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Stats or Studs: Does it Pay to be Good Looking? The Economic Impact of Lookism

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Abstract

"*Beauty is in the eye of the beholder*" is a phase that exemplifies the subjectivity of attractiveness. In recent years, researchers in the fields of economics, sociology, and anaplasty have used symmetry analysis in an attempt to make beauty an objective issue. People characterized by greater facial symmetry, as defined by exhibiting balanced lateral proportions, are considered to be more attractive. Furthermore, labor economists, such as Hamermesh and Biddle (1994), suggest a wage premium for more attractive individuals, however, the measure of attractiveness was not based on symmetry. This study examines the effect of NFL quarterbacks' attractiveness on their salaries, holding productivity constant. One may hypothesize that the general manager of a NFL team would benefit by hiring a more attractive quarterback, ceteris paribus. This benefit could be seen through the creation of a bandwagon effect to sell more tickets and team paraphernalia thus increasing profits. Increasing attention in the literature is being paid to the effects of beauty in the labor market. This study seeks to utilized productivity measures of NFL quarterbacks in conjunction with their attractiveness ratings to predict the true impact of beauty.

Introduction

"*Beauty is in the eye of the beholder*." Margaret Wolfe Hungerford, under the pseudonym 'The Dutchess,' coined this phrase in 1878. Benjamin Franklin, William Shakespeare, and David Hume each contributed their own versions of this proverb to the literary world as well. Each great mind relayed a common message: beauty is a subjective issue. People of differing cultures define beauty according to the social norms and values which they uphold. For example, the Ubangi tribe of Africa believes a beautiful characteristic of a woman is to have a protruding lower lip. In order to accentuate this feature, they insert discs in women's lips during childhood development. This is much akin to the feet-binding custom which is practiced in subsets of Chinese societies. However, numerous sociological studies denote symmetry as a universal indicator of beauty (Gunes 2006, Scheib 1999, Whitehill 2008). From birth, people are instinctively drawn to symmetrical entities (Samuels 1994).

In recent years, researchers in the fields of economics, sociology, and anaplasty (application of reconstructive surgery) have used symmetry analysis as a method to make beauty an objective issue. People characterized by greater facial symmetry, as defined by exhibiting balanced lateral proportions, are considered to be more attractive. Furthermore, labor economists, such as Hamermesh and Biddle (1994), suggest a wage premium for more attractive individuals, however, the measure of attractiveness was not based on symmetry. To test this wage premium hypothesis, comprehensive data sets including productivity measurements, obtainable pictures for symmetry analysis, and the individuals' salaries are necessary. The National Football League (NFL) provides productivity measures on all its players and provides salary information that is available to the public. Given easily obtainable pictures of the players, symmetry analysis, leading to an objective measure of beauty, is attainable. Additionally, this NFL data can then be used to test the wage premium hypothesis.

This study examines the effect of NFL quarterbacks' attractiveness on their salaries, holding productivity constant. One may hypothesize that the general manager of a NFL team would benefit by hiring a more attractive quarterback, ceteris paribus. This benefit could be seen through the creation of a bandwagon effect to sell more tickets and team paraphernalia thus increasing profits. Increasing attention in the literature is being paid to the effects of beauty in the labor market. This study seeks to utilized productivity measures of NFL quarterbacks in conjunction with their attractiveness ratings to predict the true impact of beauty.

Literature Review

The Merriam-Webster dictionary defines beauty as, "the quality or aggregate of qualities in a person or thing that gives pleasure to the senses or pleasurably exalts the mind or spirit." However, determining which qualities provide such gratifying sentiments varies for each individual. Research in the field of sociology indicates that facial symmetry is a way in which beauty can be universally defined. Through the refined technology of symmetry processing tools, researchers have been able to quantify one's facial symmetry. As a result, beauty can be evaluated in an objective and quantitative manner. Beauty, or lack thereof, is a quality which every person possesses. Furthermore, it is a quality which has been shown to affect a person throughout his or her life. Whether this impact if found through human capital formation, or discrimination within the labor market, examination of one's beauty is worthy of consideration. The following sections will further define beauty and outline the past research done in specific areas of facial symmetry.

Universal Beauty

Beauty has no intrinsic, set meaning. Each person defines beauty based on his or her preference. Meanwhile, people believe they instinctively know what is generally considered to be beautiful and conversely, what lacks beauty. This impression is derived by implicit cultural norms. However, across cultures and time, the consideration of what constitutes the definition of beautiful greatly varies. As perceptive humans, people are bombarded by the concept of beauty in a variety of ways. Walking along the street, people find themselves individually critiquing the beauty in nature, architecture, and each other. As a result of the ubiquitous nature of beauty, judgment is passed.

Since beauty is conceived to be subjective to culture, race, and personal preferences, sociological studies attempt to show how a commonality among these subsets defines beauty. This commonality is typically found in levels of proportion. Samuels (1994) showed infants pictures of both symmetrical and asymmetrical faces and objects. The babies in the study paid more attention to symmetrical faces, indicating attraction to symmetry is a natural instinct. Furthermore, symmetry has been found to play a large role in sexual attraction. Honekopp et al (2006) asked a sample of women to rate the attractiveness of 240 men on a scale of 1-7. The high attractiveness ratings positively correlated with the men who possessed the greatest facial symmetry. These sociological studies appear to support the concept that correlating symmetry with beauty is a reasonable notion.

Symmetry: Quantitative Beauty

Beauty can be measured in a quantitative manner when using symmetry as the basis. As a result, beauty no longer has to be considered completely subjective. Utilizing a digital image processing tool designed to rate symmetry and comparing the score to the attractiveness ratings assigned to a sample of 215 individuals, Gunes and Picccardi (2006) found a high correlation between the human and digital ratings. Individuals considered to be ‘attractive’ by the human evaluators were characterized as having highly symmetrical faces when analyzed by the image processing tool. This research illustrates the way in which beauty can be quantitatively measured. Despite the common misconception that beauty is only in the eye of the beholder, using symmetry as the key element of defining beauty allows for beauty to be conceived in more of a universal manner.

