Measuring and calibrating the racial/ethnic densities of executives in US publicly traded companies

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Abstract

We measure and calibrate the racial/ethnic densities (RAEDs) of executives in US public companies. We show that the magnitudes of underrepresentation for Blacks and Hispanics and overrepresentation for Whites are 10+ times larger when executive RAEDS are calibrated against the US population than when calibrated against an economic benchmark that reflects the demand for and supply of proto-executive talent. We conclude that at least 90% of the underrepresentation of Black and Hispanic executives in US public companies comes from factors in effect before US public companies hire proto-executive talent rather than actions taken by companies after such talent is hired.

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1. Introduction and Summary of Results

A view that is often expressed by academics, activists, business leaders, and commentators is that Blacks and Hispanics are underrepresented while Whites are overrepresented in the ranks of corporate executives, particularly in large US publicly traded firms and at the C-Suite level (Zimmerman 2010; Green, Holman and Paskin 2018; Chen 2020; Larcker and Tayan 2020; Singh 2020).[1]

We show that this view is correct when under- and overrepresentation are defined by calibrating executive racial and ethnic densities (RAEDs) against the RAEDs of the US population. However, we show that mainly different and at times opposite inferences arise when under- and overrepresentation are instead defined as underdensity and overdensity by calibrating executive RAEDs against an economic benchmark that seeks to take into account key features of the demand for and supply of executive talent. In particular, we demonstrate that the magnitudes of underrepresentation for Blacks and Hispanics and overrepresentation for Whites are 10+ times larger when executive RAEDS are calibrated against the US population than when they are calibrated against our economic benchmark.

The underpinning of our economic benchmark is the argument that the demand by US public companies for executive talent will not lead them to hire in an unconditionally proportional manner from the US population or labor force. Instead, it will center on the academically strongest BA/BS graduates, particularly when such students are graduating and their proto-executive talent can be shaped to fit firms' specific human capital needs.[2] Using the *New York Times* (NYT) list of the top 100 US four-year colleges and universities (Ashkenas, Park, and Pearce, 2017) as a proxy for top BA/BS qualified (TBQ) talent, we develop economic-based expected executive RAEDs against which we then calibrate observed executive RAEDs by matching the RAEDs of the yearly cohorts of seniors graduating from the NYT list to executives' BA/BS graduation years. We refer to TBQ expected executive RAEDS as ERAEDs. We show that when ERAEDs are used to calibrate executive RAEDs, sometimes very different inferences about racial/ethnic under- or over-proportionality emerge for Black, Hispanic and White executives. Most prominent among our conclusions is that at least 90% of the underrepresentation of Black and Hispanic executives in US public companies comes from factors in effect before US public companies hire proto-executive talent rather than actions taken by companies after such talent is hired.

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[1] In "Diversity in the C-Suite: The dismal state of diversity among Fortune 100 senior executives," Larcker and Tayan (2020, p. 3) state, "Racially diverse executives hold only 16 percent of total C-suite positions. Only 16 have a non-white CEO. 26 of the Fortune 100 have no ethnic diversity at the C+1 level … The CFO role is the least racially diverse position in the C-suite. There are only 4 CFOs who are not white." Green, Holman, and Paskin (2018) state that "the occupants of corner offices are a stunningly homogeneous bunch. There are now just three black CEOs running Fortune 500 companies … [E]xecutive ranks and upper management remain persistently, stubbornly white."

[2] In this study, we use the term BA/BS to refer to all bachelor's degrees, i.e., degrees received from a college or university at the completion of undergraduate study.

Our data consist of 10,246 different executives who we identified over the period June–August 2020 as being employed in two sets of companies: a random sample of 523 US publicly traded firms, and all 500 firms in the S&P 500® Index. We chose the former to be able to make unbiased generalizations about the population of US publicly traded firms, and the latter because S&P 500® firms are large, visible and often the focus of public attention. We define an executive as any individual who is publicly disclosed by a firm to be on its leadership team. In judging an executive's race or ethnicity, we studied their photo and first and last names, ultimately classifying them into one of five racial or ethnic groups: American Indian/Alaska Native, Asian/Pacific Islander, Black, Hispanic, and White.[3] We adjust for biases due to likely undercounting non-Whites and overcounting Whites because Hispanic and European faces and names can appear similar to each other by multiplying prima facie executive RAEDs by Visual Identification Adjustment Factors (VIAFs) that we independently calculate for Black, Hispanic and Asian/Pacific Islander executives. We use the acronym VRAEDs for RAEDs that have been multiplied by their VIAFs, and we base all of our empirical analyses on VRAEDs.

We first determine the overall VRAEDs for the 4,057 random sample executives (6,931 S&P 500® executives). In alphabetical order, they are American Indian/Alaska Native 0.02% (0.01%), Asian/Pacific Islander 6.9% (7.6%), Black 2.6% (3.9%), Hispanic 3.4% (3.3%), and White 87.1% (85.1%). We then compare these VRAEDs to the common benchmark of the US population, USPopRAED. From US Census data, we estimate that the 2019 USPopRAED figures are as follows: American Indian/Alaska Native 1.0%, Asian/Pacific Islander 6.4%, Black 13.0%, Hispanic 18.5%, and White 61.2%. After calibrating VRAEDs against USPopRAED, and employing the terms underrepresentation, at-representation, and overrepresentation to denote VRAEDs that are below, at, and above USPopRAED, respectively, we find that in the random sample and in S&P 500® firms, American Indian/Alaska Natives, Blacks, and Hispanics are underrepresented and Whites are overrepresented. Asians/Pacific Islanders are at their US population representation in the random sample and are overrepresented in the S&P 500®.[4]

Next we perform similar calculations using top-BA/BS-qualified expected executive ERAEDs to calibrate observed executive VRAEDs separately in the random sample and the S&P 500®. We do so for executives as a whole and for 10 subsets of executives, employing the terms underdensity, at-density, and overdensity to denote VRAEDs that are below, at, and above their ERAEDs, respectively. The main takeaway from our analyses of VRAED – ERAED is that the TBQ method of calibrating executive

[3] We employ these five racial/ethnicity categories to follow the National Center for Educational Statistics' Integrated Postsecondary Education Data System (NCES IPEDS) categories that were in place during the majority of the window of time covered by our study. See sections 2.2 and 3.2 for further details.

[4] US census data indicate that the RAEDs of the US civilian workforce, USCivRAED, are similar to those of the US population such that using USCivRAED yields similar representation inferences to using USPopRAED.

racial/ethnic proportions typically yields different and sometimes yields quite the opposite under-, at, and overdensities as compared to the under-, at, and overrepresentations that come when executive VRAEDs are calibrated against the RAEDs of the US population. We highlight five key findings.

First, consider 11 groups of executives in each of our random sample and S&P 500® datasets: All executives; EVPs, SVPs and VPs; and CEOs, CFOs, GCs, COOs, CHROs, CIOs, and CTOs.[5] We find that in only two of these 11 groups is it the case that the fraction of times where the *Z*-statistics on VRAED – USPopRAED and VRAED – ERAED yield the same statistical inference exceeds 50%, with the mean agreement frequency being 42%. Equivalently, for a given set of firms to which the racial/ethnic calibration of executives is applied, calibrating executive RAEDs using a TBQ labor supply benchmark rather than the US population benchmark yields different inferences 58% of the time.

Second, the frequency of inferential disagreement varies greatly by executive race/ethnicity. The mean frequency of inferential disagreement across the 11 groups of executives is 5% for Asians/Pacific Islanders, 36% for American Indians/Alaska Natives, 73% for Blacks, 77% for Whites, and 100% for Hispanics. The choice of benchmark therefore matters very little when evaluating the under-, at, or overrepresentation or under-, at, or overdensity of Asian/Pacific Islander executives, but it matters very much in making the same evaluations for Hispanic executives.

Third, for executives overall, in the random sample we find that Asians/Pacific Islanders are at their US population representation and at their TBQ expected density, Blacks are underrepresented and underdense, Hispanics are underrepresented but at their expected density, and Whites are overrepresented and overdense. In S&P 500® firms Asians/Pacific Islanders are overrepresented and overdense, Blacks and Hispanics are underrepresented but overdense, and Whites are overrepresented but underdense. These contrasts suggest that inferences related to the racial/ethnic representation and density of executives can change based on the particular set of firms to which US population versus TBQ calibrations are applied.

Fourth, we show that Blacks and Hispanics are underrepresented and Whites are overrepresented among CEO and CFO executives. However, we also find that while Blacks are also underdense in CEOs and CFOs, Hispanics are not—they are at their TBQ expected densities. Whites are likewise at-density in CEOs at S&P 500® firms, not overdense.

Last but most importantly, the degree of under- or overrepresentation [VRAED – USPopRAED] is often 10+ times larger than the degree of under- or overdensity [VRAED – ERAED]. For example, in the random sample of firms, the underrepresentations for Blacks and Hispanics and the overrepresentation for Whites are –10.4%, –15.1%, and 26.0%, respectively, whereas the underdensity for Blacks and the

[5] These acronyms represent the following common executive ranks and titles: Executive Vice President, Senior Vice President, and Vice President; and Chief Executive Officer, Chief Financial Officer, General Counsel, Chief Operating Officer, Chief Human Resource Officer, Chief Information Officer, and Chief Technology Officer.

overdensities for Hispanics and Whites are at most 1/10th as large at –1.0%, 0.2%, and 1.1%, respectively. We interpret this to mean that the large underrepresentation of Black and Hispanic executives in US public companies is more likely due to factors that are in effect before US public firms hire such individuals as top-BA/BS-qualified talent than to actions taken by or within firms after they are hired and are working towards becoming an executive. We emphasize that we are not proposing that the magnitudes of VRAED – USPopRAED, VRAED – ERAED, and the differences between them indicate that no racial bias and/or discrimination exists in firms' hiring or talent development (Bertrand and Mullainathan 2004). Only that 90% or more of the large representational gap between VRAED and USPopRAED occurs before TBQ proto-executive talent is hired by firms, rather than at or after the time when such talent is hired.

Overall, we conclude that the benchmark against which executive racial/ethnic densities are calibrated matters to inferences, and sometimes a great deal. We see this as important to highlight because the underrepresentation of a particular race or ethnicity in firms based on calibrating against the US population influences narratives and policy formulations regarding racial bias, and underrepresentation is often taken as indicative of racial bias by or within firms. In taking an economic stance on calibrating the racial/ethnic densities of executives, our work seeks to align with the "honest broker" role of Eagly (2016, p. 214), who in her 2015 Presidential Address to the Society for the Psychological Study of Social Issues states that "the honest broker encourages decision makers to think beyond personal values and ideologically driven preferences to consider options that may make sense from a variety of perspectives."

The rest of our paper proceeds as follows. We describe our data in section 2, and our TBQ measure of expected executive racial/ethnic densities in section 3. In section 4 we present our empirical results, while in section 5 we discuss the ways in which we hope our TBQ calibration can contribute to the debate about race and ethnicity in business. We follow this in section 6 by identifying some of the questions that we see our study as raising, and we present concluding remarks in section 7.

2. Data

2.1 Firms and executives' non-race/ethnicity characteristics

We gather executive race, ethnicity, and other data on two sets of firms that were in place as of 12/31/2019: a random sample of 523 US publicly traded firms, and all firms in the S&P 500® Index. We choose the former so as to be able to generalize our results to the population of US publicly traded companies, and the latter because S&P 500® firms are large and often the focus of public attention.

We follow the website-disclosure approach of Hunt, Layton, and Prince (2015) and define an executive as any individual who is publicly disclosed by a firm to be on its leadership team, most often on the firm's website. In the infrequent cases in which no executives are found on the firm's website, we

define a firm's executives as the employees listed on the firm's Bloomberg or Yahoo! Finance profile page, else the firm's annual report, or (when available) judged from its comparably.com page.[6] We searched online for and captured, when available (primarily from firms' websites), in a screenshot the facial photo of each executive, together with her or his first and last name(s).[7]

In table 1 we present the data availability waterfalls. Based on our definition of an executive and the availability of individual data items, we arrived at a final set of 510 randomly chosen firms and 497 S&P 500® firms for which we were able to identify at least one named executive with a facial photo.

In table 2 we present descriptive statistics on the industry composition and selected financial characteristics of our sample firms, as of 12/31/19 or for the fiscal year ending on or before 12/31/19. Panel A reveals that in terms of Fama-French 12-Industry classifications, randomly chosen firms are more tightly clustered in Finance and in Healthcare, Medical Equipment, and Drugs than are S&P 500® firms, due to the presence of many small banks and biotech companies. Apart from the expected differences in the size and scale of firms for all fundamental and stock market-based firm characteristics, panel B shows that based on medians, S&P 500® firms (SP) are more profitable than the random sample of firms (RS) in terms of gross margin %, ROE, ROA, and ROS. S&P 500® firms are also more levered.

Table 3 reports descriptive statistics for selected executives' characteristics using all the available data on each executive.[8] Panel A shows that SP firms have an average of 14.6 executives, as compared to 8.6 executives in RS firms. Panel B reports that RS and SP firms have statistically indistinguishable gender statistics: 78% (22%) of RS executives and 76% (24%) of SP executives are male (female). Panel C shows the frequencies of different Chief- and Officer-level positions. Not surprisingly, the most common executive positions are CEO and CFO. Presidents are also common, as are GCs, Corporate Secretaries (who are often the same person as the GC), CHROs, and COOs. In terms of seniority, the most senior level of Senior EVPs/EVPs slightly outnumbers SVPs, which in turn outnumber VPs.

