

The path and performance of a company leader: A historical examination of the education and cognitive ability of Fortune 500 CEOs



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ABSTRACT

The path to becoming a CEO (and performance on the job) can be viewed as a difficult cognitive challenge. One way to examine this idea is to see how highly selected CEOs are in terms of education and cognitive ability. The extent to which Fortune 500 CEOs were selected on education and cognitive ability at an earlier age was retrospectively assessed at four time points that spanned 1996 to 2014 (Total N = 1991). Across the last 19 years, between 37.5% and 41.0% of these CEOs were found to attend an elite school which likely placed them in the top 1% of cognitive ability. People in the top 1% of ability, therefore, were likely overrepresented among these CEOs, at about 37 to 41 times the base rate. Even within each of the four samples, higher CEO education and cognitive ability was associated with higher gross revenue of the CEO's company. Although Fortune 500 CEOs were highly selected on education and cognitive ability, when placed in the context of a broader array of occupations in the extreme right tail of achievement (e.g., politicians, judges, billionaires, journalists, academics, powerful people, and other business elites), CEOs were not at the top. This showed the wide cognitive ability range (and mental test difficulty) across various occupations that compose the U.S. elite. That Fortune 500 CEOs had similar education and cognitive ability selectivity over time shows that the CEO (and perhaps business) occupational and filtering structure has remained relatively unchanged across the last two decades.

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1. Introduction

Life can be considered a cognitive challenge. The occupation one ends up in is a reflection in part of an individual's general cognitive ability which can have a cumulative effect on careers, primarily due to the continuous life event test items one has successfully overcome along the path to eventual achievement (Gottfredson, 2003).

One occupation at the pinnacle of business achievement is becoming a chief executive officer (CEO) of a company. The mental test battery that is the path to becoming a CEO, as well as performance on the job, is likely extremely complex, and filled with both professional (e.g. performance, navigating office politics) and personal challenges (e.g. balancing work and family). In the development of such occupational expertise (Wai, 2014a), there are likely many personal traits and other factors at work (Lubinski, 2004), including cognitive ability (Kuncel, Hezlett, & Ones, 2004; Nyborg & Jensen, 2001; Schmidt & Hunter, 1998, 2004), deliberate practice (Ericsson, Krampe, & Tesch-Romer, 1993), and even luck.

In addition to general cognitive ability, one important factor along the path to the head of a company might include whether or not a

CEO attends college or graduate school and the educational or intellectual return, social networks attained, branding and institutional reputation effects, or other value that might be associated with such school attendance.

In a series of studies investigating a variety of U.S. sectors—federal judges, billionaires, Senators, House members, Fortune 500 CEOs, CEOs who attended the World Economic Forum in Davos, Davos media, Davos academia, Davos government and policy, Davos overall, and the most powerful men and women¹ according to *Forbes* magazine—that compose the U.S. elite (Wai, 2013, 2014b), the educational selectivity and corresponding ability levels of these groups were assessed by retrospectively assessing these factors at a younger age (Cox, 1926; Simonton, 2009). Overall, these papers showed each of these groups were quite cognitively able and intellectually gifted, but to varying degrees. One specific finding of interest for the present investigation was that 38.6% of Fortune 500 CEOs in 2012 had attended an elite school and were in the top 1% of cognitive ability (Wai, 2013).

¹ The term "powerful people" refers to the definition given by *Forbes* magazine. According to Wai (2014b, p. 55), "The most powerful people list methodology included four factors: the number of people the person employed or managed, the amount of financial resources they controlled, their number of spheres of influence, and how actively they used their power." This resulted in many politicians, business and media elites, people with extreme wealth, and others that fit these selection criteria. See Ewalt (2012) and Howard (2013) for more detail.

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The current study attempts to provide insight into the extent to which Fortune 500 CEOs are cognitively and educationally select, whether this has remained the same or changed across the last two decades, and whether the education and ability of a CEO is associated with the gross revenue of a company. This study also examines whether the findings from Wai (2013) do or do not replicate in samples that span 1996 to 2014. Finally, this research situates the cognitive ability of Fortune 500 CEOs in the context of a wider range of U.S. elite groups to assess whether occupations in the extreme right tail of achievement might be difficult mental tests (Gordon, 1997; Gottfredson, 2003). Whether or not these findings align with different time points provides important information about the education levels, cognitive abilities, as well as the CEO (and more broadly) business occupational structure in the U.S. across the last 19 years.