Additional studies, which employed digital imagery analysis, suggest that our definition of attractiveness is formulated instantaneously. For example, Olson and Marshuetz (2005) asked subjects to rate the attractiveness of facial pictures shown to them for a fraction of a second. On several occasions the authors commented, the subjects were unaware that the pictures were of faces. The researcher concluded that attractiveness, based on symmetry, is determined in an instant. The interviewees assigned high attractiveness ratings to the symmetrical faces without knowing the background information about the subject. This lead the authors to deduce that beauty is determined based on sight without individual characteristics coming into play. Again this study found that symmetrical faces were appointed higher attractiveness ratings.

Fink et al (2004) attempted to correlate the ratio between the length of the second and fourth fingers as an indicator of likelihood for facial symmetry. Similar to the symmetry processing tool utilized in the present study, this research used a picture of a subject’s face and then used the center of gravity, the focal point which divides the face into equivalent sectors, to reach a proportion of symmetry. The highly capable detection ability of the image processing tools used in such studies has proven to be a key strength of this analysis method. No minimum amount of symmetry is needed to use the system of placing a picture on the center of gravity and having the processing tool allow for various alignments. These tools are designed to choose pockets of the face to study to see if there is symmetry within that designated area (Stentiford, 2005). Therefore, manual error is reduced by the competence of such software programs.

While the purpose and results of each study addressed above greatly differ with regard to why researchers are studying facial symmetry, each report shares one commonality pertinent to this research topic which is quantifying beauty. These studies are able to link technological ratings of attractiveness, as defined by symmetry, to human perception of attractiveness, ultimately generating a significant level of correlation. This is helpful in expounding why symmetry is chosen as the method of making beauty an objective, not subjective, matter.

Impact of Beauty

From birth, beauty impacts a person's life. Better-looking babies have been found to receive more attention from nurses. Lavoie (1974) and Clifford and Walster (1973) found that teachers treat more attractive students with more favorable treatment than those whom are less fortunate looking. The overall schooling experience of more attractive children is affected in terms of both teacher and peer interactions. These students are more likely to receive favorable treatment by both their teachers and peers, based on being more attractive. Stalcup (2002) focuses her research on the effects of beauty particularly in western culture. She calls on Hamermesh and Biddle (1994) to support her theory that despite cultural preferences, there is generally a consensus on what is considered beautiful at a given point in time within a culture. Beauty has become so engrained in our culture that at mock trials, prettier people are given lighter sentences (Beck and Tiene,1989) and people have been proven to be more easily persuaded by more attractive people (Buck and Tiene,1989). Alarmingly, prettier people have a greater likelihood of being aided in emergencies (Juhnke et al, 1989).

By studying one's level of attractiveness, researchers have gained a better understanding of its outcome on human capital formation. High school beauty is positively correlated to a student's overall experience as shown by higher GPAs, more attention received from teachers, and less likelihood of suspension (Cialdini, et al. 1984). As a result of this unequal treatment, better-looking students gain greater confidence, social skills, and communication capabilities. The combination of these beneficial outcomes leads to higher wages in the labor market. For the less attractive students, the inequitable treatment decreases the person's human capital formation. Mekin and Tocan (2005) note that unattractive high school students are less likely to enter the labor market and more likely to engage in criminal activity. Plainly stated, exhibiting above-average looks prior to one's entry into the labor market has been proven to enhance a person's treatment by peers and mentors, ultimately affecting one's socio-economic status through positive human capital formation

Beauty in the Labor Market

The definition of lookism as defined by Fred Siegel (1991) is “the construction of a standard for beauty/attractiveness.” While attractiveness is not accounted for under the laws of the Americans with Disabilities Act (ADA), many contend it should be due to the premium for beauty and penalty for lack thereof. The ADA considers disability to be the “public perception of impairment,” not necessarily the impairment itself. If a lack of beauty does indeed “limit one or more major life activities,” it can qualify as a disability under the ADA. However, one must also consider the argument that one’s looks should be considered natural assets. If this argument were permitted, then beauty is as much of a natural asset as intelligence is. Therefore, hiring based on beauty is non-discriminatory. The 1994 study conducted by Hamermesh and Biddle revealed holding all variables equal, better looking people make more money than average looking people, creating a wage premium of 5%. Furthermore, below-average looking people earn less money than the average looking person, accounting for a penalty of 9% amongst men and 4% for women. Subjective measures of beauty, the rating of one’s beauty by interviewers, formed the measurement of beauty in their study.

Height and weight, other indicators of appearance, have also been shown to impact wages. Seng (1993) found men who are 10% taller than the population average, generate a 6.6 % greater hourly wage. Race and health were not statistically significant predictors of wages. Regarding the sensitivity of his model, Seng addresses several possible errors. First, family background could play a role in his study because people of lower income families may not be privy to the same nutrition as those of higher income families, therefore increasing one’s propensity to be obese, which results in a wage penalty. Second, is the consideration of ‘mental outlook.’ If more attractive people are provided more favorable treatment from a young age, they may take on a certain attitude which then affects their job performance. For example, if a less fortunate person is constantly being belittled, he may not be as pleasant or easy-going in team-related assignments. Furthermore, Seng found a greater penalty for men than women with regard to below average height and weight standards, ultimately generating lower wages. Seng addresses the issue that attractiveness can be measured in a number of ways. The most utilized methods include human ratings based on photographs, interviewer perceptions of a person’s overall attractiveness (this would include personality traits), and examining the emphasis on more quantitative aspects such as weight and height.