2.2 Executive race and ethnicity

In judging an executive's race or ethnicity (RAETH), we follow Hunt, Layton, and Prince (2015) by visually studying each executive's photo and first and last names and classifying them into nine granular RAETH categories. With our lowercase tag for each category shown in parentheses, these categories are African ancestry (aa), European ancestry (eur), Near Eastern (ne), East Asian (ea), South

[6] Yahoo! Finance's profile page lists up to five executives. Bloomberg's profile page typically lists 3–10 executives. Comparably.com lists up to 50+ people who work for the firm, only some of whom we judged to be executives.

[7] The bulk of the capturing of executive names and photos took place June 10–August 5, 2020. For documentation and authentication purposes, we saved all executive screenshots in a separate Word + PDF file for each firm.

[8] A full description of the executive characteristics that we coded is provided in appendix A.

Asian (sa), Latino (lat), Native American (na), and Other (o). We only diverge from Hunt, Layton, and Prince (2015) by redefining the Other RAETH category to consist of Pacific Islander (pi) or Alaska Native (an). To ensure consistency, all RAETH judgments were made by one coauthor.

As the data we use in seeking to calibrate executive RAEDs come from the National Center for Educational Statistics' Integrated Postsecondary Education Data System (NCES IPEDS), and NCES IPEDS used five racial/ethnicity categories during the time period pertinent to our study (outside of Nonresident aliens, which we set aside), we collapse our nine RAETH categories into NCES IPEDS' five RAETH categories. With our lowercase tag for each broader category in parentheses, the IPEDS RAETH categories are American Indian/Alaska Native (aian), Asian/Pacific Islander (api), Black (b), Hispanic (h) and White (w), where we define aian = ai + an, api = ea + sa + pi, b = aa, h = lat, and w = eur + ne. IPEDS' RAETH categories closely match those used for US executives in Hunt, Prince, Dixon-Fyle, and Yee (2018) and Dixon-Fyle, Hunt, Dolan, and Prince (2020).

The strength of our method of classifying an executive's race or ethnicity based on their photo and first and last name(s) is that we obtain RAETH estimates for 10,286 unique executives. However, because we do not employ in-depth biographical analysis of each executive, our approach is likely to undercount non-Whites, mainly because some Hispanic and European faces and names can be similar. We therefore calculated Visual Identification Adjustment Factors (VIAFs) in order to adjust the numbers and densities of our prima facie judged RAETHs and RAEDs of executives. We estimate VIAFs for Asian/Pacific Islander, Black, and Hispanic executives, set the VIAF for American Indians/Alaska Natives at 1.0 and treat the VIAF-based number of Whites as the plug. The executive-level data we use to calculate the VIAFs was provided by Crist|Kolder Associates (CK) from their 2020 Volatility Report. CK's data consist of the first and last names of all the CEOs and CFOs that CK recorded as being in the union of firms in the S&P 500® and Fortune 500, the name of the firm the CEO or CFO works for, and CK's classification of the CEO's or CFO's race or ethnicity. Our approach to calculating VIAFs uses only the subset of CK firms that are also in our database of S&P 500® firms, and only those CEOs and CFOs whom both we and CK identify. We take CK's racial/ethnic identifications to be the gold standard, because CK puts a great deal of effort into its identification process, going well beyond our approach of relying on executives' facial photos and names.

We define an executive's ethnicity or race coding as being correct and not needing adjustment if both we and CK agree on the coding. Where our coding of an executive's race or ethnicity differed from CK's, we researched biographical and other sources to confirm the coding. Then, to use Asians/Pacific Islanders (api) as an example, we calculate VIAF_api as the ratio of the number of CEOs + CFOs that CK correctly coded as api to the number of CEOs + CFOs that we correctly coded as api, multiplied by the ratio of the difference between the number of CEOs + CFOs that CK correctly coded as api versus

incorrectly coded as api, and the number of CEOs + CFOs that CK correctly coded as api. Similar calculations were performed for Black and Hispanic race/ethnicity. The resulting VIAFs are VIAF_aian = 1.00, VIAF_api = 1.073, VIAF_b = 1.100, and VIAF_h = 1.546.[9] VIAF_h is larger than both VIAF_api and VIAF_b because some Hispanic and European faces and names can appear to be similar, likely leading us in our race/ethnicity coding to undercount Hispanic and overcount White executives.

Based on the assumption that our VIAFs are independent of executive level and title, we apply our VIAFs to all our executive RAEDs.[10] We use the acronym VRAED to denote that RAEDs have been multiplied by their VIAFs, and we base all our analyses on VRAEDs.

Table 4 presents the raw and VIAF-based numbers and densities of executives in the random sample of firms (panel A) and S&P 500® firms (panel B). The top half of each panel classifies executives by the nine RAETH categories of Hunt, Layton, and Prince (2015), and the bottom half by the five NCES IPEDS RAETH categories. For the 4,057 executives in the random sample (and the 6,931 executives in S&P 500®), we observe that the VRAEDs for executives taken as a whole are as follows: American Indian/Alaska Native 0.02% (0.01%); Asian/Pacific Islander 6.9% (7.6%); Black 2.6% (3.9%); Hispanic 3.4% (3.3%); and White 87.1% (85.1%). Comparing across the two sets of firms, the density of Black executives in S&P 500® firms is 1.3% higher than in the random sample of firms, and the density of White executives is –2.0% lower, with *z*-statistics of 3.9 and –2.9, respectively.

3. Top-BA/BS-qualified executive labor supply

3.1 Rationale and description

The distinguishing feature of our study is that we measure, calibrate, and contrast the racial/ethnic composition of executive teams in US publicly traded firms against both the common approach to representation that calibrates relative to the US population,[11] and an economic-based density method that benchmarks against a measure of the supply of qualified proto-executives. A strength of the latter

[9] A full description of the calculations behind each VIAF is provided in appendix B.

[10] As a validation check on our VIAF-based RAEDs, we also obtained RAETH estimates at the executive level from List Service Direct (LSD). LSD uses a person's names to estimate their RAETH. However, similar to other studies that have used LSD (Brochet et al. 2019; Flam et al. 2020), we find that while the average across RS and SP of our VRAEDs for aian, api, and h (0.01%, 7.25%, and 3.35%, respectively) are close to the RAEDs obtained from LSD (0.04%, 7.31%, and 3.83%, respectively), LSD's RAED for b (0.75%) is far smaller than our VRAED for b (3.25%). This is because many Black and White names are not distinguishable, leading LSD to underidentify (overidentify) the number of Black (White) individuals. Nevertheless, this provides some support for the accuracy of our average VRAED for b (3.25%) in that for our executives, the ratio of 0.75% to 3.25% (= 23%) is very close to a similar calculation that can be made using the LSD versus manual RAETH identification numbers of Black analysts (= 27%) found by Green et al. (2020, combining data in fn. 8 and table 1).

[11] We estimate the 2019 RAEDS of the US population to be American Indian/Alaska Native 1.0%; Asian/Pacific Islander 6.4%; Black 13.0%; Hispanic 18.5%; and White 61.2%. A full derivation is shown in appendix C.

approach is that it aims to take into account key features of the demand for and supply of the raw talent from which firms hire. We propose that the demand by US public companies for executive talent will not lead them to hire in an unconditionally proportional manner from the US population or labor force. Instead, it will center on the academically strongest BA/BS graduates, especially when such students are graduating and their proto-executive talent can be shaped to fit firms' specific human capital needs.

In line with this thinking, we use as our proxy for the supply of proto-executives facing firms the cohorts of seniors who graduated from institutions on the NYT 2017 list of the top 100 US four-year colleges and universities (CUs) (Ashkenas, Park, and Pearce, 2017). The NYT list consists of a broad set of 58 large public flagship schools (one per state, plus an additional eight from California), plus 42 private CUs.[12] The 58 public schools account for 82% of the 218,716 graduating seniors in the NYT's list of CUs in 1987 and 84% of the 300,308 graduates in 2008; these degrees from public CUs comprise 22.8% (19.8%) of all bachelor's degrees conferred by postsecondary US institutions in 1987 (2008), excluding degrees conferred to nonresident aliens.[13] In appendix E we present evidence that we interpret as indicating that the NYT list is a plausible proxy for the full set of CUs that we suggest are likely to supply proto-executive talent to US publicly traded firms.

We obtained the sizes and races/ethnicities of the graduating cohorts in each college and university in the NYT list from the NCES IPEDS database for 1987–2008, enabling us to compute overall annual RAEDs for seniors graduating from the NYT top 100 CUs list. The annual RAEDs are shown in figure 1 and in the unshaded rows of table 5. Since the median executive graduated from college in 1988, and NCES IPEDS data is unavailable before 1987, we estimate the annual RAEDs of graduating seniors in the NYT list of top 100 CUs in 1974–1986 using straight-line backwards-in-time extrapolation. The resulting estimated annual RAEDs for 1974–1986 are shown in the tan-shaded area in table 6. We set the RAEDs of seniors graduating before 1974 at their 1974 levels.

3.2 Matching the top-BA/BS-qualified labor supply to executives by executive age

We match each executive to their TBQ benchmark based on their age. For example, if a given executive is aged 60 in 2020, we assume that they graduated with their BA/BS in 1982, and we take their

[12] A full description of NYT's top 100 US four-year colleges and universities, together with the number of BA/BS degrees conferred by each school in 1987 and in 2008, is provided in appendix D. We use the NYT top 100 rather than, for example, the top 100 colleges and universities in the prominent US News & World Report (USNWR) rankings of the Best US Colleges and Universities because the top 100 USNWR colleges and universities tilt more heavily toward smaller private institutions (63% for USNWR versus 42% for NYT). In our judgment the USNWR top 100 US colleges and universities moves away from, rather than toward, obtaining a TBQ labor supply measure that accurately reflects the size of the pool of academically talented undergraduates whom we posit firms are most likely to seek to hire with a view to building their pipeline of future executives.

[13] We acknowledge that we focus on only US colleges and universities, thereby likely omitting some portion of the BA/BS-or-equivalent qualified labor supply outside the US that is available to many US publicly traded firms.

TBQ labor supply expected RAED, or ERAED, to be the RAED of the seniors that graduated in 1982 from an institution on the NYT list of the top 100 US four-year colleges and universities.

We arrived at each executive's age in three stages. First, for the 4,057 RS executives and 6,931 SP executives for whom we had a facial photo, we made a visually based judgment of their age, rounded to 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, and 90 years old.[14] Second, we were able to identify the true age of 1,905 RS and 2,234 SP executives because they were listed in the Profile section of Yahoo! Finance's webpage for their firm and their Year Born was reported there. Third, we sought to improve the accuracy of our visually based judgments of executive age by regressing actual age on judged age and other actual or judged executive characteristics, enabling us to use the estimated regression parameters to calculate improved estimates of the ages of executives for whom we only have a judged age.[15] In matching each executive to their TBQ benchmark based on their age, we took an executive's age to be their true age where available, else their fitted age based on our age regressions, else their judged age.

4. Results

We measure the VRAED, ERAED, VRAED – USPopRAED, and VRAED – ERAED for each race/ethnicity, in both the random sample and S&P 500® datasets, and for each of 11 groups of executives: All executives (table 6); EVPs, SVPs, and VPs (table 7); and CEOs, CFOs, GCs, COOs, CHROs, CIOs, and CTOs (table 8). We focusing on assessing the degree of inferential agreement between the measures VRAED – USPopRAED and VRAED – ERAED, starting off first by summarizing the overall amount of agreement and then moving to highlighting particular specific disagreements.

4.1 Overall degree of agreement of different calibration benchmarks

Let executive groups be indexed by $i = 1$ (all executives) to 11 (CTOs), race and ethnicity by $j = 1$ (aian) to 5 (w), and datasets by $k = 1$ (RS) to 2 (SP). Let $Z_{ijk}[USPopRAED]$ be the Z-statistic on $VRAED_{ijk} - USPopRAED_j$, and let $Z_{ijk}[ERAED]$ be the Z-statistic on $VRAED_{ijk} - ERAED_{ijk}$.

In panel A of figure 2 we color-code the full set of 11 x 5 x 1 = 55 $Z_{ijk}[USPopRAED]$ statistics and the 55 $Z_{ijk}[ERAED]$ statistics that are reported in detail in each of tables 6–8. A red cell indicates $Z \leq -1.96$, a green cell $Z \geq 1.96$, and a white cell $-1.96 < Z < 1.96$. Panel A reveals that the largest (smallest) numbers of significantly negative Z-statistics are found for Black and Hispanic (White) executives, and that the converse is true for significantly positive Z-stats.

[14] All age judgments were made by the same coauthor who made all of the judgments about executive race/ethnicity.

[15] A full description of our approach and our regressions is provided in appendix F.

Panel B recharacterizes panel A by determining for each executive group, race/ethnicity, and dataset whether $Z_{ijk}[ERAED]$ yields the same or a dissimilar/non-same inference as $Z_{ijk}[USPopRAED]$. Dissimilar inferences are classified as either a different inference, defined as $Z_{ijk}[USPopRAED] \geq 1.96$ and $-1.96 < Z_{ijk}[ERAED] < 1.96$ or $Z_{ijk}[USPopRAED] \leq -1.96$ and $-1.96 < Z_{ijk}[ERAED] < 1.96$; or an opposite inference, defined as $Z_{ijk}[USPopRAED] \geq 1.96$ and $Z_{ijk}[ERAED] \leq -1.96$, or $Z_{ijk}[USPopRAED] \leq -1.96$ and $Z_{ijk}[ERAED] \geq 1.96$. If the inferences are the same, then we shade the compared cells yellow; if different, blue; and if opposite, red. We further calculate the mean fraction of times that inferences are dissimilar, different, and opposite, by executive group (shown in the far right-hand column of panel B) and by executive race/ethnicity (shown in the bottommost row).