2. Samples

Fortune 500 Chief Executive Officers (U.S. CEOs). Information on name, company, gender, and undergraduate and graduate education was collected from Fortune magazine (fortune.com) at four time points where systematic data was available. Some companies had no listed CEO or other missing data and were excluded from the samples. There were 493 CEOs in 1996 (Male = 493, Female = 0), 498 in 2006 (M = 489, F = 9), 500 in 2012 (M = 481, F = 17; see Wai, 2013), and 500 in 2014 (M = 478, F = 22). The total sample size was 1,991. The Fortune 500 is a list compiled annually by Fortune magazine that ranks top U.S. companies by gross revenue for their respective fiscal years and other inclusion/exclusion criteria.² See Fortune 500 CEOs (1996, 2006, 2014) and Fortune 500 CEOs (2012) for links to data.

Groups from the broader U.S. elite. In order to place the data on Fortune 500 CEOs in the broader context of extreme right tail achievement in the U.S., data was drawn from prior papers (Wai, 2013; Wai, 2014b, Table 1) and updated with new data. The updates included broadening the list of elite schools used in Wai (2013) to encompass global schools used in Wai (2014b) and reanalyzing the data, as well as including an analysis of data using the same method on *The New Republic* masthead (N = 95; see Schonfeld, 2014 for link to data).

3. Method

Assessing education and ability level. The method for the current study is an extension of that used by Wai (2013) for the U.S. alone and is detailed in Wai (2014b). This method was used because not all people who become Fortune 500 CEOs were educated solely in the U.S. Gaining admission to a top U.S. college, university, or graduate school requires for the large majority scoring at or above a certain level on standardized tests such as the Scholastic Assessment Test (SAT), American College Test (ACT), Graduate Record Examination (GRE), Law School Admissions Test (LSAT) or Graduate Management Admission Test (GMAT), among others. Student assessment tests are regarded as being good measures of cognitive ability highly correlated with the results of psychometric IQ tests and showing similar cognitive

² According to fortune.com on the Fortune 500 methodology: "Companies are ranked by total revenues for their respective fiscal years. Included in the survey are companies that are incorporated in the U.S. and operate in the U.S. and file financial statements with a government agency. This includes private companies and cooperatives that file a 10-K or a comparable financial statement with a government agency, and mutual insurance companies that file with state regulators. It also includes companies that file with a government agency but are owned by private companies, domestic or foreign, that do not file such financial statements. Excluded are private companies not filing with a government agency; companies incorporated outside the U.S.; and U.S. companies consolidated by other companies, domestic or foreign, that file with a government agency. Also excluded are companies that failed to report full financial statements for at least three quarters of the current fiscal year. Percent change calculations for revenue, net income, and earnings per share are based on data as originally reported. They are not restated for mergers, acquisitions, or accounting changes. The only changes to the prior years' data are for significant restatement due to reporting errors that require a company to file an amended 10-K."

demands (e.g. Rindermann & Baumeister, 2015; Rindermann & Thompson, 2013). The SAT and ACT have been shown to measure general intelligence (g) or IQ to a large degree (Frey & Detterman, 2004; Koenig, Frey, & Detterman, 2008), and it is reasonable to think other tests (e.g. international standardized exams) also measure intelligence due to Spearman's (1927) *indifference of the indicator*—the idea that "g enters into any and every mental task" (Jensen, 1998, p. 33). Murray (2012, p. 366) concluded: "the average graduate of an elite [U.S.] college is at the 99th [per]centile of IQ of the entire population of seventeen-year-olds," and defined an elite college to be roughly one of the top dozen schools in the U.S. *News & World Report* rankings (*America's Best Colleges's*, 2013).

The list of colleges, universities, and graduate schools indicating top 1% in cognitive ability status within the U.S. can be found in Table 1 of Wai (2013). The criteria for selection of these schools was based on the average scores of an institution indicating roughly the top 1% compared to the general U.S. population.³ However, some individuals who ended up as Fortune 500 CEOs and in other elite occupations attended colleges and universities within their home countries before coming to the U.S., therefore the *QS World University Rankings* (2012) were used to determine elite school status within each country.

As a reasonably select cut point, up to the top 10 schools within each country were considered elite and included. In many cases there were fewer than 10 schools within each country that made it onto the *QS* world rankings, and only the schools on the *QS* rankings were used. Although the method in Wai (2013) reasonably isolated the schools that required standardized test scores indicating top 1% in cognitive ability status, the same method cannot be directly applied for countries worldwide due to varying criteria for university admissions and lack of publicly reported standardized test scores. However, it is reasonable to think the top colleges and universities within each country would attract a large fraction of the brightest individuals. Therefore, admission to one of these schools is a direct measure of elite school status, and also a reasonable but indirect proxy of high cognitive ability relative to the selection pool within each country – likely within the top 1%.

