Health Care	20	24
Real Estate	35	36
Consumer Discretionary	40	108
Consumer Staples	45	34
Industrials	50	93
Basic Material	55	25
Energy	60	18
Utilities	65	15
Total		417

Notes: This table shows the industry distribution among the 417 company samples used in this research。The Industry Classification Benchmark (ICB) system has a total of 11 industries, but this study excludes the Financials industry, so this table only shows 10 industries.

Table 2. The CEO, CFO and Chairman of non-financial listed companies in FTSE 350 based on the subdivision of the ‘boardrole’ under the BoardEx database from 2000 to 2019

Boardrole	Freq.
Acting CEO	1
Acting Chairman	3
Acting Chairman (Independent NED)	2
Acting Chairman (Senior Independent NED)	5
CEO	350
CEO Designate/Division MD	1
CEO/FD	1
CEO/MD	5
CFO	64
CFO/Company Secretary	4
CFO/FD	3
CFO/GFD	1
CFO/Secretary	2
COO/CFO	2
Chairman	35
Chairman (Executive)	98
Chairman (Independent NED)	350
Chairman (Non-Executive)	230
Chairman (Senior Independent NED)	6
Chairman (Shareholder Representative)	1
Chairman/Acting CEO	1
Chairman/CEO	12
Chairman/Chief Executive	1
Chairman/Interim CFO	1
Chief Executive	21
Co-Chairman	2
FD/CFO/Company Secretary	1

Group CEO	52
Group CFO	12
Group Chairman	1
Group Chairman (Independent NED)	1
Group Chief Executive	25
Independent Chairman	1
Interim Director/Interim Finance Officer	1
Joint CEO	1
President/CEO	4
Total	1,301

Notes: This table shows the position distribution of 1,301 company executives among 417 companies.

Table 3. Summary Statistics in fWHR with different industries

Industry	N	Mean	Median	Q1	Q3	Min	Max	SD
Technology	119	2.096	2.086	1.981	2.233	1.647	2.483	0.160
Telecommunications	52	2.115	2.119	1.966	2.232	1.852	2.441	0.158
Health Care	79	2.120	2.127	2.008	2.196	1.835	2.460	0.141
Real Estate	93	2.094	2.084	1.964	2.225	1.747	2.464	0.167
Consumer Discretionary	350	2.090	2.091	1.971	2.197	1.451	2.620	0.162
Consumer Staples	110	2.114	2.105	2.007	2.212	1.768	2.647	0.161
Industrials	314	2.118	2.106	2.012	2.216	1.707	2.739	0.164
Basic Materials	93	2.123	2.106	1.989	2.208	1.771	2.523	0.166
Energy	48	2.098	2.086	1.971	2.222	1.775	2.399	0.165
Utilities	43	2.093	2.093	1.970	2.228	1.744	2.467	0.173

Notes: This table shows the distribution of the number of 1,345 company executives in 10 different industries and the descriptive statistics of their fWHR.

Table 4. Definitions of all variables

Variables	Acronym	Measurements
DUVOL	DUVOL	The down-to-up volatility. For any stock in year t + 1, we separate all the weeks with firm-specific weekly returns below the annual mean (down weeks) from those with firm-specific weekly returns above the period mean (up weeks) and compute the standard deviation for each of these subsamples separately. The down-to-up volatility is measured as the natural logarithm of the ratio of the standard deviation in the down weeks to the standard deviation in the up weeks.
NCSKEW	NCSKEW	The negative skewness of firm-specific weekly returns over year t + 1, calculated by taking the negative of the third moment of firm-specific weekly returns for the year and normalizing it by the standard deviation of firm-specific weekly returns raised to the third power;
Facial width-to-height ratio with ImageJ	fWHR	Use ImageJ to measure sample photos
Facial width-to-height ratio with Python	fWHRAI	Use computer artificial intelligence to measure sample photos
Book value of leverage ratio	BVLEV	Total liabilities ÷ total assets
Market-value-based leverage ratio	MVLEV	Total debt ÷ (total debt + market value of equity)

Firm size	SIZE	The natural logarithm of the market value of equity
Return on asset	ROA	Net income ÷ total assets
Market to book ratio	MTB	Market value of equity ÷ book value of equity
DTURN	DTURN	The detrended average monthly stock turnover in year t, calculated as the average monthly share turnover in year t minus the average monthly share turnover in t-1, where monthly share turnover is calculated as the monthly share trading volume divided by the number of shares outstanding over the month;
RET	RET	The average of firm-specific weekly returns over year t;
STDRET	STDRET	The standard deviation of firm-specific weekly returns during one fiscal year.
Age of company executives	AGE	Age of CEO, CFO and Chairman

Notes: This table shows the abbreviations and definitions of all variables.