Two main results emerge in panel B. First, in only two of the 11 groups of executives does the fraction of cases where $Z_{ijk}[USPopRAED]$ and $Z_{ijk}[ERAED]$ yield the same statistical inference exceed 50%; the mean fraction is 42%. Equivalently, holding constant the set of firms to which alternative racial/ethnic calibrations of executives is applied, using a TBQ labor supply benchmark rather than a US population benchmark yields dissimilar/non-same inferences about calibrated executive racial/ ethnic proportions 58% of the time (50% different plus 8% opposite).

Second, the degree and type of dissimilarity varies substantially by executive race/ethnicity. The mean rates of dissimilarity across the 11 groups of executives are 5% for Asians/Pacific Islanders, 36% for American Indians/Alaska Natives, 73% for Blacks, 77% for Whites, and 100% for Hispanics. Of the opposite inferences, 4/9 occur for Whites in S&P 500® firms, 3/9 for Blacks in S&P 500® firms, 1/9 for Hispanics in S&P 500 firms, and 1/9 for Hispanics in our random sample. Thus the choice of calibration benchmark matters little in evaluating the representation and density levels of Asian/Pacific Islander executives; it matters materially for Black and White executives, where inferential reversals are not uncommon; and it matters a great deal for Hispanic executives.

4.2 Specific differences between results from alternative calibrations

In table 6, we present the detailed results of calibrating the VRAEDs of all executives for the random sample and the S&P 500® against the RAEDs of the 2019 US population and against the TBQ labor supply. For executives as a whole, it is not the case that all non-Whites are underrepresented, nor are all non-Whites underdense. Relative to their representation in the 2019 US population, Asians/Pacific Islanders are at-representation in the random sample and overrepresented in the S&P 500® sample. Blacks and Hispanics are underrepresented but overdense in the S&P 500®, while Whites are overrepresented but underdense. In the random sample, Hispanics are underrepresented but at their TBQ expected density. These results suggest that the composition of the set of firms to which racial/ethnic calibrations of executives are applied matters a great deal.

Table 6 also shows that the size of the difference between a VRAED and its benchmark is often affected by the benchmark used to calibrate the VRAED, sometimes by 10X or more. Thus, in the random sample the levels of underrepresentation for Blacks and overrepresentation for Whites are –10.4% and 26.0%, respectively, whereas, the levels of underdensity for Blacks and overdensity for Whites are –1.0% and 1.1%, respectively. Similarly, the –15.1% underrepresentation for Hispanics in the random sample and the S&P 500® either disappears or converts to overdensity when calibration is measured against the TBQ supply of proto-executive labor (0.2% in the random sample and 0.4% in the S&P 500®).

We interpret these latter results to mean that the large underrepresentation of Black and Hispanic executives in US public companies is more likely due to factors in effect before US public firms hire such individuals as top-BA/BS-qualified talent than to actions taken by or within firms after they are hired and are working towards becoming an executive. We stress that we are not proposing that the magnitudes of VRAED – USPopRAED, VRAED – ERAED, and the differences between them indicate that no racial bias and/or discrimination exists in firms' hiring or talent development (Bertrand and Mullainathan 2004). Only that our analyses indicate that 90% or more of the very large gap between VRAED and USPopRAED occurs before TBQ proto-executive talent is hired by firms, not at or after when the talent is hired.

In table 7, we repeat the tests in table 6 for the seniority-based subgroups of SEVP/EVPs, SVPs, and VPs. The results are generally similar to those in table 6, suggesting that because VPs are on average younger than SVPs, who in turn are on average younger than EVPs, the inferential inconsistencies and reversals documented for all executives are likely not related to executive age.

In table 8 we present the same types of calibrations separately for CEOs, CFOs, GCs, COOs, CHROs, CIOs, and CTOs. Focusing on the CEO and CFO positions that have been the subject of much discourse, in panels A and B we confirm that Blacks and Hispanics are underrepresented and Whites are overrepresented in CEOs and CFOs. However, while Blacks are also underdense in CEOs and CFOs, Hispanics are not—they are at their TBQ expected densities. We also observe that White CEOs are at-density, not overdense, in S&P 500® firms. Thus, it is not the case that non-Whites are always underdense in the highest levels of the C-suite in US publicly traded companies. Moreover, for positions below the CEO and CFO, we note that several inferential reversals occur when calibrating executive VRAEDs against the US population, as compared to our measure of the TBQ supply of proto-executive labor facing firms. First, in GCs and COOs, Blacks and Hispanics are underrepresented but are at-density or overdense (panels C and D). Second, in CHROs, Blacks are not underrepresented in either sample of firms, but in S&P 500® firms they are overdense, while Whites are overrepresented but at-density or underdense (panel E). Third, in CIOs and CTOs, Blacks and Hispanics are underrepresented but not underdense, and Whites are overrepresented but not overdense (panels F and G). In contrast, Asians/Pacific Islanders are both overrepresented and overdense in CTOs in the random sample of firms and in the S&P 500® sample.

4.3 Underdensity, at-density, and overdensity by executive age

Given the marked trends over time in the racial/ethnic densities of seniors graduating from the top 100 US colleges and universities (table 5 and figure 1), we explore the extent to which the degrees of density of a given race/ethnicity exhibit similar time trends. In table 9, for all executives in the random sample plus the S&P 500® sample we report VREADs and ERAEDs (panel A), and also VRAED – ERAEDs and their *Z*-statistics (panel B), by executive age in five-year bins. If the increasing density of American Indians/Alaska Natives, Asians/Pacific Islanders, Blacks, and Hispanics and the decreasing density of Whites in the graduating seniors seen in table 5 and figure 1 feed proportionately and "naturally" over time into the ranks of firms' executives, then there should be on average no relation between VRAED – ERAED and executive age.

Overall, we judge that such an expectation is borne out for the 96% of executives who are aged 42.5 to 67.5.[16] For these executives, the only race/ethnicity where there is a consistent departure from at-density is American Indian/Alaska Natives. In every other race/ethnicity, the *Z*-statistics on VRAED – ERAED are never always positive or negative, nor do they show a reliable trend by executive age. The relative stability of VRAED – ERAED by executive age is therefore consistent with there being little change in the racial/ethnic densities of the mainly exogenous supply of talent over time, from when the proto-executives were first hired through their conversion into executives.[17]

5. Discussion

Racial/ethnic representation is an important and sensitive topic for many people. In the US business world, the saliency of recent racial unrest has particularly increased the volume and intensity of calls for actions that would enlarge the number of Blacks in executive positions, especially at the CEO level. With this background in mind, we view our putting forward an alternative benchmark against which to measure and evaluate the racial/ethnic densities of executives in US publicly traded companies as an effort to contribute to the crucial societal debate on race and ethnicity in business in several ways. We enumerate some of these below, emphasizing that our goal in doing so is to present a balanced yet challenging set of different and potentially competing perspectives, all of which we propose may benefit from the inclusion of perspectives and thinking along the lines of a TBQ labor framework.

[16] The exceptions are the overdensity (underdensity) for old (young) Asians/Pacific Islanders and the overdensity (underdensity) for young (old) Whites. We note, however, that the executives in these comparisons—those over 67.5 or under 42.5—comprise only 4% of all sample executives.

[17] We emphasize that we are not proposing that the magnitudes of VRAED – ERAED indicate that racial bias and/or discrimination is not present in firms' hiring decisions. For one recent perspective on racial discrimination in corporate hiring, see Quillian, Pager, Midtøen, and Hexel (2017).

1. Our TBQ benchmark recognizes that the size and racial makeup of the supply of executive labor facing firms is predominantly exogenous to firms and largely outside their control. That is, the number and racial/ethnic backgrounds of the academically strongest undergraduates who US publicly traded firms most wish to hire are not to any material degree caused by nor directed by firms, especially in the short term. By isolating the portion of executive RAEDs that is more likely to be within a firm's control, VRAED – ERAED, our TBQ labor supply method may enable greater attention to be focused on understanding the size and causal determinants of what can be affected by the firm and its employees, such as, but not limited to, racial discrimination that may exist within a firm, as well as the impartial fostering and development of executive talent.[18]

2. Matching as it does to executive age, our TBQ benchmark recognizes that the racial/ethnic background of academically top undergraduates has substantially and systematically changed over the past 50 years (figure 1). If executives typically become CEOs at the average age of 55 when they have gained the set of skills that are needed through 30+ years of human capital investment and success, then we think that it is likely inappropriate to calibrate the density of, say, Hispanic CEOs in 2019 against the density of Hispanics in the 2019 US population, because the fraction of seniors graduating from top US colleges and universities in 1987 who were Hispanic was far smaller than is the fraction of Hispanics in the 2019 US population or seniors graduating in 2019 from the top 100 US colleges and universities. In this sense, we propose that, defined with regard to calibrations made against USPopRAED, there exists what is sometimes referred to as a "pipeline problem" with regard to non-Asian non-White individuals—primarily Blacks and Hispanics—in the domain of C-suite executives such as CEOs, and likewise for other ranks or groups of executives (Mac Donald, 2020).

3. We think the pipeline problem is one explanation for why, despite much pressure exerted by activists, politicians, and others, even the largest US publicly traded firms tend not to have had, nor currently have, American Indian/Alaska Native, Pacific Islander, Black, and Hispanic executives in densities that are close to those of the US population. For example, as of 6/14/21, we judged that Apple Inc. had no American Indian/Alaska Natives or Hispanics, and just one Black individual, on its 16-member executive Leadership Team. It seems likely to us that were there not a pipeline shortage of American Indian/Alaska Native, Black, and Hispanic executives from which Apple could choose without discriminating against equally qualified other races/ethnicities, that this would not be the case.

4. We suggest that a TBQ benchmark perspective leads to the prediction that a rapid resolution of the pipeline problem is unlikely to be feasible for two reasons. First, the substantial supply of executive-qualified Blacks and Hispanics that would be required to rapidly solve the pipeline problem likely does not currently exist. Per table 6, the ratios of the densities of Blacks and Hispanics in the US population to those in our datasets of US publicly traded firms are 2.8 and 4.5, respectively—far higher than 1.0 (see Gayton 2021 and Epstein 2021 for differing perspectives on this in the context of corporate legal work). Second, rapid and widespread promotions of American Indian/Alaska Natives, Blacks and Hispanics into executive positions to the degree needed to remove current underrepresentation would seem likely to impose net costs on firms, in that were such actions feasible and firm-value-increasing, they would likely already have been undertaken. Among potential costs might be the suboptimal and firm-value-reducing financing, investing, and/or operating decisions that could accrue if firms have less-experienced individuals in C-suite or other leadership positions, and legal challenges that would likely be brought by other races/ethnicities arguing that they had been inequitably treated and/or discriminated against in their firm's 'overly rapid' hiring of American Indian/Alaska Natives, Blacks and Hispanics.

[18] In recognition of the potential that firms may have to exert influence on the racial/ethnic composition of the supply of proto-executive talent facing them, some firms have begun early education programs. See www.google.org/our-work and https://ripplematch.com/journal/article/coding-bootcamps-that-are-helping-to-close-the-diversity-gap-in-tech-27fc364b/.

5. Does the passing of time help fix the pipeline problem highlighted by the TBQ benchmark? We suggest yes and no. On the "yes" side is that, all else held equal, we propose that the very different RAEDs of new hires made by firms in 2019 (as compared to the RAEDs of new hires that were made by firms in 1980) are likely to 'naturally' make their way over time through the corporate hierarchy. Figure 1 suggests this, as do the 2018–2019 RAEDs of the top 100 US colleges and universities (comparable RAEDs for the 2019 US population in parentheses): American Indian/Alaska Natives 0.4% (1.1%); Asian/Pacific Islanders 15.7% (6.4%); Blacks 5.4% (13.0%); Hispanics 13.3% (18.5%); Whites 65.2% (61.2%). However, on the "no" side of the coin there are two limitations to mention. First, we suggest that the RAEDs of new hires will likely take 20–40 years to fully show up in the RAEDs of senior executives. Second, the RAEDs of seniors graduating today from the top 100 US CUs differ from those of the US population in material and potentially contentious ways. For example, in the group of seniors graduating from the top 100 CUs, American Indian/Alaska Natives, Hispanics, and Blacks are currently underrepresented relative to the US population by 0.7%, 7.6%, and 6.2%, respectively, and Asians/Pacific Islanders and Whites are overrepresented by 9.1% and 4.0%, respectively. This suggests that removing the underrepresentation of Blacks and Hispanics will require removing the overrepresentation of Whites and Asians. As the Harvard and UNC–Chapel Hill court cases involving allegations of discrimination against Asians demonstrate, actively removing such overrepresentation in top US colleges and universities may be controversial and divisive.

6. By calibrating against all five of the race/ethnicity categories that we use, our TBQ benchmark treats all races/ethnicities on an equal and level playing field. We see this as pertinent in light of empirically supported concerns that have been raised in the area of corporate boards to the effect that Asians and Hispanics have been "left behind" Blacks (Barrett, 2020; Barrett and Rodriguez, 2020; Gow, Larcker, and Watts, 2020; Green, 2020).