Some students attend an elite school with lower than typical test scores (e.g., due to athletics, legacy status, political connections, or affirmative action; Espenshade & Radford, 2009; Golden, 2006; Sander, 2004), whereas others who have higher than typical test scores may not have attended an elite school (e.g. financial limitations, scholarship, staying close to home). Gender roles are additionally important. This lowers the reliability of the educational measure as an ability indicator, especially at the individual level. Factors in both directions likely counterbalance one another, which makes the method reasonable for group estimates.

4. Results

Table 1 presents data on the education and ability level of Fortune 500 CEOs from 1996 to 2014. *Elite School* indicates the percentage of people who attended one of the top schools in the U.S. (see Wai, 2013, Table 1) according to *U.S. News & World Report* (*America's Best Colleges's*, 2013), or one of the top schools in the world according to *QS World University Rankings* (2012), and roughly represents a group

³ Attendance at a national university or liberal arts college that had median combined SAT Critical Reading and Math scores of 1400 or greater according to *U.S. News & World Report* (*America's Best Colleges's*, 2013) was used as a reasonable indicator that the individual was in the top 1% in cognitive ability compared to the general U.S. population. This resulted in 29 schools which can be found in Table 1 of Wai (2013). Additionally, similar cut scores on the LSAT (12 schools) and GMAT (12 schools) were used as a reasonable indicator that the individual was in the top 1% in cognitive ability. Finally, for students who had graduate degrees outside of law and business, attendance at one of the 29 schools in Table 1 was used as a reasonable indicator that their GRE scores placed them in the top 1% in cognitive ability compared to the general U.S. population. For specific details on the population level statistical calculations that led to these selection criteria, see Wai (2013) and Murray (2012).

Table 1
Education and cognitive ability of Fortune 500 CEOs from 1996 to 2014.

Year	Sample Size (N)	Elite school	Grad school	College	NR/NC	Harvard	Elite UG	Elite G	MBA	M/F ratio
1996	493	37.5%	20.1%	24.7%	17.4%	9.9%	23.9%	25.2%	23.1%	All male
2006	498	38.4%	28.3%	29.9%	3.4%	10.8%	21.3%	30.3%	38.8%	54.3
2012	500	41.0%	26.2%	26.8%	5.8%	11.6%	22.6%	32.8%	39.6%	28.3
2014	500	38.6%	25.8%	30.8%	4.8%	10.2%	20.6%	31.4%	39.0%	21.7

Note: "UG" and "G" are shorthand for undergraduate and graduate school, respectively. "M/F ratio" indicates male to female ratio.

likely in the top 1% of ability. *Grad School* indicates the percentage having attended some graduate school independent of the elite school category and roughly represents the top percentiles of ability. *College* indicates the percentage having attended college but not graduate school or an elite school. *NR/NC* indicates the percentage that either did not report their education or had no college. When conducting internet searches, some people did not report educational information in their biographies or it simply could not be found. Therefore in many cases it was unclear whether the person did not go to college or simply did not report this information publicly, hence the NR/NC combined category. These four categories sum to 100%.

Overall, **Table 1** shows the percentage of Fortune 500 CEOs who attended an elite school has remained stable from 37.5% to 41.0% across the last two decades. This replicates the finding from **Wai (2013)** looking just at elite U.S. schools in 2012 (38.6%) and expands it across time. Looking at Harvard, elite undergraduate, elite graduate, and MBA attainment individually shows stability across time as well, with the exception of lower percentages in 1996 for elite graduate (25.2%) and MBA (23.1%). Looking just at data in 2014, elite undergraduate (20.6%) was lower than elite graduate (31.4%), which was lower than MBA (39.0%). In 1996 all Fortune 500 CEOs were male, but by 2014 the male–female ratio had dropped to 21.7 to 1.

The Fortune 500 includes companies with the highest gross revenue. However, within this list there is variability in gross revenue. Therefore, the data and analyses in **Table 2** assess the extent to which the education and ability of a company's CEO is associated with gross revenue of that CEO's company. The 95% confidence intervals around the differences between proportions (gross revenue above the median vs. gross revenue below the median) were calculated for elite undergraduate and graduate combined, and elite undergraduate and graduate separately. With the exception of all comparisons in 2006 as well as elite undergraduate or graduate comparisons in 2014, all other comparisons (8 of 12) were statistically significant (shown in bold). Overall, however, the pattern of percentages were always (12 of 12) in the direction where companies with higher gross revenue was associated with higher education and ability level of the CEO.