With regard to the hiring process, Olson and Marshuetz (2005) indicate the following reasons why an employer may hire a more attractive individual. First, an above-average looking person is more likely to be hired because the employer would like to spend more time with the attractive person (the person may exhibit sexual feelings). Second, the attractiveness exerts an implicit influence: the good-looking person makes the interviewer *feel* happy, and therefore, because of that feeling, the interviewer is more likely to hire the attractive person. These results allow for a subjective reason to hire someone that is objectively more attractive.

The research conducted by Hamermesh and Biddle (1998) on the effects of beauty in the labor market provide the basis for the hypothesis of this paper, that exhibiting above-average looks does, indeed, generate higher wages. The exclusion of physical body attractiveness may be a limitation of this study, but the innovation of this study is the addition of measuring beauty in an objective manner. Although Hamermesh and Biddle are able to provide quantitative proof regarding wage premium and penalties as a result of beauty measurements, their measurement of beauty required human-ratings rather than digital symmetry analysis measurements. This paper seeks to explore the effect of beauty on wages, given an objective measure of beauty based on defining beauty as symmetry.

Symmetry Measurement Overview

In 2002, Dave Davis, with the assistance of Dr. Mike Jones, developed a symmetry measurement tool.[1] The development of this tool is a result of Davis's curiosity and research on the applications of symmetry to realistic situations and dilemmas. Having acknowledged a need for an online interactive program, he ultimately created Symmeter. Davis's interest in this area piqued as a result of extensive conversations with the co-authors of *Reading Faces*, a book which introduces the concept of bilateral symmetry as a measure of facial and personality analysis. Davis firmly believed that the implementation of bilateral facial symmetry would enhance the works of these authors. His interest in combining mathematical and technical capabilities resulted in a program which allows a person to analyze the symmetry of objects.

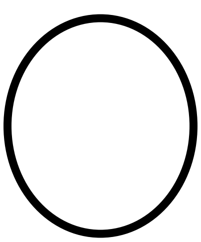
Symmeter utilizes bilateral and/or radial symmetry to determine the percentage of proportion comprised by an object or face. In general, symmetry is defined as balanced proportions, or equal correspondence in the position of parts of an object, based on a median. Bilateral equilibrium is reached when an object is arranged on an axis so that one plane can divide the object into identical halves. Slightly distinct, radial equilibrium entails equal portions of an object centered around a focal point. Whilst the initial intention of this program was to measure the symmetry of faces, it can also be applied to a variety of objects and industries. According to Davis and patrons of this tool, uses of Symmeter include, but are not limited to the following: reconstructive surgery, precious stone segmentation, inspection of mass-produced objects, and academic purposes. Since its creation in 2002, Symmeter has been used in over a dozen academic research

[1] Dave Davis received his Bachelors in Business from Ursinus College. In recent years, he has done extensive work in the fields of Neuroscience and Biomedical Engineering. Dr. Mike Jones holds a Ph.D. in Computer Vision and Robotics. See http://www.symmeter.com for more information on this computer package.

studies. Several recent topics include handedness, correlating criminal behavior with facial symmetry, and several projects on mandible symmetry for dentistry.

The ease and advanced capabilities of Symmeter make it a highly applicable tool for a variety of users. Davis's design is not constrained by configuration (.jpg only) and size. Furthermore, it allows the reviewer to set the exact area from which symmetry should be measured. The version utilized in this study provides two options for selecting the area of interest including both elliptical and circular. Given that people's faces are characterized as being elipse-shaped, the elliptical option was chosen. Thereafter, the ellipse can be rotated and sized to appropriately evaluate the selected area. The Symmeter program assigns corresponding pixels to the picture, creating a mirror-like image. The number of pixels are then calculated and displayed as a percentage of total pixels within the picture.

Below are examples of objects and faces that have been analyzed through the Symmeter software and their corresponding symmetry percentages. If a plain circle, such as the one depicted below, were placed into the software program, it would be assigned a symmetry reading of 1 since the pixels on either side of the centerline are equal. However, faces are not as perfectly symmetrical. Therefore, they generate percentages less than 100. Adjacent to the circle is a picture of Tony Romo, whose face has a relatively high symmetry value. To the right of Romo is a picture of Elephant man, who is considered to have a super deformity. When analyzed by Symmeter, he produced a value of approximately 75.28%. The fourth image shows a picture of Doug Flutie, whose symmetry rating is significantly greater than that of the Elephant Man, yet not as high as Tony Romo's. The values generated by the Symmeter program are generally high. This is to be expected because people's faces are generally symmetrical, unless one has a relatively large deformity. As a result, the percentages are extremely refined numbers. Dave Davis, creator, contends that the average person exhibits a facial symmetry reading in the high 80's to low 90s.




Circle	Tony Romo	Elephant Man	Doug Flutie

Symmetry Value: 100%	Symmetry Value: 98.20478530738162%	Symmetry Value: 75.28242925108034%	Symmetry Value: 96.3017589991037 %

Method

Subjects.

Headshot pictures of 312 National Football League quarterbacks from the years 1994-2006 constitute the sample size of this study. The data set is characterized as an unbalanced panel because the years of data on each player are not identical. For instance, there are 12 distinct observations for Drew Bledsoe where as there are only three years worth of data on Carson Palmer. All photographs were retrieved from the NFL homepage and Yahoo Sport, therefore ensuring comparable picture quality. Supplemental information regarding each players' productivity measurements was obtained through the official NFL website. Historical information was obtained from the NFL annual yearbooks.

Materials and Procedure.