7. A qualified labor supply approach provides for ERAEDs that conditionally flex to take into account the key supply and demand features of a wide variety of different labor markets. In support of this, in appendix G we calibrate the RAEDs of the 2019–2020 rosters of players in the NBA, MLB, MLS, and NFL against the RAEDs of the 2019 US population. The results show that Blacks are overrepresented in the NBA, MLS, and NFL and underrepresented in the MLB, while Hispanics are overrepresented in the MLB and MLS and underrepresented in the NBA and NFL. However, rather than these results necessarily being taken as indicating the presence of large racial biases, we propose that due to the intensely competitive nature of these professional sports labor markets, the differences likely instead indicate that the RAEDs of the qualified supplies of labor that feed each market are simply very different from one another. Such a view predicts that if one were to calibrate the densities of each race and ethnicity of players in the NBA, MLB, MLS, and NFL against their qualified labor supplies, such as NCAA Division 1 schools, one would find very small under- or overdensities.

8. A TBQ benchmark methodology could be applied to the boards of directors. For example, one could classify board members into our five racial/ethnic groups and calibrate their VRAEDs against those of both the US population and the RAEDs of the top 100 US colleges and universities. A plausible prediction is that results would emerge for boards of directors that are similar to what we find for senior executives such as CEOs, CFOs and EVPs, since it seems reasonable to suppose that both groups pull from the same (i.e., more experienced) executive TBQ labor pool/supply.

9. A TBQ benchmark approach could also be taken in calibrating the density of the genders of executives and board members. Such an approach might start with the densities of the genders of the cohorts of seniors who graduated with a BA/BS from the top 100 US colleges and universities, or it could potentially focus on seniors graduating with a business major and/or expand to individuals graduating with an MBA or other professional qualification(s) beyond a BA/BS. Given that the median executive

age in our data of 54 points to a median executive BA/BS graduation year of 1987 (panel E of appendix G), and given that women earned 47% of bachelor's and 33% of master's degrees in business and management conferred in the US 1986–1987,[19] a qualified labor supply benchmark approach might arrive at a lower level than the currently common level of 50%.

10. Our TBQ benchmark approach has deliberately focused on comparing unconditional mean differences between executive VRAEDs, USPopRAEDs and TBQ-based ERAEDs. Future studies might usefully extend our analyses by examining the degree to which unconditional inferences about under-, at- and over-densities across executive race/ethnicity are affected if conditioning variables such as executives' undergraduate majors (Flynn and Quinn, 2010), and the presence, field/domain and quality of executives' post-graduate degree qualifications held by executives (Arcidiacono and Lovenheim, 2016) are included. For example, such conditional analysis might be able to somewhat separate VRAED – ERAED into one component that is informative about "mismatch", the degree to which outcomes for minority BA/BS graduates might have been worsened as a result of attending a top US college or university (Arcidiacono et al., 2011), and a separate component that speaks to the degree of racial bias or discrimination that occurs within a firm after a proto-executive is hired.

11. Lastly, we think that the labor demand vs. supply underpinning of our TBQ benchmark suggests a new way to quantitatively measure the degree of racial/ethnic diversity in groups of employees and/or board members. Despite its pervasive use in business, the word 'diversity' is rarely defined in a way that facilitates quantitative calibration, analysis or critique. A notable exception is *DIV_McK*, the inverse normalized Herfindahl-Hirschman definition of racial/ethnic diversity in executive teams proposed and used by McKinsey in their influential reports on the correlations between the financial performance of large global firms and the racial/ethnic diversities of their executive teams:[20]

$$DIV\_McK_j = 1 - \frac{\sum_{i=1}^{N} RAED_{ij}^2 - N^{-1}}{1 - N^{-1}} \quad (1)$$

However, a weakness of McKinsey's *DIV_McK* quantification of executive racial/ethnic diversity is that it maximizes at equal fractions of executives $RAED_{ij} = 1/N$ for each of the N races/ethnicities used in classifying executives. This is problematic in that neither the US population nor the US labor force contain equal numbers of each race/ethnicity, making maximum *DIV_McK* infeasible for many firms and firms as a whole.[21] This leads us to highlight the alternative quantitative measure of the racial/ethnic diversity of a firm's executives proposed by Green and Hand (2021), denoted *DIV_TBQ* that maximizes when executive RAEDs match the ERAEDs of the firm's TBQ benchmark:[22]

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[19] Tables 235 and 237 of the *Digest of Educational Statistics* (1990).

[20] Hunt, Layton and Prince (2015), Hunt, Prince, Dixon-Fyle and Yee (2018), and Hunt, Prince, Dixon-Fyle and Dolan (2020). McKinsey measure the racial/ethnic diversity of firm executives and board members at the end of the preceding 4-5 year period over which average industry-adjusted EBIT margin-based financial performance is measured.

[21] A normalized Herfindahl-Hirschman definition also yields the result that a firm that has RAEDs equal to USPopRAED is no more diverse that a firm that has the same RAED percentages but spread "oppositely" or in any way differently across races/ethnicities, which we suggest does not accord with intuition. For example, per Appendix C the 2019 USPopRAED are: American Indian/Alaska Native 1.0%, Asian/Pacific Islander 6.4%, Black 13.0%, Hispanic 18.5%, and White 61.2%. So *DIV_McK*(aian, api, b, h, w) = *DIV_McK*(1.0%, 6.4%, 13.0%, 18.5%, 61.2%) = *DIV_McK*(61.2%, 18.5%, 13.0%, 6.4%, 1.0%) = *DIV_McK*(6.4%, 18.5%, 61.2%, 13.0%, 1.0%) = 0.77. This feature of *DIV_McK* seems to go counter to a key reason for creating an algebraic definition of racial/ethnic diversity to begin with, namely to be able to quantitatively compare and contrast the degree of racial/ethnic diversity in executive teams across different firms.

[22] *DIV_TBQ* per equation (1) is intended to be illustrative. It could readily be adapted to reflect asymmetric loss functions over the RAED – ERAED of one or more races/ethnicities, and/or include alternative power functions.

$$DIV\_TBQ_j = 1 - \sum_{i=1}^{N} \left(RAED_{ij} - ERAED_{ij} \right)^2 \quad (2)$$

Finally, we propose that since ERAED conditionally flexes to take into account the key supply and demand features of a given labor market, *DIV_TBQ* or a similar metric could be used to quantitatively measure the degree of racial/ethnic diversity in a variety of private or public organizations, such as firms, government departments, K-12 public schools, or professional sports teams, or positions within an organization such as CEOs, GCs, CHROs and CTOs, or Boards of Directors. It could also be adapted to measure racial/ethnic diversity from an aspirational view, such as measuring progress towards the goal of attaining US population representation among a firm's executives:

$$DIV\_USPop_j = 1 - \sum_{i=1}^{N} \left(RAED_{ij} - USPopRAED_i \right)^2 \quad (3)$$

6. Questions raised by our study

The orientation of our paper has one of carrying out up-to-date measurements and calibrations of executive RAEDs in US publicly traded firms, and not seeking to make normative inferences / statements. However, we recognize that our findings may raise a number of challenging questions. In this section we suggest some, readily noting that there are likely many others that could be, but are not, included.

- What do differences between executive RAEDs and those of the US population or the ERAEDs of a TBQ benchmark reveal? Why is it that Asians/Pacific Islanders are both overrepresented and overdense in CTOs, and Blacks are both underrepresented and underdense in CEOs and CFOs? Do these results reveal an equilibrium between the demand by firms for a portfolio of business skills and a supply of such skills that is not equally provided by each RAETH, whether for intrinsic or extrinsic reasons? Or do they reveal racial discrimination by one or more RAETHs in firms against one or more other RAETHs? Or do they reveal racial discrimination in where and how the pre-college segment of the US population is educated, or racial discrimination in the colleges and universities that firms choose to recruit TBQ talent from?

- If underrepresentation or underdensity of executives of a given RAETH in firms can reasonably be shown to be caused by discrimination, should interventions be made by firms or by the government to increase the size of underrepresented or underdense groups already in the executive labor market? Should such interventions occur when undergraduates first enter the corporate labor market, or further back in the educational or social timeline? Alternatively, should a laissez-faire, noninterventionist, free-market approach be taken by firms and encouraged by the US government?

- Should the executives featured in business cases used in undergraduate or graduate economics or business programs or in articles in top newspapers such as the *New York Times* and the *Wall Street Journal* reflect the actual and observed RAEDs of executives in today's US publicly traded companies? Or should they reflect the RAEDs of the US population? Which best prepares students for success in business or other careers, and why?[23]

[23] For example, page R1 of the October 24, 2020 *Wall Street Journal C-Suite Strategies Report* titled "View from the Top" featured the photographs and names of five C-Suite executives in prominent public and private organizations (position, firm, and our judgment of his/her race/ethnicity in parentheses): Judith Batty (CEO, Girl Scouts of the USA, Black), Matt Carey (CIO, Home Depot, White), James Park (CEO, Fitbit, Asian), Jill Woodworth (CFO, Peloton Interactive, White) and Kate Wik (CMO, Las Vegas Convention and Visitors Authority, Hispanic). On the one hand the racial/ethnic and gender of the set of five executives comes close to being diversity-maximizing as measured using the

7. Conclusions

In this study, we have estimated the racial and ethnic densities of executives in US publicly traded companies as of mid-2020 and have calibrated them against the US population and an economic measure of the top BA/BS-qualified supply of proto-executive talent facing firms. Our results indicate that when the RAEDs of executives as a whole are calibrated against the US population, American Indians/Alaska Natives, Blacks, and Hispanics are underrepresented, and Whites are overrepresented. In contrast, when executive RAEDs are calibrated against a benchmark that seeks to take into account firms' demand for and the supply of proto-executive talent, namely the seniors graduating from the institutions on the *New York Times* 2017 list of the top 100 US colleges and universities, matched to executives' BA/BS graduation years, a mainly different and at times opposite set of outcomes emerges.

In particular, we demonstrate that the magnitudes of underrepresentation for Blacks and Hispanics and overrepresentation for Whites are 10+ times larger when executive RAEDS are calibrated against the US population than when they are calibrated against our economic benchmark. In the random sample of firms, for example, the underrepresentations for Blacks and Hispanics and overrepresentation for Whites are –10.4%, –15.1%, and 26.0%, respectively, whereas the underdensity for Blacks and the overdensities for Hispanics and Whites are at most $1/10^{th}$ as large at –1.0%, 0.2%, and 1.1%, respectively. These results imply that at least 90% of the underrepresentation of Black and Hispanic executives in US public companies comes from factors in effect before US public companies hire proto-executive talent rather than to actions taken by companies after such talent is hired.

More generally, we also find that using a TBQ benchmark rather than the US population yields dissimilar inferences about calibrated executive racial/ethnic proportions 58% of the time, and on 8% of occasions the inferences from calibrating against a TBQ benchmark versus the US population are reliably the opposite of each other. While dissimilar inferences occur only 5% of the time for Asians/Pacific Islanders and 36% for American Indians/Alaska Natives, they occur 73% of the time for Blacks, 77% for Whites, and 100% for Hispanics. We also find that Blacks and Hispanics in S&P 500® firms are typically underrepresented but overdense, while Whites are typically overrepresented but underdense.

We stress that we are not proposing that our results imply that no racial bias and/or discrimination exists in firms' hiring or talent development (Bertrand and Mullainathan 2004), only that the choice of

Blau index (Blau 1977), in that four of the five races/ethnicities we include in our study are present, with two men and three women featured. On the other hand our executive RAEDs data strongly suggest that the likelihood of observing this racial/ethnic and gender composition in a randomly chosen five-person executive team from a US publicly traded firm is remote. The article therefore illustrates the question of whether students are best prepared for success in business by engaging with what many would see as a desirable, almost-perfectly-race/ethnicity/gender-balanced set of executives that is very unlikely to be seen in practice, or by engaging with a more realistic but race/ethnicity/gender-unbalanced set of executives that is very likely to be seen in practice.

benchmark against which executive racial/ethnic densities are calibrated matters to inferences, sometimes a great deal. We see this as important to highlight because the underrepresentation of a particular race/ethnicity in firms' employees based on calibration against the US population is often taken as indicating racial bias and can influence narratives and policy formulations regarding racial discrimination. Our hope is that by also measuring, calibrating, and comparing executive RAEDs through a TBQ-type perspective, a richer understanding can be gained and better decisions can be made by academics, executives, firms, journalists, politicians, policy makers, and regulators about the difficult, emotionally charged, and important economic and moral issues surrounding race and ethnicity in US publicly traded firms and in US business as a whole. It is in this spirit that our study has sought to align with the "honest broker" role proposed by Eagly (2016, p. 214), who encourages academics to be "the honest broker [who] encourages decision makers to think beyond personal values and ideologically driven preferences to consider options that may make sense from a variety of perspectives."

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Appendix A

This appendix presents screenshots of the raw firm and executive data items for four example firms in the random sample (RS), along with an explanation of what each data item means, how it was collected, and how it was coded. An identical data structure applies to firms in the S&P 500® sample (SP).