Table 2
Fortune 500 CEO elite education and cognitive ability differences by higher vs. lower CEO company gross revenue.

Year	Gross revenue	Sample size (N)	Elite UG or G	Elite UG	Elite G
1996	Above median	246	43.9%	29.3%	29.3%
	Below median	247	31.2%	18.6%	21.1%
			95% CI PD		
			(0.042, 0.212)	(0.032, 0.182)	(0.006, 0.158)
2006	Above median	249	39.4%	23.7%	30.9%
	Below median	249	37.3%	18.9%	29.7%
			95% CI PD		
			(-0.064, 0.106)	(-0.024, 0.120)	(-0.069, 0.093)
2012	Above median	250	46.4%	28.0%	38.0%
	Below median	250	35.6%	17.2%	27.6%
			95% CI PD		
			(0.022, 0.194)	(0.035, 0.181)	(0.022, 0.186)
2014	Above median	250	42.8%	26.8%	36.0%
	Below median	250	34.4%	14.4%	26.8%
			95% CI PD		
			(-0.001, 0.169)	(0.054, 0.194)	(0.011, 0.173)

Note: "UG" and "G" are shorthand for undergraduate and graduate school, respectively. Confidence intervals not including zero are in bold font, indicating statistical significance. In the sample size (N) column, correlations and respective sample sizes are reported for the association between Elite UG or G and gross revenue.

Fig. 1 places the 2012 data from **Table 1** on Fortune 500 CEOs in the broader context of multiple groups in the extreme right tail of achievement within the U.S. The same classification categories are used in **Fig. 1** as in **Table 1** with occupations ranked by elite school percentage. There is wide variability across occupations in terms of elite education and cognitive ability, even within these highly select groups, ranging from 20.6% for House members, 41.0% for Fortune 500 CEOs, 59.9% for CEOs who attended the World Economic Forum in Davos, Switzerland, 85.2% for the *Forbes* most powerful men, and 90.1% for academics who attended Davos. Roughly half of the U.S. groups examined attended an elite school and are likely in the top 1% of cognitive ability.

5. Discussion

5.1. The education and brainpower of a CEO

About 37% to 41% of the 1,991 CEOs examined attended elite schools and were likely in the top 1% of cognitive ability, and top 1% in ability people are by definition 1% of the general population. Given the 37 to 41% of CEOs attending elite schools, people in the top 1% in ability have been about 37% to 41 times overrepresented among Fortune 500 CEOs from 1996 to 2014. However, Fortune 500 CEOs are only one extremely select occupation among the broader U.S. and global elite (**Wai, 2014b**). For example, among the wider U.S. elite (see **Fig. 1**), top 1% in ability people were overrepresented from 21 to 90 times base rate expectations (overall about 50 times). Among the U.S. elite, becoming a Fortune 500 CEO does not appear to require as high an education and brainpower level compared to other highly select occupations.

5.2. Variability in the g-loading of occupations, even within the extreme right tail of achievement

Therefore, in comparison to the highly select groups examined, the path to becoming a Fortune 500 CEO is a relatively lower g-loaded mental test battery (**Gordon, 1997; Gottfredson, 2003**). **Gottfredson (2003, Fig. 15.1, p. 299)** illustrated the wide range of cognitive ability across