The initial phase of this query was to compile a list of NFL quarterbacks for the selected time-frame. The compiled data set is not restricted to first string players. After assembling a list of 312 players, digital pictures were sought for each subject. Optimal photographs were defined as frontal-view headshots wherein the subject was neither smiling nor tilted to one direction. However, the symmetry program is not constrained by smiling or tilting of the head. Upon extracting pictures of each quarterback from the internet, the program designed by Dave Davis, *Symmeter*, was used as the symmetry measurement tool. A photograph of a selected player was uploaded onto the software's website. Thereafter, an ellipse-shaped cropping tool was applied to more clearly define the area to be analyzed. Vertically, the area consisted of the chin to the hairline. Horizontally, the entire face was selected, excluding the subject's ears. As described in the previous section of this paper, the *Symmeter* program was able to analyze the symmetry of the player's face in both a bilateral and radial manner. The number of pixels correlating to the mirror image of the picture generates a proportion of symmetry. The percentages of these 312 NFL quarterbacks' respective facial symmetries range from 99.76 to 82.47. Finally, the players' symmetry rating, as a proxy for attractiveness, is added to the regression analysis combined with other productivity measures model to ultimately derive the impact of beauty on wages, ceteris paribus.

Theoretical Model

In the game of football there are winners and there are losers. Fans, players, and coaches are happier being on the winning side of this equation. Although it is in the best interests of the general manager to hire a quarterback who will be the most productive on the field, the general manager's ultimate goal is to generate the greatest revenues. Therefore, it would be in the best interest of the general manager of a given NFL team to have a quarterback who is not only productive but also well-liked by the fans. The general manager will undoubtedly hire the "best" quarterback that is the most productive quarterback; however, other aspects of a quarterback, such as his looks, can be viewed as an additional bonus to the general manager. After consideration of productivity, the quarterback who can create a greater fan base is more likely to be hired than one who does not possess these characteristics.

From a revenue standpoint, the general manager hires a factor of production that may generate revenue in two ways: athletic capability and consideration of attractiveness. A more attractive quarterback could bring more people to the stands, get fans more excited, and create a band-wagon effect. As stated by psychological researcher, Samuels (1994) found that people are drawn toward more symmetrical beings. Therefore, fans could be more drawn toward symmetrical, or good-looking, quarterbacks. In the end, these results could lead to more profits.

In terms of economic theory, the marginal revenue product of labor represents the demand curve for labor. People are in demand because of what they can produce. This production in turn quantifies to revenue for the firm. Using established productivity measures for a quarterback, we are able to put a dollar price on this outcome. For example, in terms of football, the quarterback is "producing" completed passes, touchdowns, rushing yards, all which the fans are willing to buy. Therefore, the more productive he is, increases his worth to the owner. This increase in demand can also due to reasons other than marginal revenue and marginal product changing. Essentially, this increase could theoretically be a result of a quarterback's attractiveness. This attractiveness leads to increasing marginal revenue product for a given productivity level because of a larger number of endorsements and possible excitement amongst the fans, which could lead to ticket or team logo sales increases. An increase in the quarterback's ability to create this bandwagon effect could create a higher demand for the player. In the end, this player's wage may increase as well. For example, if the GM is presented with two identically productive quarterbacks yet one resembles Bret Favre and the other bears a resemblance to Qauzi Motto, the general manager and the profitability of the team could benefit by hiring the Bret Favre look-alike.

Based on the theories of profit maximization-from the viewpoint of the GM- and marginal revenue product of labor, quarterbacks conveyed as 'good-looking' would theoretically increase their own contract prices in addition to increase the revenue of the team.

Empirical Model

$$\textbf{LN SALARY}_{it} = \textbf{B0 + B1(PRODUCTIVITY MEASUREMENTS}_{it}\textbf{) +B2 (BEAUTY/TIME INVARIANT CHARACTERISTICS}_{it}\textbf{) +B3 (INDUSTRY TRENDS}_{it}\textbf{) +} \mu_{it}$$

The null and alternative hypotheses are as follows, given that B_2 is defined as the coefficient on the beauty variable.

$$H_0 : B_2 \leq 0$$

$$H_A : B_2 > 0$$

This paper seeks to reject the null hypothesis, so as to show that the impact of beauty on a player's salary is greater than zero, ceteris paribus. Furthermore, the impact of symmetry is expected to be greater with regard to secondary quarterbacks. It is hypothesized that, while the primary quarterbacks are probably hired for their athletic capabilities, the beauty of a secondary quarterback may bear greater impact on wages because the additional component may be more important. A general manager would consider hiring a player who is good enough to perform on the field, given the case of an injury of the starting quarterback, but the role of the secondary quarterback is twofold. A general manager may take into consideration what can the secondary quarterback do while sitting on the bench. Public appearances, attending charitable events, and acting as the 'face' of the organization are all possible endeavors taken by a secondary quarterback. Therefore, because sociological and economic studies suggest that people are more drawn to symmetrical beings, a general manager may likely consider the attractiveness of secondary quarterbacks. As a result, one would expect the quarterback to be subject to a wage premium for his looks.

Data

The sample regression function consists of three categories of regressors. First, a player's productivity is assessed through several variables. The second grouping of regressors consists of time in variant characteristics. The final group includes industry trends. This section outlines the specific variables which compose these three groupings.

The dependent variable of the sample regression function employed by this study is the log of quarterback *i*'s salary in period *t* ($LSALCAP_{it}$). This figure is defined as the base and bonus of a players' salary in a given year. The number deflated by the CPI and stated in terms of 1999 dollars.

Productivity Measurements

To assess the productivity of an individual player, there are several noted statistics which can be utilized. The NFL created a recognized quarterback rating (QBRAT) equation, known as the passer rating systems, which is employed in this study. The complete equation is depicted as follows

$$\left[\frac{\frac{COMP}{PASSATT}-.3}{0.2}+\frac{\frac{PASSYDS}{PASSATT}-3}{4}+\frac{\frac{PASSTD}{PASSATT}}{0.05}+.095-\frac{\frac{INT}{PASSATT}}{0.04}\right]*\frac{100}{6}$$

The variables above are defined as:

COMP= Completions
PASSYDS= Yards Passing
PASSTD= Touchdown passes thrown
INT= Interceptions thrown
PASSATT=Passing attempt

Each of the four components of rating calculator ranges from 0-2.375. The quarterback rating is predicted to have a positively correlated relationship with the player's salary. One would assume that a quarterback with a higher rating would be considered to be more valuable to the team, and therefore, earn a higher salary.