Panel A: Items 1-19

RS or SP	Is firm also in SP500 dataset?	YWP, YWN or NWN?	RS Firm ID	RS Company Name	RS Webpg 1	RS Webpg 2	RS Webpg 3	RS Webpg 4	RS Exec #	RS Last name(s)	RS First name(s)	RS Middle initial(s)	RS Chief or Officer 1	RS Chief or Officer 2	RS Chief or Officer Domain	RS Rank or Title	RS Rank or Title Domain	RS Area
RS	0	YWP	1	CENTRUS ENERGY CORP	Home	Who We	Leadersh	Executive	1	Poneman	Daniel	B	CEO	President	CEO-PRES			
RS	0	YWP	1	CENTRUS ENERGY CORP					2	Cutlip	Larry	B				SVP	SVP	Field Oper
RS	0	YWP	1	CENTRUS ENERGY CORP					3	Dyke	Elmer					EVP	EVP	ELEU Oper
RS	0	YWP	1	CENTRUS ENERGY CORP					4	Scott	Dennis	J	CS	GC	Legal	SVP	SVP	
RS	0	YWP	1	CENTRUS ENERGY CORP					5	Strawbridg	Philip		CFO	Chief Acco	Finance	SVP	SVP	
RS	0	YWP	1	CENTRUS ENERGY CORP					6	Donelson	John	MA				SVP	SVP	
RS	0	YWP	1	CENTRUS ENERGY CORP					7	Howe	Jim					VP	VP	Governme
RS	0	YWP	1	CENTRUS ENERGY CORP					8	Leistikow	Dan					VP	VP	Corporate
RS	0	YWN	2	FIRST NATIONAL CORP/VA	Home	Investor	Corporat	Senior M	1	Harvard	Scott	C	CEO		CEO-PRES			
RS	0	YWN	2	FIRST NATIONAL CORP/VA					2	Dysart	Dennis	A	COO	President	Operations			
RS	0	YWN	2	FIRST NATIONAL CORP/VA					3	Bell	Shane	M	CFO		Finance	EVP	EVP	
RS	0	NWN	17	PLANET GREEN HOLDINGS CORP					1	Zhou	Bin		CEO		CEO-PRES			
RS	0	NWN	17	PLANET GREEN HOLDINGS CORP					2	Hu	Lili		CFO		Finance			
RS	0	NWN	17	PLANET GREEN HOLDINGS CORP					3	Cui	Daqi		COO		Operations			
RS	0	NWN	17	PLANET GREEN HOLDINGS CORP					4	Yin	Mingze					Director	BU-CEO-PR	Investor Re
RS	0	YWP	488	MEDIFAST INC	Investors	Management			1	Chard	Daniel	R	CEO		CEO-PRES			
RS	0	YWN	488	MEDIFAST INC					2	Kelleman	Joe		CFO		Finance			
RS	0	YWP	488	MEDIFAST INC					3	Tyree	Tony		Chief Marketing Office		Marketing			
RS	0	YWP	488	MEDIFAST INC					4	Johnson	Nicholas					President	BU-CEO-PR	Coach & Cl
RS	0	YWP	488	MEDIFAST INC					5	Baker	Bill					EVP	EVP	Informatio
RS	0	YWP	488	MEDIFAST INC					6	Groves	Jason	L	GC	CS	Legal	EVP	EVP	
RS	0	YWP	488	MEDIFAST INC					7	Greninger	Claudia					EVP	EVP	HR

Item 1 RS or SP. Indicator to denote whether firm is from the random sample or the S&P 500®.
Item 2 Indicator = 1 if firm is in both the RS and SP datasets. There are 54 such overlap firms.
Item 3 YWP = firm website shows the named executive and their photo.
YWN = firm website shows the named executive but not their photo.
NWN = firm website does not show an/the executive's name or photo.
Item 4 Firm ID = for RS, runs from 1-523.
Item 5 Firm name per Compustat.
Item 6 Webpg 1 = 1st level in firm's website address identifying the page with the executive on it.
Item 7 Webpg 2 = 2nd level in firm's website address identifying the page with the executive on it.
Item 8 Webpg 3 = 3rd level in firm's website address identifying the page with the executive on it.
Item 9 Webpg 4 = 4th level in firm's website address identifying the page with the executive on it.
Item 10 Executive #, coded in the order shown on firm's website (if in a row, order taken is left to right).
Item 11 Last name(s) of executive.
Item 12 First name(s) of executive.
Item 13 Middle initial(s) of executive.
Item 14 Chief or Officer 1 = 1st of a maximum of two Chief or Officer positions ascribed to the executive.
Item 15 Chief or Officer 2 = 2nd of a maximum of two Chief or Officer positions ascribed to the executive.
Item 16 Chief or Officer Domain = category covering one or more Chief or Officer 1 or 2 positions.
Item 17 Rank or Title = rank or title of executive, outside of Chief or Officer 1 and 2.
Item 18 Rank or Title Domain = category covering one or more Ranks or Titles.
Item 19 Area = area of business responsibility covered by the executive, as judged by authors based on the text provided about the executive on firm's website.

Appendix A (continued)

Panel B: Items 20-32

YWP, YWN or NWN?	RS Firm ID	RS Company Name	RS Photo	RS Photo Source	RS Gender	McK 2015 race/ethnicity aa,eur,ne,ea, sa,lat,na,pi,an	McK 2018 US + NCES IPEDS race/ethnicity w,b,h,api,aian	RS Visual est age	RS Formal attire?	RS Jacket?	RS Tie?	RS Smile (1-10)	RS Pay ($M) Yahoo! Finance	RS Year Born Yahoo! Finance	RS True Age @ Feb-20
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	60	y	y	y	10	$ 1.56	1956	64
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	55	y	y	y	5			
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	55	y	y	y	7	$ 0.65	1964	56
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	55	y	y	y	8			
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	55	n	y	n	5		1955	65
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	40	y	y	n	7			
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	60	y	y	n	6			
YWP	1	CENTRUS ENERGY CORP	y	Website	m	eur	w	45	y	y	n	6			
YWN	2	FIRST NATIONAL CORP/VA	y	LIN	m	eur	w	65	y	y	y	7	$ 0.44	1955	65
YWN	2	FIRST NATIONAL CORP/VA	y	LIN	m	eur	w	50	y	y	y	8	$ 0.30	1972	48
YWN	2	FIRST NATIONAL CORP/VA	y	LIN	m	eur	w	45	y	y	y	6	$ 0.28	1973	47
NWN	17	PLANET GREEN HOLDINGS CORP	n		m								$ 0.10	1990	30
NWN	17	PLANET GREEN HOLDINGS CORP	n		f								$ 0.05	1979	41
NWN	17	PLANET GREEN HOLDINGS CORP	y	LIN	m	ea	api	50	y	y	y	4	$ 0.10	1967	53
NWN	17	PLANET GREEN HOLDINGS CORP	n		m										
YWP	488	MEDIFAST INC	y	Website	m	eur	w	55	y	y	y	7	$ 2.04	1965	55
YWN	488	MEDIFAST INC	y	LIN	m	eur	w	60	y	y	n	5			
YWP	488	MEDIFAST INC	y	Website	m	aa	b	55	y	y	y	6	$ 0.70	1965	55
YWP	488	MEDIFAST INC	y	Website	m	eur	w	45	y	y	y	4	$ 0.56	1980	40
YWP	488	MEDIFAST INC	y	Website	m	eur	w	45	y	y	y	7	$ 0.58	1972	48
YWP	488	MEDIFAST INC	y	Website	m	aa	b	45	y	y	y	5			
YWP	488	MEDIFAST INC	y	Website	f	lat	h	45	y	y	n	7			

Item 20 Photo = y if a photo of the executive was found on the firm's website, else the executive's LinkedIn page (LIN), else the firm's Bloomberg profile (BB), else business media (OTH).

Item 21 Photo source: If photo = y, photo source = firm's website, LIN, BB or OTH.

Item 22 Gender: Male or female, based on the executive's photo and/or bio, where available.

Item 23 McK 2015 race/ethnicity. We classified an executive's race or ethnicity by visually examining their photo and first and last name(s). All classifications were done by the same coauthor. The most granular racial and ethnic categories we employ are those of Hunt, Layton, and Prince (McKinsey, 2015). With our lowercase descriptor tag of each race/ethnicity category shown in parentheses, these are: African ancestry (aa), European ancestry (eur), Near Eastern (ne), East Asian (ea), South Asian (sa), Latino (lat), Native American (na), and Other (o). We specify Other as either Pacific Islander (pi) or Alaska Native (an). We use the nomenclature American Indian rather than Native American because American Indian is the nomenclature used in much of the historical data that we extract from the National Center for Educational Statistics' Integrated Postsecondary Education Data System (NCES IPEDS) and use in calibrating executives' observed racial and ethnic densities against their expected executive labor supply metric densities.

Item 24 NCES IPEDS race/ethnicity. For the historical data we use to calibrate executives' observed racial and ethnic densities against their expected densities, NCES IPEDS specifies five race/ethnicity categories outside of Nonresident aliens (lowercase descriptor tag of each race/ethnicity category in parentheses: American Indian/Alaska Native (aian), Asian/Pacific Islander (api), Black (b), Hispanic (h), White (w). We connect McK 2015 race/ethnicity categories into NCES IPEDS race/ethnicity categories by defining b = aa, w = eur + ne, api = ea + sa + pi, h = lat, aian = ai + an (see item 23 for McK category descriptor tags). NCES IPEDS' race or ethnicity categories match closely with those used for US executives in McKinsey's 2018 and 2020 studies (Hunt, Prince, Dixon-Fyle, and Yee, 2018; Dixon-Fyle, Hunt, Dolan, and Prince, 2020).

Item 25 Visual est age. Age of the executive as judged by the same coauthor from their photo, assigned into one of the following point estimates: 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90.

Item 26 Formal attire? = y if executive was wearing formal attire as judged by the same coauthor from the executive's photo. Sometimes not possible if photo was only of the executive's face.

Item 27 Jacket? = y if executive was wearing a jacket as judged by the same coauthor from their photo. Sometimes not possible if photo was only of the executive's face.

Appendix A (continued)

Item 28 Tie? = y if executive was wearing a tie as judged by the same coauthor from the executive's photo. Sometimes not possible if photo was only of the executive's face.

Item 29 Smile (1-10). Degree of genuine smile on the executive's face as judged by the same coauthor from the executive's photo, where 1 = not at all smiling/"very grumpy" and 10 = very wide, "joyous" smile.

Item 30 Pay ($M) Yahoo! Finance. If executive is one of the maximum of five individuals listed on the firm's Yahoo! Finance Profile page, Pay is the amount of "salary, bonuses etc." for the last fiscal year ending December 31, 2019.

Item 31 Year Born Yahoo! Finance. If executive is one of the maximum of five individuals listed on the firm's Yahoo! Finance Profile page, Year Born is the executive's YYYY year of birth.

Item 32 True Age @ Feb-20. If Year Born is available, True Age @ Feb-20 is the age of the executive to the nearest one year as of February 2020.

Appendix B

Description of the calculations behind the Visual Identification Adjustment Factors (VIAFs) used to adjust the raw numbers and densities of the judged races/ethnicities of executives in our (GH) RS and SP datasets to take into account the likely undercounting of non-Whites. VIAFs are estimated for Asian/Pacific Islander, Black, and Hispanic executives, with the VIAF-based number and density of Whites being a plug. The data we use to calculate the VIAFs were generously provided by Crist|Kolder Associates (CK) from their 2020 Volatility Report. It consists of (1) the first and last names of all the CEOs and CFOs that during the summer of 2020 CK identified as being in the union of firms in the S&P 500® and the Fortune 500; (2) the name of the firm that the CEO or CFO works for; and (3) CK's classification of the CEO's or CFO's race/ethnicity. Our approach to calculating VIAFs uses only the subset of CK's firms that are also in our database of S&P 500® firms, and only those CEOs and CFOs who are identified by both CK and ourselves. We define an executive's race/ethnicity coding as being correct if both we and CK agree on the coding. For every case where our coding of an executive's race/ethnicity differed from CK's, we carefully researched biographical and other data sources to confirm the classification. In testimony to the substantial resources that CK spend on their highly visible and respected Volatility Report, we found only one executive out of 83 whose CK classification we believe is incorrect, as compared to 14 out of 82 from our own less resource-intensive classification process. Using Blacks as the example, we calculate VIAF_b as the ratio of the number of CEOs + CFOs that CK coded as b to the number of CEOs + CFOs that we coded as b, multiplied by the number of correct b CEOs + CFOs divided by the total number of b CEOs + CFOs.

	For CK firms in the S&P® 500 and where the CK-identified executive is the same as the GH-identified executive:	CK race/ethnicity using NCES IPEDS classifications				
		aian	api	b	h	Total
i	# CK CEOs + CFOs coded correctly	0	44	11	27	82
ii	# CK CEOs + CFOs coded incorrectly	0	0	0	1	1
iii	# GH CEOs + CFOs coded correctly	0	41	10	17	68
iv	# GH CEOs + CFOs coded incorrectly	0	3	1	10	14
	VIAF = (i / iii) * [(i - ii)/i]	1.0	1.073	1.100	1.546	

Note: VIAF for aian is set at 1.0 since denomination in VIAF calculation = 0.
VIAF for w is not calculated, but is treated as a plug.
GH stands for the authors of the study.