Table 5. Descriptive statistics

Variable	N	Mean	Median	Q1	Q3	Min	Max	SD
NCSKEW	8,340	-0.346	-0.370	-0.820	0.200	-1.970	1.020	0.686
DUVOL	8,340	0.304	0.310	-0.150	0.740	-0.780	1.450	0.554
fWHR	1,301	2.113	2.108	1.992	2.217	1.695	2.739	0.168
fWHRAI	1,288	2.162	2.141	2.042	2.276	1.795	2.640	0.169
BVLEV	5,533	0.513	0.251	0.067	0.574	0	5.027	0.842
MVLEV	5,533	0.877	0.996	0.985	0.998	0	0.999	0.304
SIZE	7,215	20.299	20.292	19.340	21.323	15.596	24.146	1.607
ROA	5,743	5.937	6.540	2.980	10.660	-43.510	33.480	10.801
MTB	7,139	3.230	2.090	1.160	3.770	-17.800	43.020	5.998
DTURN	5,694	1.494	0.193	-2.948	4.552	-121.972	134.584	28.549
RET	7,357	0.002	0.000	-0.001	0.005	-0.024	0.030	0.008
STDRET	7,356	0.041	0.038	0.023	0.055	0.000	0.161	0.032
AGE	1,047	65.814	66	58	74	35	91	10.683

Dummy variables：

C_ScoreD=1 :11.3%

E/PD=1 :9.5%

Notes: This table presents the descriptive statistics.

Table 6. Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 DUVOL	1.000												
2 NCSKEW	-0.407	1.000											
3 fWHR	0.248	0.242	1.000										
4 fWHRAI	0.215	0.216	0.842	1.000									
5 DTURN	0.011	0.008	0.007	0.015	1.000								
6 RET	0.046	-0.036	-0.021	-0.027	-0.054	1.000							
7 STDRET	0.006	0.013	-0.001	-0.004	0.093	-0.081	1.000						
8 SIZE	-0.069	-0.052	-0.047	0.010	0.016	-0.204	-0.359	1.000					
9 MTB	0.021	-0.008	0.010	0.012	0.024	-0.084	0.002	0.132	1.000				
10 ROA	-0.045	0.010	0.007	0.021	-0.043	0.028	-0.176	0.171	0.067	1.000			
11 BVLEV	0.115	0.110	0.191	0.157	0.019	0.040	0.123	-0.069	-0.074	-0.049	1.000		
12 MVLEV	-0.001	0.03	0.110	0.115	0.000	-0.013	-0.039	0.072	-0.034	0.046	0.130	1.000	
13 AGE	0.002	-0.020	0.00	0.035	0.011	0.005	-0.024	-0.060	0.037	-0.012	0.021	-0.059	1.000

Note：This table provides Spearman correlations of key variables employed in our analysis. All variables are defined in Table 4.

Table 7. Main regression result

Column	(1)	(2)	(3)	(4)
Variable	$DUVOL_{it}$	$NCSKEW_{it}$	$BVLEV_{it}$	$MVLEV_{it}$
fWHR	0.856***	1.137***	1.194***	0.553***
	(5.504)	(5.563)	(4.231)	(4.222)
DTURN	-0.000	-0.000	0.000	-0.000
	(-0.481)	(-0.351)	(0.593)	(-0.873)
RET	-2.503***	1.791	0.746	-0.397
	(-2.838)	(1.545)	(0.327)	(-0.598)
STDRET	0.394	-0.667	3.755***	0.562*
	(1.046)	(-1.494)	(4.688)	(1.850)
SIZE	-0.026***	0.007	-0.119***	0.002
	(-2.994)	(0.612)	(-3.648)	(0.147)
MTB	0.001	-0.000	-0.002**	0.000
	(1.233)	(-0.250)	(-2.117)	(0.076)
ROA	0.000	-0.000	0.000	0.000
	(0.194)	(-0.382)	(0.438)	(0.369)
BVLEV	0.040***	0.014		
	(2.625)	(0.720)		
AGE	-0.000	-0.001	0.002	0.000
	(-0.062)	(-1.186)	(1.624)	(0.101)
_cons	-0.780**	-3.127***	0.225	-0.316
	(-1.989)	(-6.406)	(0.229)	(-0.871)
Industry & Year FE	Yes	Yes	Yes	Yes
N	2909	2909	2909	2909
R^2	0.522	0.556	0.117	0.057