While the quarterback rating is one measure of a player's productivity, additional factors that measure performance should be included to gain a better understanding of a player's athletic capabilities. Additional measurements of a players' prior productivity are included as separate variables. One of the factors, passing attempts (ATT), is calculated as the number of times a quarterback attempted to pass the ball in a given season. This variable also provides an indication of whether a player is a starter or back-up. As a component of performance measurement, one would expect the relationship between passing attempts and salary to be positive. On average, starting quarterbacks will likely have more passing attempts, in addition to higher salaries.

An additional way of assessing whether a player is a starter or back-up is to look at the number of plays in which he was involved. The NFL season is composed of 16 games. Historical analysis and counter-reference with sports economists suggest that starting quarterbacks, herein referred to as primary quarterbacks, participate in greater than 200 plays in a given season. If the quarterback participated in less than 200 plays, he qualifies for the secondary position. These players are not classified as second-string quarterbacks because the number of plays, as listed in the data set, does not account for injuries. Although the number of plays is not regressed on salary, it was used to generate two distinct data sets: primary and secondary quarterbacks.

As a player gains familiarity of the game through greater involvement on the field, one would expect his productivity to increase. A quarterback's total number of years in the NFL is accounted for in the variable, experience (EXP). Years of experience are classified as number of years on a team whether or not playing time occurred. One could hypothesize that a player with greater experience could demand a higher salary but this demand would increase at a decreasing rate, suggesting a quadratic form.

Players leave teams for several reasons. Whether a player's contract matured, he has been performing sub-par, or he seeks greater playing time elsewhere, it is common in the NFL for players to be traded (multiple times, on occasion) throughout their professional careers. A study of NFL salaries by Simmons and Berri (2007) indicates that quarterbacks who have been traded at least once are more likely to earn lower salaries than those who have never been traded. To account for this observation, the variable CHANGETEAM has been regressed in this model. However, the correlation between CHANGETEAM and a player's salary could be interpreted in a number of ways. Due to the flexible impact of this variable, either a positive or negative correlation with salary is generated. For example back-up quarterback, A.J Feeley, played for the Philadelphia Eagles when the starting quarterback, Donovan McNabb, got injured. After performing well for the Eagles, he signed with Miami for the starting position. In this case, his reasoning for changing teams was twofold: more playing time and a higher salary. This example illustrates a case in which a player's salary is positively related to the CHANGETEAM variable.

The final performance-related characteristic regressed on a quarterback's salary is whether the player has ever been selected to play in a Pro Bowl (PBOWLEVER). This honorary nomination is a valid indication of a player's reputation, and therefore, performance. Six quarterbacks are selected to play in the Pro Bowl each year. These players are considered to be some of the most elite and preeminent players in the NFL. Because a general manager would benefit by hiring a player who has a fine reputation amongst the fans, acquiring a quarterback who has previously competed in the Pro Bowl would likely increase the demand of a given quarterback. An increase in demand provides a player with greater bargaining leverage, ultimately increasing his salary. The relationship between a player who has participated in a Pro Bowl in his professional NFL career and his salary can be characterized as positively correlated.

Time Invariant Characteristics

Individual characteristics, aside from those related to a player's performance, are taken into account in the sample regression function utilized in this study. The personal attributes examined are symmetry and race. As stated at the onset of this paper, a higher level of symmetry is predicted to generate a higher salary. The second attribute, race, is measured using a dummy variable, BLACK. If a player self reports as an African-American, he is denoted as BLACK. The remaining players are lumped together as non-black. Sociological studies suggest that black people, as a whole, earn lower wages than white people. One would assume that this theory holds true in the football industry, as well. Furthermore, an interaction term, BLACKSYM, tests the combined effect of being black and one's level of symmetry on a player's salary. While the combination of race and symmetry is not the primary focus of this study, one may speculate that more symmetrical black quarterbacks would be paid less than more symmetrical white quarterbacks, seeing as race has been proven to have a significant impact on wages across various industries.

A quarterback's innate athletic prowess undoubtedly plays a role in how productive he is. Although this characteristic is not accounted for in its entirety in this study, the players' draft round (DRAFT1 or DRAFT2) is used as a proxy. By using the DRAFT variable as a regressor in this study, a quarterback's athletic ability prior to entering the NFL can be measured. A player's first year salary can be used as an indication of his worth to the team, as well as a sum of his predicted future productivity. There are seven draft rounds in the NFL. Previous research suggests that a quarterback drafted in the first or second round is likely to have a higher salary than one drafted in round three or more. Consequently, a quarterback who was a first round draft pick would correlate to the dummy variable, DRAFT1, to be compared to the remaining six rounds.

Industry Trends

Cyclical changes in the overall economy are accounted for in the dependent salary through the real salary cap which is deflated by the 1999 CPI. However, in the National Football League, the collective bargaining agreement is assembled so that the salary cap is a percentage of the total league revenue. As the revenues of the league increase, the salary cap does as well. Consequently, all players' salaries can fluctuate from one year to the next, regardless of one's productivity or related traits. The change in industry trends is depicted through the YEAR variable, which simply illustrates of which year the observation denotes. The data ranges from years 1994-2006, so each observation falls in this time frame.