Appendix C

Derivation of the estimated racial/ethnic densities of the US population (USPopRAED) at July 1, 2019 using the race and ethnicity categories defined in the US Department of Education's National Center for Educational Statistics' Integrated Postsecondary Education Data System (NCES IPEDS).[24]

Panel A: Annual Estimates of United States Resident Population by Sex, Race, and Hispanic Origin: April 1, 2010 to July 1, 2019 (see link for raw data file NC-EST2019-SR11H, June 2020)

Sex, Race, and Hispanic Origin	Population estimate as of July 1, 2019	Hispanic	Not Hispanic
TOTAL POPULATION	**328,239,523**	**60,572,237**	**267,667,286**
One Race:			
White	250,522,190	53,212,368	197,309,822
Black or African American	44,075,086	2,927,598	41,147,488
American Indian and Alaska Native	4,188,092	1,753,184	2,434,908
Asian	19,504,862	598,983	18,905,879
Native Hawaiian and Other Pacific Islander	806,937	211,029	595,908
Two or More Races	9,142,356	1,869,075	7,273,281

Panel B: Rules in Reporting Race and Ethnicity Data to IPEDS (see link for full details)

Institutions MUST give students and staff the opportunity to self-report their race and ethnicity. Students and staff do NOT have to respond. Institutions MUST use a 2-part question to collect these data. The questions must be presented in this order:

1. Are you Hispanic or Latino?
2. Select one or more of the following races:
   American Indian or Alaska Native
   Asian
   Black or African American
   Native Hawaiian or Other Pacific Islander
   White

Report race and ethnicity data to IPEDS as follows:

If the individual self identifies as…	Report to IPEDS as…	IPEDS tag
Hispanic only, or Hispanic and any race category	Hispanic	h
Not Hispanic; American Indian or Alaska Native	American Indian or Alaska Native	aian
Not Hispanic; Asian only	Asian	api
Not Hispanic; Black or African American only	Black or African American	b
Not Hispanic; Native Hawaiian or Other Pacific	Native Hawaiian or Other Pacific Islander	api
Not Hispanic; White only	White	w
Not Hispanic; more than one race category	Two or more races	tomr

[24] The Integrated Postsecondary Education Data System is a system of interrelated surveys conducted annually by the National Center for Education Statistics, a part of the Institute for Education Sciences within the United States Department of Education. IPEDS consists of twelve interrelated survey components that are collected over three collection periods each year as described in the Data Collection and Dissemination Cycle. The completion of all IPEDS surveys is mandatory for all institutions that participate in, or are applicants for participation in, any federal financial assistance program authorized by Title IV of the Higher Education Act of 1965, as amended.

Appendix C (continued)

Panel C: Estimated Racial and Ethnic Densities by IPEDS Label after Allocating Two or More Races (tomr) to aian, api, b, w

IPEDS label	Population estimate as of July 1, 2019	tomr allocations to aian, api, b, w	Population estimate as of July 1, 2019 after allocating tomr to aian, api, b, w	Estimated densities by IPEDS tag after allocating tomr to aian, api, b, w
h	60,572,237		60,572,237	18.5%
aian	2,434,908	1,010,678	3,445,586	1.0%
api	19,501,787	1,463,435	20,965,222	6.4%
b	41,147,488	1,383,906	42,531,394	13.0%
w	197,309,822	3,415,261	200,725,083	61.2%
tomr	7,273,281			
Total	328,239,523	7,273,281	328,239,523	100.0%

Notes:

1. Per US Office of Management and Budget guidelines, the terms White, Black or African American, Asian, American Indian and Alaska Native, and Native Hawaiian and Other Pacific Islander are used to describe the race of people. Beginning in 2003, people in these categories are those who selected that race group only. Those who identify multiple race groups are categorized as people of Two or More Races. Prior to 2003, people identified a group as their main race.
2. Hispanic or Latino ethnicity refers to people who identify themselves as being of Hispanic, Latino, or Spanish origin. Hispanic ethnicity subcategories consist of Mexican, Puerto Rican, Cuban, Central and South American, and Other Hispanic or Latino.
3. The allocation of the 7,272,381 tomr people to aian, api, b and w in panel C was done using the data in table 2 ("Two or More Races Population by Specific Combination: 2000 and 2010") reported on p. 6 of the 2010 Census Brief The Two or More Races Population: 2010. In that table 2, for each *j*-race tomr group 2-races, 3-races, 4-races, 5-races and 6-races, and within each tomr group for each permutation of the 6 races aian, a, b, pi, w, and sor (some other race), the total number of people in that permutation was allocated equally to the races (and only to those races) in that permutation. For example, for the aian/a/b/w/sor permutation in the 5-race group, 1/5 of the 1,023 people in that permutation were estimated to be aian, 1/5 a, 1/5 b, 1/5 w, and 1/5 sor. Then, because there is no sor category in IPEDS, that data in sor were in turn then indirectly allocated to aian, a, b, pi, and w through multiplying the total of 7,273,281 people in tomr by the fraction that each of the estimated-within-tomr numbers of aian, a, b, pi, and w people were of the total estimated-within-tomr numbers.

Appendix D

This appendix lists the NCES IPED UnitIDs, names, and number of BA/BS degrees conferred in academic years 1986–1987 and 2007–2008 for each institution in the "Top 100 US colleges and universities" as defined by Ashkenas, Park, and Pearce in their *New York Times* article "Even with affirmative action, Blacks and Hispanics are more underrepresented at top colleges than 35 years ago" (August 24, 2017).

Public, 4-year or above One per State (+8 additional from California)		# students	
UnitID	Institution Name	1987	2008
151351	Indiana University-Bloomington	4,546	5,779
159391	Louisiana State Univ & Ag & Mech College	3,173	4,600
204796	Ohio State University-Main Campus	6,853	8,721
214777	Pennsylvania State University-Main Campus	7,415	9,442
186380	Rutgers University-New Brunswick	5,148	5,454
100751	The University of Alabama	2,247	3,398
180489	The University of Montana	1,131	1,712
221759	The University of Tennessee-Knoxville	3,226	3,655
228778	The University of Texas at Austin	6,751	8,669
196088	University at Buffalo	2,454	3,966
102614	University of Alaska Fairbanks	466	444
104179	University of Arizona	3,598	5,619
106397	University of Arkansas	1,655	2,343
110635	University of California-Berkeley	5,264	6,960
110644	University of California-Davis	3,031	5,785
110653	University of California-Irvine	2,040	5,209
110662	University of California-Los Angeles	4,909	7,089
445188	University of California-Merced	0	74
110671	University of California-Riverside	665	3,544
110680	University of California-San Diego	2,177	5,328
110705	University of California-Santa Barbara	3,194	4,977
110714	University of California-Santa Cruz	1,288	3,450
126614	University of Colorado Boulder	3,515	5,790
129020	University of Connecticut	2,906	4,591
130943	University of Delaware	2,639	3,500
134130	University of Florida	5,260	8,737
139959	University of Georgia	3,871	6,414
141574	University of Hawaii at Manoa	2,594	2,994
142285	University of Idaho	1,110	1,833
145637	University of Illinois at Urbana-Champaign	5,938	7,314
153658	University of Iowa	3,826	4,488
155317	University of Kansas	2,887	3,997
157085	University of Kentucky	2,606	3,775
161253	University of Maine	1,438	1,622
163286	University of Maryland-College Park	5,570	6,307
166629	University of Massachusetts-Amherst	4,167	4,431
170976	University of Michigan-Ann Arbor	4,981	6,258
174066	University of Minnesota-Twin Cities	5,525	6,650
176017	University of Mississippi	1,434	2,450
178396	University of Missouri-Columbia	3,494	4,779
181464	University of Nebraska-Lincoln	2,937	3,246
182290	University of Nevada-Reno	904	2,119
183044	University of New Hampshire-Main Campus	1,934	2,377
187985	University of New Mexico-Main Campus	1,803	3,052
199120	University of North Carolina at Chapel Hill	3,272	4,131
200280	University of North Dakota	1,561	1,836
207500	University of Oklahoma-Norman Campus	2,455	3,817
209551	University of Oregon	2,274	3,636
217484	University of Rhode Island	1,673	2,201
218663	University of South Carolina-Columbia	2,910	3,823
219471	University of South Dakota	703	819
230764	University of Utah	2,639	4,882
231174	University of Vermont	1,675	2,003
234076	University of Virginia-Main Campus	2,809	3,526
236948	University of Washington-Seattle Campus	4,959	6,952
240444	University of Wisconsin-Madison	6,000	6,376
240727	University of Wyoming	1,625	1,786
238032	West Virginia University	2,539	3,790
	Total for Public, 4-yr or above	179,664	252,520

Private not-for-profit, 4-year or above 21 States + DC (max = 6 in CA, MA)		# students	
UnitID	Institution Name	1987	2008
164465	Amherst College	392	445
161004	Bowdoin College	345	451
217156	Brown University	1,515	1,542
110404	California Institute of Technology	176	208
173258	Carleton College	426	461
112260	Claremont McKenna College	203	281
161086	Colby College	479	521
190099	Colgate University	619	675
190150	Columbia University	1,298	1,824
190415	Cornell University	1,735	3,431
182670	Dartmouth College	1,053	1,084
198385	Davidson College	342	432
198419	Duke University	1,654	1,505
139658	Emory University	1,109	1,513
131496	Georgetown University	1,399	1,730
153384	Grinnell College	304	408
191515	Hamilton College	419	442
166027	Harvard University	1,766	1,755
115409	Harvey Mudd College	124	179
212911	Haverford College	288	301
162928	Johns Hopkins University	733	1,548
166683	MIT	1,159	1,217
230959	Middlebury College	558	636
147767	Northwestern University	2,027	2,037
121345	Pomona College	333	385
186131	Princeton University	1,129	1,137
227757	Rice University	629	792
167835	Smith College	684	708
243744	Stanford University	1,628	1,646
216287	Swarthmore College	353	374
144050	University of Chicago	717	1,185
152080	University of Notre Dame	1,867	2,087
215062	University of Pennsylvania	2,363	2,766
123961	University of Southern California	2,774	4,528
221999	Vanderbilt University	1,245	1,542
197133	Vassar College	558	638
234207	Washington and Lee University	290	449
179867	Washington University in St Louis	1,355	1,760
168218	Wellesley College	545	604
130697	Wesleyan University	654	732
168342	Williams College	522	510
130794	Yale University	1,283	1,319
	Total for Private not-for-profit 4-yr or above	39,052	47,788
	Total for Public, 4-yr or above	179,664	252,520
	Total for Public + not-for-profit Private 4-yr or above	218,716	300,308
	Total all Bachelor's degrees conferred by post-secondary US institutions, excl. non-resident aliens	959,813	1,518,747
	Total for Public + not-for-profit Private 4-yr or above as % of Total all Bachelor's degrees conferred by post-secondary US institutions, excl. non-resident aliens	22.8%	19.8%

Note: 4-yr or above refers to US colleges and universities with at least a 4-year BA/BS program

Source: NCES IPEDS Digest of Education Statistics

Appendix E

This appendix presents descriptive statistics on the overlaps between the US colleges and universities (CUs) from which the executives in our S&P 500® (SP) and random sample (RS 523) datasets and (1) all CUs, (2) CUs ranked by US News & World Report (USNWR), (3) the subset of CUs consisting of those that supplied 6+ executives to SP firms or 5+ executives to RS 523 firms, and (4) the subset of the CUs in (3) that are also in the *New York Times* 2017 list of the top CUs (NYT top 100 CUs). We obtained executives' education background from BoardEx via WRDS. BoardEx's data provided us with executives' demographic information, employment history, compensation, networks, and educational background. Educational background includes college and graduate education, as well as certificates and executive education programs. As we are interested in college education, we use the dataset *BoardEx - Individual Education Profile* to identify the institutions and qualifications earned at each institution for each executive in our SP and RS 523 datasets. We match each executive to BoardEx by their names and firm. BoardEx contains several variables that can be used to link to other databases, including International Security Identification Number (ISIN) and Central Index Key (CIK). For firms that are missing these identifiers, we hand-match the firms using a combination company name, company web address, telephone number, and fax number. If we did not find an exact match by executive name and firm, we sought to hand-match executives and firms one-by-one.

	S&P 500® firms	Random sample of 523 firms
# CUs in US per Statista in 2018-2019	2,698	2,698
# CUs ranked by USNWR @ 2/15/2019	1,400	1,400
# CUs that sample executives come from	1,312	900
% of all CUs that sample executives come from	49%	33%

	S&P 500® firms	Random sample of 523 firms
# executives in sample dataset	6814	3853
# of sample executives with BA data in BoardEx	5470	2961
% sample executives with BA data in BoardEx	80%	77%

	S&P 500® firms			Random sample of 523 firms		
Of executives in dataset with BA/BS data in BoardEx:	# CUs	# execs	% execs	# CUs	# execs	% execs
# CUs with 1 exec	661	661	12%	496	496	17%
# CUs with 2 executives	214	428	8%	128	256	9%
# CUs with 3 executives	109	327	6%	58	174	6%
# CUs with 4 executives	58	232	4%	46	184	6%
# CUs with 5 executives	47	235	4%	44	220	7%
# CUs with 6+ executives	223	3,587	66%	128	1,631	55%
	1,312	5,470	100%	900	2,961	100%

	S&P 500® firms	Random sample of 523 firms
% of S&P 500® executives whose BA/BS is from one of the 223 CUs that supplied 6+ executives to S&P 500® firms	66%	
% of S&P 500® executives who come from the 78 NYT top 100 CUs that are in the 223 CUs that have supplied 6+ executives to S&P 500® firms	35%	
% of RS 523 executives whose BA/BS is from one of the 172 CUs that supplied 5+ executives to RS 523 firms		63%
% of RS 523 executives who come from the 78 NYT top 100 CUs that are in the 172 CUs that have supplied 6+ executives to RS 523 firms		34%

Appendix E (continued)

We also estimated the fraction of Black executives in our SP and RS datasets who graduated with their BA/BS from a Historically Black College or University (HBCU). We propose that the smaller this fraction, the more accurate is the NYT top 100 list as a proxy for the schools that SP and RS firms hire their proto-executive talent from, given that there are no HBCUs in the NYT top 100 list. Based on the 2020 list of 79 HBCUs on the USNWR website, we find that just 13% of SP and RS Black executives are from HBCUs (33 of 246 in SP firms and 13 of 95 in RS firms).