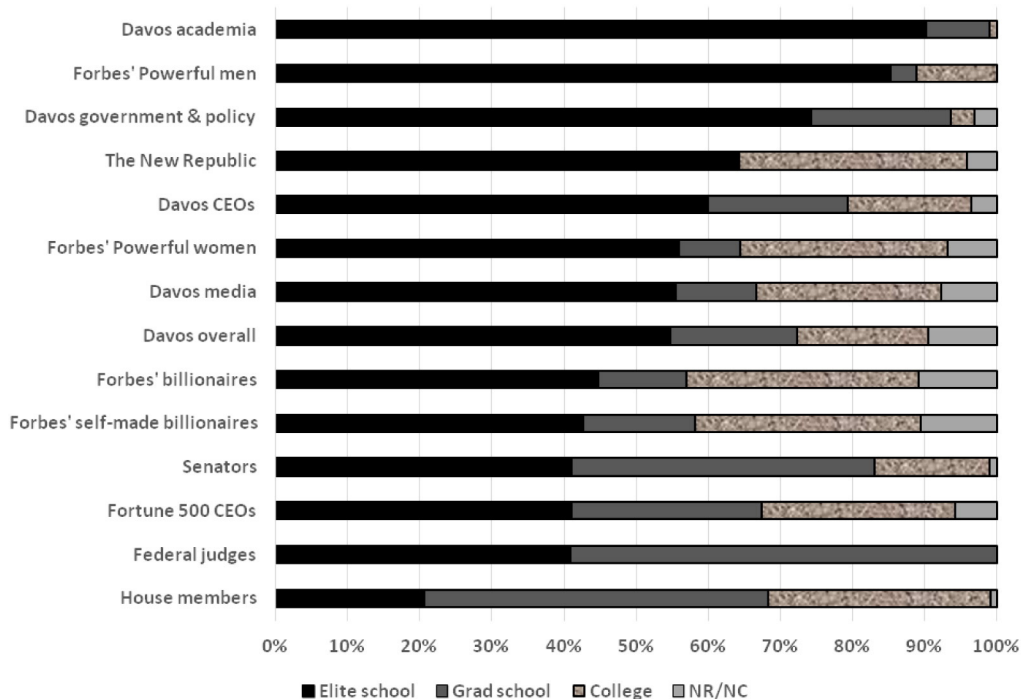


Fig. 1. Education and cognitive ability range among U.S. occupations in the extreme right tail of achievement.

various occupations among the general population, ranging from a packer (21st percentile) and material handler (25th percentile) up to a research analyst and attorney (91st percentile), and discussed how more socially desirable (and correspondingly prestigious) occupations recruit their workers from the upper end of the IQ distribution (Canter, 1956). Fig. 1 illustrates that even within the extreme right tail of occupational achievement, there continues to be wide variability in the cognitive abilities of workers recruited into those occupations (and corresponding *g*-loading of occupations), with certain jobs likely placing a premium on such cognitive abilities more than others. These findings on Fortune 500 CEOs and other elite groups in Fig. 1 also supports the relative stability of intelligence across the lifespan (Deary & Brett, 2015; Gow et al., 2011) because people who were bright enough to be admitted to an elite school were still bright enough to become a member of a global elite occupation.

5.3. If you want to be a CEO, where you go to school may matter

In addition to cognitive abilities, the data presented here on Fortune 500 CEOs and the broader U.S. elite (Fig. 1) also reflects the degree to which an elite education may matter in the pathway towards extreme right tail success. Some public intellectuals have argued the selectivity of the institution one attends may not matter much (Bruni, 2015; Leonhardt, 2014), and research by Dale and Kreuger (2002) uncovered that the selectivity of a college did not have an impact on earnings. However, by looking at the educational backgrounds of people who have attained a position in the broad U.S. elite—essentially groups in the extreme right tail of achievement—just as there is a large overrepresentation of people in the top 1% in ability in these groups, there is also a large overrepresentation of people who attended elite schools in these groups. Of course it is unclear whether it is the initial cognitive ability and motivation (measured by test scores), the actual education and intellectual stimulation received at college and/or graduate school, or the brand name on a resume and access to elite networks that helps open the door to future opportunities. Most likely, it is a mixture of all these and other factors, in different measure for different people. However, given the current focus on credentials in the U.S. and the educational histories of the people who currently play a large role in the selection

of future employees that may one day take their place, elite school attendance likely still matters.

The low percentage not reporting or not having college also indicates that contrary to media stories glamorizing college dropouts (e.g. Lin, 2010; Williams, 2012) and/or CEOs who went to relatively unknown colleges (e.g. United Parcel Service CEO David Abney went to Delta State University, Stevens, 2014), nearly all the people who became Fortune 500 CEOs graduated from college and a majority of them attended an elite school and/or a non-elite graduate school (roughly 57% to 68%). In addition, starting in 2006 through 2014, about 39% obtained MBAs. Based on data for the last 19 years, the path to the top of a company appears to include a college or graduate school education of some kind (many MBAs), often from a name brand school.