Descriptive Statistics: Secondary Quarterbacks

Variable	Mean	Std Dev	Minimum	Maximum
Symmetry	97.2328556	2.3199945	82.4700502	99.6671000
year	1999.94	3.7061320	1994.00	2006.00
qbrat	63.8805293	31.5884877	0	158.3000000
att	47.6162571	48.2062154	0	181.0000000
exp	5.8317400	4.4020182	0	22.0000000
exp2	52.7448015	73.3059765	0	484.0000000
changeteam	0.2022684	0.4020715	0	1.0000000
pbowlever	0.1361059	0.3432255	0	1.0000000
black	0.1266541	0.3328998	0	1.0000000
lrsalcap	-0.4443547	0.7681912	-3.4362800	1.9737060
draft1	0.0453686	0.2083083	0	1.0000000
draft2	0.0189036	0.1363135	0	1.0000000

Descriptive Statistics: Primary Quarterbacks

Variable	Mean	Std Dev	Minimum	Maximum
Symmetry	97.7316636	1.8160749	91.3304000	99.7671000
year	2000.12	3.6938554	1994.00	2006.00
qbrat	79.0681250	11.9878542	39.0000000	121.1000000
att	386.5145833	125.5080024	160.0000000	691.0000000
exp	6.9125000	4.1117798	0	20.0000000
exp2	64.6541667	69.0423698	0	400.0000000
changeteam	0.2041667	0.4035119	0	1.0000000
pbowlever	0.4625000	0.4991119	0	1.0000000
black	0.1833333	0.3873433	0	1.0000000
lrsalcap	0.8392977	0.8964505	-1.4614440	2.6655400
draft1	0.1208333	0.3262735	0	1.0000000
draft2	0.0354167	0.1850234	0	1.0000000

Empirical Findings

As stated in the hypothesis of this paper, we expect to find a greater impact of beauty on wages amongst secondary quarterbacks, ceteris paribus. To isolate the true impact of beauty on the two distinct groupings of players, the regression model was run on two data sets: primary quarterbacks and secondary quarterbacks. Both ordinary least square models and random effects models were run, as a test to see whether the variable, YEAR, would bear a significant impact on the wages. The comprehensive results of the four sample regression models are outlined in Table 1.

Table 1

Variable	Primary OLS	Primary Random Effects	Secondary OLS	Secondary Random Effects
Symmetry	0.03083**	.05138*	0.03259	0.03479
	(0.02016)	(0.02827)	(0.01595)	(0.01727)
Black	13.20613*	12.37770**	8.61500*	8.50910*
	(6.06558)	(8.70140)	(7.58391)	(8.17110)
Black*symmetry	-0.13429*	-0.12570**	-0.08684*	-0.08581*
	(0.06198)	(0.08896)	(0.07748)	(0.08353)
Draft1	0.53937	0.46830	1.31193	1.30440
	(0.11491)	(0.11870)	(0.14087)	(0.14800)
Draft2	0.03145**	0.06944**	0.32975*	0.2783**
	(0.17996)	(0.1890)	(0.20656)	(0.2135)**
Pro Bowler	0.31646	0.42990	0.36306	0.38900
	(0.07803)	(0.08991)	(0.11331)	(0.12350)
Experience	0.21018	0.19910	0.22334	0.22770
	(0.03637)	(0.03713)	(0.02573)	(0.02660)
Experience^2	-0.01193	-0.01177	-0.01197	-0.01226
	(0.00202)	(0.00210)	(0.00165)	0.00172
QB Rating	0.00435*	0.00134**	0.00182*	0.001971
	(0.00305)	0.00305	(0.00102)	(0.00103)
Change Team	-0.80074	-0.71670	-0.19000	-0.22680
	(0.08071)	(0.07481)	(0.07864)	(0.08172)
Year	0.03646	N/A	0.03864	N/A
	(0.00879)	N/A	(0.00911)	N/A
Attempts	0.00234	0.00189	0.00183	0.00156
	(0.00028)	(0.00028)	(0.00066)	(0.00065)

*Variable significant at a level of .05
**Variable not statistically significant in this model.
Variables lacking an (*) are significant at a level of .01

A key facet of this data set is the presence of multiple observations for a single player. Certain characteristics such as symmetry, changing team, and having participated in the Pro Bowl, do not change over time, while other independent variables change over time. For instance, if a given quarterback is paid more than average than predicted in one year, it is likely he is paid more than average the following year, which suggest serial correlation in salaries. Ordinary least squares assumes that there is no serial correlation. If there is serial correlation, however, it can be taken into account and remedied to make the estimates more reliable. Pooled ordinary lease squares regressions do not take serial correlation into account where as the mixed effect model does. Therefore, a random effects estimator provides consistent results.[2]

The alternative estimation process is to use a random effects model. Random effects model assumes that unaccounted for attributes are uncorrelated to other independent variables. For instance, there are variables such as attitude, drive, and related physical attributes that do not change for a player. If the error term is serial correlated across time, OLS estimates are not as precise.

When running a log model, Wooldridge (2006) notes that large beta values yield underestimate impacts on the dependent variable, and recommends the use of the equation below. When the beta coefficient is relatively large, there's a more exacting formula one uses to find the percentage change in real wage. This equation was performed on each parameter estimate. The discussion of the empirical findings addresses a more precise effect of each variable on wage. The equation, proposed by economist and author, Wooldridge (2006), is as follows.

$$\textbf{Adjusted Parameter Estimate} = [\exp^{(beta1 * \Delta x1)} - 1] * 100\%$$

Table 2

Variables	Adjusted Primary Parameter Estimates	Adjusted Secondary Parameter Estimates
Symmetry	*	0.03313
Black	*	*
Black*Symmetry	-0.12560	0.16980
Draft1	0.71490	2.71000
Draft2	*	0.39060
Pro Bowler	0.37220	0.43770
Experience	0.04630	0.09830
Experience ^{2}	-0.01219	0.01189
QB Rating	0.00435	0.00183
Change Team	0.55060	0.17300
Year	0.04576	0.03940
Attempts	0.00234	0.00183

[2] See Wooldridge p. 490 for more information.

*Variable not statistically significant.