Our conclusion from the statistics above is that the NYT is a reasonable proxy for the full set of US colleges and universities from which US publicly traded firms hire proto-executive talent, in the form of BA/BS-graduating seniors. Taking S&P 500® firms as the example, we calculate that the 223 "material supplier" CUs have supplied 66% of all the executives in S&P 500® firms, where we define a CU as a material supplier of proto-executive talent if 6+ of the 5,470 executives with BA/BS data in BoardEx obtained their BA/BS at the CU. For S&P 500® firms, of the executives coming from these 223 CUs, 53% come from the NYT top 100 CUs, leading us to conclude that because the NYT top 100 CUs are well scattered within the 223 6+ execs CUs, and not unduly clumped in the 1st thru 100th of the 223 material supplier CUs, that the NYT top 100 is a reasonable proxy for the full set of US colleges and universities from which US publicly traded firms hire proto-executive talent.

Appendix F

Results of analysis that seeks to improve the judged age of an executive when the executive's true age is unknown, using the regression-estimated relations between an executive's true age when known from the firm's Yahoo! Finance's profile page, the visually judged age of the executive, and judgments of the executive's gender, attire, smile, race/ethnicity, Chief/Officer position, and organizational rank.

Panel A: Determination of Executive Age (from the firm's Yahoo! Finance's profile page; the visually judged age of the executive; and judgments of the executive's gender, attire, smile, race/ethnicity, Chief/Officer position, and organizational rank)

Independent variable	Random sample	S&P® 500
Intercept	19.0	24.0
	(14.1)	(18.9)
Visually estimated age of executive	0.70	0.62
(in 5-year bins, 25 - 90)	(37.7)	(37.1)
Executive gender (male = 0, female = 1)	2.36	1.77
	(4.6)	(4.5)
Is exec in formal attire? (y = 1, n = 0)	-0.47	-0.46
	(-0.6)	(-0.7)
Is exec wearing a jacket? (y = 1, n = 0)	-0.59	-0.72
	(-0.8)	(-1.3)
Is exec wearing a tie? (y = 1, n = 0)	0.72	1.08
	(2.0)	(3.9)
Degree of smile on exec's face (1-10)	-0.05	-0.20
	(-0.5)	(-1.8)
Exec is African ancestry? (y = 1, n = 0)	-1.18	-0.35
	(-0.8)	(-0.5)
Exec is Near Eastern? (y = 1, n = 0)	-3.00	-0.63
	(2.0)	(-0.7)
Exec is East Asian? (y = 1, n = 0)	1.18	1.70
	(1.3)	(2.2)
Exec is South Asian? (y = 1, n = 0)	-0.73	-0.97
	(-0.9)	(-1.7)
Exec is Latino? (y = 1, n = 0)	-2.19	-1.02
	(-2.1)	(-1.3)
Exec is CEO or President (y = 1, n = 0)	-0.53	-0.50
	(-1.2)	(-1.6)
Exec is non-CEO Chief (y = 1, n = 0)	-0.98	-1.02
	(-2.9)	(-4.3)
Exec is EVP or Senior EVP (y = 1, n = 0)	0.20	0.11
	(0.5)	(0.4)
Exec is SVP (y = 1, n = 0)	-0.41	-0.36
	(-0.9)	(-1.0)
Exec is VP (y = 1, n = 0)	-0.45	-0.36
	(-0.6)	(-1.0)
# observations	1,736	2,192
Adj. R^2	49.9%	44.9%

Appendix F (continued)

Panel B: Executives with a Visually Estimated Age

Visually estimated executive ag	# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
Random sample (RS)	4,057	25	40	50	50.9	60	85	8.3
S&P® 500 (SP)	6,930	30	45	50	51.7	60	90	7.0
RS - SP					-0.8			
z-statistic on mean{RS - SP}					-5.2			

Panel C: Executives with a True Age

True executive age	# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
Random sample (RS)	1,905	30	44	55	55.1	65	90	8.6
S&P® 500 (SP)	2,234	33	47	56	55.5	63	91	6.7
RS - SP					-0.4			
z-statistic on mean{RS - SP}					-1.6			

Panel D: Executives with Both a True Age and a Visually Estimated Age

Random sample	# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
True executive age (T)	1,742	31	44	55	55	65	90	7.1
Visually estimated exec age (V)	1,742	30	45	55	53.4	65	85	8.4
T - V	1,742	-18	-6	1	1.6	10	31	6.5
z-statistic on RS mean{T - V}					10.3			

S&P® 500	# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
T	2,194	33	47	56	55.5	63	91	6.7
V	2,194	35	45	55	54.2	65	90	7.1
T - V	2,194	-20	-6	1	1.3	9	21	5.7
z-statistic on SP mean{T - V}					10.7			

Panel E: Executives' True Age, Else OLS-Model Age, Else Visually Estimated Age

True else OLS-model else visually estimated executive age	# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
Random sample (RS)	4,220	30	45.1	53	53.6	63	90	7.1
S&P® 500 (SP)	6,970	33	48.2	53.7	54.2	60.2	91	5.2
RS - SP					-0.6			
z-statistic on mean {RS - SP}					-4.8			

Appendix G

The estimated RAEDs of the players listed in Appendix III of the Institute for Diversity and Ethics in Sport's (TIDES) 2020 Racial and Gender Report Cards on the NBA, MLB and MLS and the 2019 Racial and Gender Report Card for the NFL. The derivation of the 2019 US population RAEDs is per appendix C. *Z*-statistics in red < –1.96 (green > 1.96) indicate significant underrepresentation (overrepresentation) of the players in the sport relative to the 2019 US population. All percentages are rounded to the nearest 0.1%.

	Race / ethnicity of players				
NBA Roster 2018-19 n = 461*	aian	api	b	h	w
RAED_NBA 2019-20	0.0%	0.4%	79.2%	2.4%	18.0%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
RAED_NBA - US population	-1.1%	-6.0%	66.2%	-16.1%	-43.1%
z-stat (RAED_NBA - US popln)	**-2.2**	**-5.2**	**42.3**	**-8.9**	**-19.0**

* excludes n=31 players classified by TIDES as Other

	Race / ethnicity of players				
MLB Roster 2019-20 n = 896	aian	api	b	h	w
RAED_MLB 2019-20	0.2%	2.2%	7.5%	29.9%	60.2%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
RAED_MLB - US population	-0.8%	-4.2%	-5.5%	11.5%	-1.0%
z-stat (RAED_MLB - US popln)	**-2.4**	**-5.1**	**-4.9**	**8.8**	-0.6

	Race / ethnicity of players				
MLS Roster 2019-20 n = 756*	aian	api	b	h	w
RAED_MLS 2019-20	2.0%	1.6%	23.3%	31.6%	41.5%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
RAED_MLS - US population	0.9%	-4.8%	10.3%	13.2%	-19.6%
z-stat (RAED_MLS - US popln)	**2.5**	**-5.4**	**8.4**	**9.3**	**-11.1**

* excludes n=31 players classified by TIDES as 2 or more races

	Race / ethnicity of players				
NFL Roster 2019-20 n = 1,456*	aian	api	b	h	w
RAED_NFL 2019-20	0.2%	1.7%	67.0%	0.5%	30.5%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
RAED_NFL - US population	-0.8%	-4.7%	54.1%	-17.9%	-30.7%
z-stat (RAED_NFL - US popln)	**-3.2**	**-7.3**	**61.4**	**-17.6**	**-24.0**

* excludes n=150 players classified by TIDES as 2 or more races

Table 1

Waterfall criteria applied in arriving at two sets of firms that were publicly traded on US stock exchanges at 12/31/19 and for which at least one named executive was found on the firm's website, or the firm's Yahoo! Finance profile page, or the firm's Bloomberg profile page, or the firm's Annual Report, or on comparably.com. Executives are defined as employees whose names are disclosed on the firm's website as part of the firm's executive, leadership, or management team(s) or in its set of officers.

Panel A: Random Sample of 523 US Publicly Traded Firms at 12/31/19

	Step	Waterfall	# RS firms
	1.	# firms randomly selected (RS firms) from all the firms on Compustat that were publicly traded on US stock markets at 12/31/2019	523
less:	2.	# RS firms with no website or no executive/s on firm's website	(39)
plus:	3.	# firms of the n = 39 RS in Step 2 where ≥ 1 executive was found on Yahoo! Finance, Bloomberg, Annual Report, or comparably.com	33
	=	# RS firms with ≥ 1 named executive	517
less:	4.	# SP firms in the n = 517 above where no executive photo could be found	(7)
	=	# RS firms with ≥ 1 executive with a face photo	510

Panel B: All S&P 500® Index Firms

	Step	Waterfall	# SP firms
	1.	# firms in S&P 500® Index (SP) at 12/31/2019	500
less:	2.	# SP firms with no website or no executive/s on firm's website	(9)
plus:	3.	# firms of the n = 9 SP in Step 2 where ≥ 1 executive was found on Yahoo! Finance, Bloomberg, Annual Report, or comparably.com	6
	=	# SP firms with ≥ 1 named executive	497
less:	4.	# RS firms in the n = 497 above where no executive photo could be found	0
	=	# SP firms with ≥ 1 executive with a face photo	497

Table 2

Descriptive statistics on the industry composition and selected financial characteristics for the random sample of firms (RS) and S&P 500® Index firms (SP) at 12/31/19 or for FYE on or before 12/31/19

Panel A: Industry Composition

	# firms	
	RS	SP
Fama-French 12-industry:		
Business Equipment	64	82
Chemicals and Allied Products	7	19
Consumer Durables	11	9
Consumer Nondurables	18	31
Finance	133	97
Healthcare, Medical Equipment, and Drugs	96	37
Manufacturing	38	39
Oil, Gas, and Coal Extraction and Products	28	20
Other	63	52
Telephone and Television Transmission	7	11
Utilities	15	30
Wholesale, Retail, and Some Services	38	44
	518	471

Panel A: Selected Firm Financial Characteristics at 12/31/19 or for FYE on or before 12/31/19

	RS			SP		
	10%	Median	90%	10%	Median	90%
Market cap	$ 23	$ 748	$ 12,657	$ 9,258	$ 22,422	$ 125,125
Total assets	$ 18	$ 1,090	$ 18,518	$ 5,027	$ 20,497	$ 14,498
Total liabilities	$ 6	$ 689	$ 13,099	$ 2,693	$ 13,411	$ 104,156
Total equity	$ 3	$ 289	$ 4,186	$ 1,103	$ 6,266	$ 33,742
Revenue	$ 1	$ 371	$ 6,555	$ 2,640	$ 10,168	$ 64,888
R&D	$ -	$ -	$ 97	$ -	$ -	$ 1,276
EBIT	$ (45)	$ 32	$ 901	$ 509	$ 1,600	$ 8,150
Net Income	$ (93)	$ 13	$ 571	$ 215	$ 1,001	$ 5,889
CFOPS	$ (36)	$ 31	$ 999	$ 529	$ 1,685	$ 8,772
CAPEX	$ -	$ 7	$ 327	$ 43	$ 392	$ 3,498
Gross margin	0%	40%	83%	19%	43%	78%
ROE	-87%	7%	36%	0%	15%	45%
ROA	-53%	1%	10%	1%	6%	15%
ROS	-90%	4%	25%	2%	11%	29%
TATO	0.0	0.4	1.6	0.1	0.5	1.3
LEVG	1.1	2.4	9.5	1.5	2.9	9.2
# firms	518	518	518	471	471	471

Table 3

Descriptive statistics on key characteristics, excluding age and race/ethnicity, of the named executives with a facial photo in the random sample of firms (RS) versus the named executives with a facial photo in the S&P 500® Index firms sample (SP).

Panel A: Number of Executives and Salary + Bonus in Most Recent Fiscal Year

	Random sample of firms (RS, n = 510/523)				S&P® 500 Index firms (SP, n = 497/500)			
	Min.	Mean	Max	# execs	# execs	Min.	Mean	Max
# executives per firm	1	8.7	59	4,423	7,246	2	14.6	79
Exec salary + bonus pay, MRFY ($M)	0	1.3	47.1	1,674	2,108	0	2.4	47.1

Panel B: Executive Gender

	Male	Female	# RS execs	# SP execs	Male	Female
Gender: #	3,439	984	4,423	7,246	5,533	1,713
%	78%	22%			76%	24%

Panel C: Chief and Officer Positions Occupied by Executives, and Executive Presidential Rank

Chief or Officer (outright or Co-) position	C-Label	# RS execs	# SP execs
CEO	CEO	515	501
President	Pres	372	351
Chief Financial Officer	CFO	481	491
General Counsel or Chief Legal Officer	GC,CLO	299	452
Chief Operating Officer	COO	190	170
Corporate Secretary	CS	189	242
Chief Human Resources (or People) Officer	CHRO	103	228
Chief Information Officer	CIO	79	143
Chief Technology Officer	CTO	77	113
Chief Marketing Officer	CMO	63	87
Chief Accounting Officer	CACO	50	84
Executive Chairman	Exec-CH	31	39
Chief Diversity/Equity/Inclusion Officer	CDEIO	8	19
Senior Executive Vice-President	SEVP	11	65
Executive Vice-President	EVP	797	1,686
Senior Vice-President	SVP	783	1,676
Vice-President	VP	688	1,162

Table 4

Racial/ethnic categories and VIAF-based number and densities of executives in the random sample of 523 firms and all firms in the S&P 500® Index. The definition of each racial/ethnic category and how the data was coded is in appendix A. Visual Identification Adjustment Factors (VIAFs) for aian, api, b and h are calculated as described in appendix B.