5.4. Is CEO education and brainpower related to company performance?

Prior research demonstrated that higher education and cognitive ability, within the 2012 Fortune 500 CEO sample as well as within the top 1% in cognitive ability of that sample, was associated with higher CEO compensation (Wai, 2013). The current study shows that from 1996 to 2014 higher CEO education and cognitive ability was also associated with higher current gross revenue of their company. This aligns with research looking at CEOs celebrated on the covers of major business magazines (Miller, Xu, & Mehrotra, 2015),⁴ whereas other researchers have concluded that CEO education plays an important role in hiring, but does not affect long-term firm performance (Bhagat, Bolton, & Subramanian, 2010). Some ways that CEO cognitive ability might be related to company performance could be through *information processing demands* (Henderson & Fredrickson, 1996) and the ability to deal with *unexpected situations* (Arvey, 1986; Gottfredson, 2003), highly *g*-loaded tasks. More broadly, international comparisons show

⁴ Miller et al. (2015, p. 931) note that “Candidates must have demonstrated outstanding scholastic ability [and] general intelligence as demonstrated by standardized testing such as SAT scores” but fail to cite papers such as Frey and Detterman (2004) as well as Wai (2013, 2014b) which document the extent to which such scores like those on the SAT (and college attendance) can be used to assess the general intelligence levels of various individuals and groups.

a decisive role of intellectual classes for STEM achievement, economic liberty and GDP (Rindermann, 2012).

5.5. Findings across time

Overall, roughly 37% to 41% of Fortune 500 CEOs attended an elite school across the last two decades and are likely in the top 1% of cognitive ability. From 2006 onwards, roughly 3% to 6% of CEOs did not report or had no college. This suggests the educational and occupational filtering structure has been relatively unchanged over time. Given that the Fortune 500 companies and respective CEOs in 1996 were not the same as those in 2014 suggests a remarkable stability in the occupational structure that at least to date appears stable.

5.6. Sex differences

However, sex differences have slightly changed. In 1996 all the CEOs of the Fortune 500 were male. By 2006 the male–female ratio was at 54.3 and in 2014 it had dropped to 21.7. Therefore females are increasing their representation among heads of top companies but there still remains a large gender gap (Wai, 2013, 2014b).

5.7. Limitations of this study

This study used average standardized test scores of a college or university according to *U.S. News & World Report* (America's Best Colleges, 2013) as an approximation for ability level (Frey & Detterman, 2004; Koenig et al., 2008), as well as attendance at a top college or university worldwide according to *QS World University Rankings* (2012) as an approximation for ability level (Li, Meng, Shi, & Wu, 2012). Although this method did not rely on individual cognitive ability scores which were not publicly available, average test scores from U.S. schools reasonably placed individuals that attended one of these elite schools within the top 1% of ability. For the rest of the world, it is reasonable to think the very top schools select for the best and brightest within each country. Ultimately, the method cannot disentangle education from cognitive ability. However, using this method may give an underestimate because extremely smart people may not have chosen to attend a top school within their country for multiple reasons (e.g., financial limitations, scholarship, staying close to home). Alternatively, this method may also give an overestimate because there were likely some legacies, athletic admits, students with political connections, or others who gained entry with lower than typical test score and academic metrics (Espenshade & Radford, 2009; Golden, 2006; Sander, 2004). It is reasonable to think factors in both directions likely counterbalance one another, however lower the reliability. The Fortune 500 CEOs examined in this study are not fully representative of the many other individuals in the top percentiles of ability worldwide, and are likely defined by attributes (such as high motivation, willingness to work and take risks, and a desire for money and power) that are not limited to ability.

One important limitation was the high percentage of missing educational data for CEOs in 1996 (17.4% fell into the NR/NC category). This was likely due to older CEOs being unlikely to have an internet presence. Despite this, however, the percentage attending an elite school remained nearly identical to later years. If anything, it's possible that if more complete data were available, the elite school percentage may have been higher in 1996, but that remains an unknown.

Finally and of course, not being CEO does not imply low cognitive ability. There are other careers for intellectually outstanding people and too many other factors including chance, institutional effects and sex roles that influence biography.

5.8. Conclusions

Gottfredson (2003) inquired as to whether and how society's members might create and reshape various occupational mental test

batteries across generations. The current study suggests that for the last two decades, the occupational hierarchy for Fortune 500 CEOs does not appear to select on elite education and general cognitive ability differently. In other words, the mental test battery that is the path to and performance of a Fortune 500 CEO has remained relatively unchanged in difficulty. This research shows that Fortune 500 CEOs are selected quite highly for brainpower and education and this has remained true for the last two decades. The path to becoming a CEO is a difficult mental test battery. Within the extreme right tail of achievement, the mental test difficulties of various occupations vary widely, with the path to becoming a CEO not necessarily the most difficult.

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