OLS RESULTS OF SECONDARY QUARTERBACKS

The data of secondary quarterbacks is composed of 402 observations. The final regression model generated an R^2 of .3562, indicating that 35.62% of variation can be accounted for by the model as shown in Table 2. As a result of running a White's test, this model fails to reject homoskedacity. The overall P-value further suggests there is no heteroskedacity in this model. The relatively low P-values of the individual variables suggest that they bear a statistically significant impact on a player's salary. One restriction of this model, however, is the presence of multicollinearity. This is to be expected because of the inclusion of variables such as experience and experience, and black and black*symmetry.[3] Several tests were appended to the analysis to determine whether such variables should be included in the model. The results indicate that although there is multicollinearity, these variables contribute to the overall reliability of the model, and should therefore be incorporated.

As predicted, symmetry has a statistically significant impact on the salary of a secondary quarterback. When testing the interaction term, black*symmetry, the test results illustrate that the interaction term should be included in the model, but the interaction with wage is taking place with the symmetry portion more so than race. The results of regressing salary on symmetry, made more exact through Wooldridge's equation, indicates that a one unit increase in a player's symmetry leads to a predicted 3.3126% salary increase for white quarterbacks. For black quarterbacks, there is a 20.29% expected increase in salary, ceteris paribus. The average symmetry level of the observations in the secondary quarterback data set is 97.25. The results of regressing the interaction term, black*symmetry on salary, indicates that at the mean symmetry value, black quarterbacks earn 16.98% more than white quarterbacks.

Looking at the draft pick of a secondary quarterback, a quarterback chosen in the first round (Draft1), relative to those chosen in round three or below, are expected to earn 271% more. The parameter estimate on this variable (see Table 1) suggests a 131% increase. However, when using the Wooldridge equation above, the more exact parameter estimate of 2.71 suggest an impact of 271%. This is the result of the scenario in which a player was a secondary quarterback but first round draft pick. His base pay when he came into the league would be very high because

[3] The first test, B(black)=blacksym=0 generated a t-value of .100, revealing that both variables should be in the model. The second test, $exp=exp^2$, should also be included because it is represented by a t-value of .0001. This suggests that the model is better represented by a quadratic form than a linear form with regard to experience. The third test suggests, in concurrence with previous research by Kahn (1992), that Draft1 and Draft2 should be represented in the model.

of his first round draft status. If it turns out that he did not perform to par and, as a result, was not a primary quarterback despite what the league had envisioned him to be, his pay would decrease in following years. Therefore, in comparison to the other quarterbacks in the secondary data set, he is likely to be paid more because of his initial contract. If a quarterback was drafted in the second round (Draft2), he is predicted to make an average 39.06% more than a player chosen in the third rounds or below, ceteris paribus.

The impact of a secondary player's participation in the Pro Bowl on his salary is straight forward and coincides with the expected outcome. A player who had ever partaken in this honorary game is expected to make 43.77% more than a player who has never been elected to play in this game. The Pro Bowl is a sign of prestige. Being elected to play in this game illustrates which players are considered to be the best in their respective positions. This salary premium is likely the result of a general manager wanting to hire a player who has been known for being the best, or most productive, at some point in his career. Such a player would likely have gathered a wide fan base, as well, which would contribute to the team's revenue.

Including experience and experience^2 as a quadratic in the final regression function produced statistically significant results in the expected direction. Until 9.77 years of experience, each additional year of experience increases wages at a decreasing rate. After reaching this point of threshold, each extra year of experience decreases the wage of a secondary quarterback at an increasing rate. The drop each year is greater. This outcome is to be expected because as the quarterbacks are getting older, they are less productive, therefore less valuable. The average years of experience for secondary quarterbacks are 5.83 years. At this level, an additional year of experience in the NFL is expected to increase a player's wage by 9.83%.

Compared to the other independent variables regressed on salary, a quarterback's rating did not bear as great of an impact as expected. A one point increase in the rating is expected to increase a player's salary by 0.182%. The disparity of QB-rating's in this data set ranges from 63-158, with a standard deviation of 31. Therefore, an increase of one standard deviation (30 points) leads to a 5.61% increase in wage. The actual sign of this coefficient corresponds with the expected sign, but the actual impact is less than expected. Multicollinearity with related productivity measurements may be the result of this finding.

An additional measure of productivity which is expected to positively affect a players' salary is passing attempts. Similar, to quarterback rating, attempts are not realistically measured in one point increases. Therefore, the impact is stated when examining an increase of one standard deviation, 48 units. If a secondary quarterback has 48 more attempts (like playing one more game), his salary is predicted to increase an average of 9.18%.

The ambiguous nature of interpreting whether a player's expected salary would increase or decrease due to having changed teams at some point in his career is refined by the outcome of running the OLS model. Amongst the secondary quarterbacks, if a player changes teams at least once in his professional career, his predicted salary is expected to decrease by 17.30%. One may assume that this conclusion is the result of a player changing teams as a sign of demotion rather than promotion. Old age, lasting injury, or poor attitude may contribute to a player changing teams, and therefore earning a lesser salary. Finally, when quarterbacks are traded, they are walking away from a significant bonus. The lack of a signing-bonus is accounted for in a percentage decrease.

The variable, 'year,' which tests for changes in the industry, was expected to have a greater impact within the random effects model. With regard to the OLS model, wages of players as a whole are expected to increase by 3.94%. This effect is likely picking up on the changes in the industry revenues and salary caps.

OLS RESULTS OF PRIMARY QUARTERACKS

The primary quarterback data set is composed of 443 observations. The adjusted R^2 of the model suggests that 50.07% of the variation is accounted for by the model. According to the White's test, the model is not restricted by heteroskedacity. Further tests indicate that the interaction term, black*symmetry, and correlating this variable with both black and symmetry, alone, enhances the predictability of the model. Interestingly, the change in salary given a one unit increase in symmetry is different for black quarterbacks and white quarterbacks. This phenomenon is not evident amongst secondary quarterbacks.

The principal variable of this study, symmetry, yields results that concur with the hypothesis. The relatively high p-value on the symmetry coefficient indicates that this variable is not significant. As previously stated, one would not expect to see an increase in wage amongst primary quarterbacks because their wage relies nearly solely on their athletic capabilities. Within the primary data set, at the mean symmetry level of 97.73, there is no discrepancy in the expected earnings of black and white quarterbacks. In the secondary data set, black quarterbacks were earning more.