t-statistics in parentheses

* p<.1, ** p<0.05, *** p<0.01

Notes: This table shows the regression results for regression models 4 and 5. fWHR is the facial width-to-height ratio of the CEO, CFO and Chairman. All regressions include industry fixed effects and year fixed effects. All variables are winsorized at the 1st and 99th percentiles. For variable definition, please refer to Table 4.

Table 8. Fixed effects model regression results

Column	(1)	(2)	(3)	(4)
Variable	$DUVOL_{it}$	$NCSKEW_{it}$	$BVLEV_{it}$	$MVLEV_{it}$
fWHR	0.887***	1.192***	1.187***	0.610***
	(8.751)	(9.765)	(9.051)	(11.334)
DTURN	-0.000	-0.000	0.000	-0.000
	(-1.172)	(-0.057)	(0.476)	(-0.636)
RET	-2.513***	2.682**	0.131	-0.410
	(-2.642)	(2.343)	(0.105)	(-0.800)
STDRET	0.504	-0.563	3.701***	0.552***
	(1.377)	(-1.276)	(7.780)	(2.827)
SIZE	-0.029***	0.016	-0.144***	-0.004
	(-2.712)	(1.242)	(-10.494)	(-0.712)
MTB	0.001	-0.000	-0.002	0.000
	(0.653)	(-0.315)	(-1.212)	(0.251)
ROA	-0.000	0.000	0.000	0.000
	(-0.110)	(0.073)	(0.340)	(0.133)
BVLEV	0.025*	-0.008		
	(1.648)	(-0.422)		
AGE	-0.000	-0.001	0.001	0.000
	(-0.203)	(-0.823)	(0.652)	(0.336)
_cons	-0.732**	-3.376***	0.549	-0.328**
	(-2.363)	(-9.047)	(1.349)	(-1.965)
Year FE	Yes	Yes	Yes	Yes
N	2909	2909	2909	2909

R^2	0.523	0.557	0.118	0.058

t-statistics in parentheses

* p<.1, ** p<0.05, *** p<0.01

Notes: This table shows the regression results for regression models 6 to 9. fWHR is the facial width-to-height ratio of the CEO, CFO and Chairman. All regressions include year fixed effects. All variables are winsorized at the 1st and 99th percentiles. For variable definition, please refer to Table 4.

Table 9. Robustness test regression results

Column	(1)	(2)	(3)
Variable	$DUVOL_{it}$	$NCSKEW_{it}$	$BVLEV_{it}$
fWHRAI	0.729***	1.012***	1.122***
	(5.348)	(5.289)	(3.337)
DTURN	-0.000	-0.000	0.000
	(-0.436)	(-0.340)	(0.609)
RET	-2.638***	1.738	0.605
	(-2.963)	(1.480)	(0.261)
STDRET	0.254	-0.791*	3.841***
	(0.652)	(-1.722)	(4.665)
SIZE	-0.028***	0.005	-0.120***
	(-3.161)	(0.481)	(-3.673)
MTB	0.001	-0.000	-0.002**
	(1.365)	(-0.141)	(-2.059)
ROA	0.000	-0.001	0.000
	(0.298)	(-0.640)	(0.211)
BVLEV	0.046***	0.020	
	(2.797)	(0.946)	
AGE	-0.000	-0.001	0.003*
	(-0.098)	(-1.287)	(1.908)
_cons	-0.532	-2.915***	0.279
	(-1.476)	(-6.196)	(0.266)
Industry & Year FE	Yes	Yes	Yes
N	2882	2882	2882

R^2	0.521	0.558	0.119

t-statistics in parentheses

* p<.1, ** p<0.05, *** p<0.01

Notes: This table shows the regression results for regression models 10 to 12. fWHR is the facial width-to-height ratio of the CEO, CFO and Chairman. fWHRAI is the facial width-to-height ratio of the CEO, CFO and Chairman measured by computer artificial intelligence. All regressions include industry fixed effects and year fixed effects. All variables are winsorized at the 1st and 99th percentiles. For variable definition, please refer to Table 4.