Primary quarterbacks drafted in the first round (Draft1) are expected to earn 71.49% greater than those drafted in rounds three and below. As indicated by a relatively high p-value, the Draft2 variable is not statistically significant. The reasons for a first round draft pick earning more than those in successive rounds hold true for both primary and secondary quarterbacks: they are expected to be more productive on the field, therefore generating a greater fan base which leads to an increase in ticket sales and overall team revenue.

Akin to the predicted outcome of a player having been chosen to play in the Pro Bowl, the adjusted parameter estimate of this variable suggests that election to play in this game increases the expected wage of a primary quarter back by 37.22%. Interestingly, the impact is greater amongst secondary quarterbacks.

The experience of a quarterback, measured as a quadratic, is an additional statistically significant variable regressed on a player's salary. Until 8.81 years of experience, the expected wage increases at a decreasing rate. After 8.81 years, one's salary is expected to decreases at an increasing rate. The threshold level of 8.81 years is lower than that of the secondary quarterbacks. Overall, each additional year of experience is assumed to augment the real salary of a primary quarterback by 4.63%. Both the sign and direction of the coefficient on this variable are in accord to the hypothesis and previous research.

Generally speaking, the players with the strongest and most accurate arms attempt to throw the ball most often. Assuming such accuracy and strength are adequately portrayed on the field, these players are also commonly thought of as the best players. Attempts are generally not measured in terms of one-unit increases. Rather, by looking a change in one standard deviation, 125 attempts, the expected salary of a primary quarterback is predicted to increase by 33.97%. Examining the expected salary change by means of a one-standard deviation increase is utilized with regard to quarterback rating as well. The standard deviation of quarterback rating is 12 unit points. For every 12 unit increase, or one standard deviation from the mean, in the quarterback rating, the expected salary of a primary player increases by 5.35%. This statistically significant impact concurs with the hypothesis stated from the onset of this paper. As a key measure of productivity, the quarterback rating is expected to have a significantly positive correlation to the wage of a primary quarterback.

The final variable regressed on salary is whether a quarterback ever changed teams at some point during his professional career. As illustrated in Table 2, this characteristic is statistically significant. More specifically, if a primary quarterback ever changed teams, he is expected to make 55.06% less than one who has never changed teams. As previously state, the reasoning behind this negatively impacting variable is slightly ambiguous. If someone is considered a good quarterback, he is likely to stay with the same team. Therefore, those who are traded at some point in their career, are probably old, have sustained injury, or have poor chemistry with the current team. Changing teams is not a common theme for NFL quarterbacks; of the 408 individual season observations, 20% changed teams.

RANDOM EFFECTS RESULTS OF SECONDARY QUARTERBACKS

The purpose of running a random effects model was to account for industry changes over time. Therefore, the variable 'year' was amended to become a dummy variable to account for years

1994-2006. Generally speaking, the results generate by the random effects model were similar to those of the ordinary least squares regression. The results of the random effects models of both primary and secondary quarterbacks are expressed in Table 1. Significant differences are as follows. First and foremost, the parameter estimate of symmetry is larger in the random effects model than in the OLS model, suggesting that as the symmetry of a secondary quarterback increases by one unit, his expected wage increases by 3.479% for white quarterbacks.

While draft2 became less significant (p-value of .1937), quarterback rating became slightly more significant and is expressed with a higher magnitude. The relatively low parameter estimates on the quarterback's rating statistic is common in sports economics because this variable often picks up on team performance, not only player performance.

RANDOM EFFECTS RESULTS OF PRIMARY QUARTERBACKS

With regard to the primary quarterbacks, the random effects model indicates that symmetry is slightly more statistically significant because it has a p-value of .0702. Were this variable to be considered significant, one could deduce that as a primary quarterback's symmetry level increases by one unit, his salary is expected to increase by 5.138%. Furthermore, race and race combined with symmetry readings are also more significant, though the parameter estimates do not drastically differ.

Whether a quarterback was chosen in the second draft compared to draft three or below, his salary is not expected to differ. In conjunction with the results of the OLS model, the draft2 variable is not significant in the random effects model either. Interestingly, the OLS model indicated that if a primary quarterback had ever been selected to play in a Pro Bowl, his expected salary was likely to increase by 37.22%. The random effects model results suggest that said player's salary is actually likely to increase by 42.99%.

In conclusion, few parameter estimates differ when generating a random effects model and ordinary least squares regression. Moreover, the signs of each coefficient remain the same. The initial assumption that secondary quarterbacks would likely see greater salaries as a result of their symmetry ratings, and that primary quarterbacks would not be as greatly affected, hold true in both models.

Conclusion

As predicted, the wages of NFL quarterbacks are not entirely derived by their ability to perform on the field. Additional factors such as race, looks, and industry trends play part in determining their contract prices. By using symmetry analysis to quantify a players' attractiveness, it is concluded that the salary of a secondary quarterback is predicted to increase by approximately 3.3% for every one unit increase in his symmetry rating.

A common theme in sports studies is the prevalence of a relatively low R_2. This is the result of difficulty in differentiating the productivity of a player versus that of the team. Additional limitations of this study include the presence of unobserved variables in the disturbance term. Several contributing factors include a player's natural football sense, attitude, chemistry with teammates, and overall charisma. The existence of such factors leads to potentially biased results. Furthermore, it may be helpful to know when players' contracts were renegotiated or set, to account for changes in industry trends.

Beauty does have an impact in society at large, as indicated in the literature review section of this paper. Therefore, this topic could be applied to various industries. For example, part of CEO compensation may be attributed to one's looks. Data in which there is public access to salary, productivity measurements, and photographs would allow a researcher to conduct a similar study.

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