Panel A: Random Sample of 523 US Publicly Traded Firms at 12/31/19

			Classification by ethnic & racial category per McKinsey study by Hunt, Layton & Prince (2015)								
Racial/ethnic category per McKinsey study by Hunt, Layton & Prince (2015)			Native American	Other	East Asian	South Asian	African ancestry	Latino	European ancestry	Near Eastern	
McKinsey racial/ethnic descriptor tag			na	≡pi + an	ea	sa	aa	lat	eur	ne	Total
Non-VIAF	All Executives	#	0	1	112	150	95	88	3,568	43	4,057
based	RAED	%	0.0%	0.02%	2.8%	3.7%	2.3%	2.2%	87.9%	1.1%	100%

			Classification per National Center for Education Statistics' Integrated Post-Secondary Education System (NCES IPEDS)					
			American Indian / Alaska Native	Asian / Pacific Islander	Black Non-Hispanic	Hispanic	White non-Hispanic	
Data			aian = na + an	api = ea + sa + pi	b = aa	h = lat	w = eur + ne	Total
Non-VIAF	All Executives	#	1	262	95	88	3,611	4,057
based	RAED	%	0.02%	6.5%	2.3%	2.2%	89.0%	100%
	VIAF		**1.00**	**1.07**	**1.10**	**1.55**		
VIAF	All Executives	#	1	281	105	136	3,534	4,057
based	VRAED	%	0.0%	6.9%	2.6%	3.4%	87.1%	100%
VIAF	CEO	#	0	20	3	8	447	478
based	VRAED	%	0.0%	4.3%	0.7%	1.6%	93.4%	100%
VIAF	President	#	0	12	3	6	331	352
based	VRAED	%	0.0%	3.4%	0.9%	1.8%	94.0%	100%
VIAF	CFO	#	0	29	3	15	382	430
based	VRAED	%	0.0%	6.7%	0.8%	3.6%	88.9%	100%
VIAF	GC or CLO	#	0	9	10	3	254	276
based	VRAED	%	0.0%	3.1%	3.6%	1.1%	92.2%	100%
VIAF	COO	#	0	12	2	5	159	178
based	VRAED	%	0.0%	6.6%	1.2%	2.6%	89.5%	100%
VIAF	Corporate Secretary	#	0	8	7	2	164	180
based	VRAED	%	0.0%	4.2%	3.7%	0.9%	91.3%	100%
VIAF	CHRO	#	0	5	8	3	90	106
based	VRAED	%	0.0%	5.1%	7.3%	2.9%	84.8%	100%
VIAF	CIO	#	0	9	3	2	63	76
based	VRAED	%	0.0%	11.3%	4.3%	2.0%	82.3%	100%
VIAF	CTO	#	0	14	0	2	62	77
based	VRAED	%	0.0%	18.1%	0.0%	2.0%	79.9%	100%
VIAF	CMO	#	0	4	2	2	55	63
based	VRAED	%	0.0%	6.8%	3.5%	2.5%	87.2%	100%
VIAF	Chief Accounting Officer	#	0	1	0	6	52	59
based	VRAED	%	0.0%	1.8%	0.0%	10.5%	87.7%	100%
VIAF	CDO/CIO/CDIO/DIO	#	0	1	6	0	1	8
based	VRAED	%	0.0%	13.4%	68.8%	0.0%	17.8%	100%
VIAF	SEVP or EVP	#	0	46	25	25	648	744
based	VRAED	%	0.0%	6.2%	3.4%	3.3%	87.1%	100%
VIAF	SVP	#	0	42	23	36	634	735
based	VRAED	%	0.0%	5.7%	3.1%	4.8%	86.3%	100%
VIAF	VP	#	1	40	17	23	527	607
based	VRAED	%	0.2%	6.5%	2.7%	3.8%	86.8%	100%

Table 4 (continued)

Panel B: All S&P 500® Index Firms at 12/31/19

Classification by ethnic & racial category per McKinsey study by Hunt, Layton & Prince (2015)

Racial/ethnic category per McKinsey study by Hunt, Layton & Prince (2015)			Native American	Other	East Asian	South Asian	African ancestry	Latino	European ancestry	Near Eastern	
McKinsey racial/ethnic descriptor tag			na	≡pi + an	ea	sa	aa	lat	eur	ne	Total
Non-VIAF	All Executives	#	0	1	191	302	246	149	5,944	98	6,931
based	RAED	%	0.0%	0.01%	2.8%	4.4%	3.5%	2.1%	85.8%	1.4%	100%

Classification per National Center for Education Statistics' Integrated Post-Secondary Education System (NCES IPEDS)

Data			American Indian / Alaska Native	Asian / Pacific Islander	Black Non-Hispanic	Hispanic	White non-Hispanic	Total
			aian = na + an	api = ea + sa + pi	b = aa	h = lat	w = eur + ne	
Non-VIAF	All Executives	#	1	493	246	149	6,042	6,931
based	RAED	%	0.01%	7.1%	3.5%	2.1%	87.2%	100%
	VIAF		**1.00**	**1.07**	**1.10**	**1.55**		
VIAF	All Executives	#	1	529	271	230	5,900	6,931
based	VRAED	%	0.0%	7.6%	3.9%	3.3%	85.1%	100%
VIAF	CEO	#	0	25	7	14	456	501
based	VRAED	%	0.0%	4.9%	1.3%	2.8%	91.0%	100%
VIAF	President	#	0	25	4	11	310	350
based	VRAED	%	0.0%	7.1%	1.3%	3.1%	88.6%	100%
VIAF	CFO	#	0	24	7	9	442	481
based	VRAED	%	0.0%	4.9%	1.4%	1.9%	91.8%	100%
VIAF	GC or CLO	#	0	19	36	11	371	437
based	VRAED	%	0.0%	4.4%	8.3%	2.5%	84.8%	100%
VIAF	COO	#	0	9	4	6	147	166
based	VRAED	%	0.0%	5.2%	2.7%	3.7%	88.5%	100%
VIAF	Corporate Secretary	#	0	13	15	5	196	229
based	VRAED	%	0.0%	5.6%	6.7%	2.0%	85.6%	100%
VIAF	CHRO	#	0	13	28	8	199	247
based	VRAED	%	0.0%	5.2%	11.1%	3.1%	80.5%	100%
VIAF	CIO	#	0	23	3	2	145	172
based	VRAED	%	0.0%	13.1%	1.9%	0.9%	84.1%	100%
VIAF	CTO	#	0	27	1	3	86	117
based	VRAED	%	0.0%	22.9%	0.9%	2.6%	73.5%	100%
VIAF	CMO	#	0	11	3	3	115	132
based	VRAED	%	0.0%	8.1%	2.5%	2.3%	87.0%	100%
VIAF	Chief Accounting Officer	#	0	3	3	2	89	97
based	VRAED	%	0.0%	3.3%	3.4%	1.6%	91.7%	100%
VIAF	CDO/CIO/CDIO/DIO	#	0	1	9	2	10	21
based	VRAED	%	0.0%	5.1%	41.9%	7.4%	45.6%	100%
VIAF	SEVP or EVP	#	0	107	80	48	1,486	1,722
based	VRAED	%	0.0%	6.2%	4.7%	2.8%	86.3%	100%
VIAF	SVP	#	0	128	62	97	1,309	1,596
based	VRAED	%	0.0%	8.0%	3.9%	6.1%	82.0%	100%
VIAF	VP	#	0	70	36	26	901	1,033
based	VRAED	%	0.0%	6.8%	3.5%	2.5%	87.2%	100%

Table 5

Numbers and racial/ethnic densities of seniors graduating in 1974–2008 from the top 100 US colleges and universities as defined by Ashkenas, Park, and Pearce (*New York Times*, 2017). Actual data values from NCES IPEDS are shown in white; linear interpolations of missing-data years that are bounded by nonmissing years are in grey; and linear extrapolations for years before the first year of data available in NCES IPEDS are in light tan.

	Race/ethnicity of graduating undergraduates				
	aian	api	b	h	w
1974	0.16%	0.47%	2.23%	0.04%	97.07%
1975	0.18%	0.92%	2.32%	0.26%	96.31%
1976	0.20%	1.36%	2.41%	0.47%	95.54%
1977	0.22%	1.81%	2.50%	0.68%	94.77%
1978	0.24%	2.26%	2.59%	0.89%	94.00%
1979	0.26%	2.70%	2.69%	1.11%	93.23%
1980	0.28%	3.15%	2.78%	1.32%	92.47%
1981	0.30%	3.59%	2.87%	1.53%	91.70%
1982	0.32%	4.04%	2.96%	1.74%	90.93%
1983	0.34%	4.48%	3.05%	1.96%	90.16%
1984	0.36%	4.93%	3.14%	2.17%	89.40%
1985	0.38%	5.38%	3.23%	2.38%	88.63%
1986	0.39%	5.82%	3.32%	2.59%	87.86%
1987	0.44%	5.52%	3.39%	2.60%	88.04%
1988	0.41%	6.01%	3.41%	2.73%	87.43%
1989	0.37%	6.50%	3.44%	2.86%	86.83%
1990	0.42%	7.13%	3.45%	3.19%	85.80%
1991	0.41%	7.46%	3.61%	3.33%	85.16%
1992	0.47%	8.02%	3.95%	3.78%	83.80%
1993	0.52%	8.75%	4.02%	4.13%	82.54%
1994	0.59%	9.57%	4.21%	4.59%	80.97%
1995	0.60%	10.75%	4.22%	4.80%	79.62%
1996	0.64%	11.54%	4.26%	5.08%	78.47%
1997	0.67%	12.25%	4.28%	5.47%	77.33%
1998	0.70%	12.41%	4.48%	5.66%	76.75%
1999	0.74%	12.49%	4.63%	5.81%	76.32%
2000	0.75%	12.80%	4.83%	5.86%	75.77%
2001	0.75%	12.98%	4.90%	5.87%	75.50%
2002	0.69%	13.00%	4.90%	5.96%	75.45%
2003	0.72%	13.30%	4.89%	6.01%	75.08%
2004	0.71%	13.63%	4.97%	6.27%	74.42%
2005	0.73%	13.89%	5.01%	6.42%	73.94%
2006	0.75%	14.21%	4.94%	6.56%	73.54%
2007	0.73%	14.38%	5.04%	6.72%	73.13%
2008	0.76%	14.31%	5.10%	7.04%	72.80%

Table 6

For **executives as a whole** in the random sample (RS) and S&P 500® (SP), this table presents calibrations of executives' VIAF-based racial/ethnic densities (VRAEDs) against the RAEDs of the 2019 US population and executives' TBQ-based expected densities (ERAEDs). *Z*-statistics shown in red < –1.96 (green > 1.96). Percentages are rounded to the nearest 0.1%. VIAFs for American Indian/Alaska Native (aian), Asian/Pacific Islander (api), Black (b), and Hispanic (h) executives are per table 4, with the VIAF applied to White (w) being a plug. 2019 US population RAEDs are per appendix C. Z-statistics in red < –1.96 (green > 1.96). Percentages are rounded to the nearest 0.1%.

	Race / ethnicity of all executives				
Random sample (RS) n = 4,057	aian	api	b	h	w
VRAED	0.02%	6.9%	2.6%	3.4%	87.1%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.0%	0.5%	-10.4%	-15.1%	26.0%
z-stat (VRAED - US population)	**-6.4**	1.4	**-19.7**	**-24.8**	**33.9**
ERAED	0.4%	6.9%	3.5%	3.1%	86.0%
VRAED - ERAED	-0.4%	0.0%	-1.0%	0.2%	1.1%
z-stat (VRAED - ERAED)	**-4.0**	0.1	**-3.3**	0.9	**2.0**
S&P® 500 (SP) n = 6,931	aian	api	b	h	w
VRAED	0.0%	7.6%	3.9%	3.3%	85.1%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.0%	1.2%	-9.1%	-15.1%	24.0%
z-stat (VRAED - US population)	**-8.5**	**4.2**	**-22.4**	**-32.5**	**41.0**
ERAED	0.4%	6.4%	3.5%	2.9%	86.8%
VRAED - ERAED	-0.4%	1.2%	0.5%	0.4%	-1.7%
z-stat (VRAED - ERAED)	**-5.2**	**4.1**	**2.1**	**2.1**	**-4.1**
SP vs. RS	aian	api	b	h	w
VRAED_SP - VRAED_RS	-0.01%	0.7%	1.3%	0.0%	-2.0%
z-stat.	-0.4	1.4	**3.9**	-0.1	**-2.9**
ERAED_SP - ERAED_RS	-0.03%	-0.5%	-0.1%	-0.2%	0.8%
z-stat.	-0.2	-1.0	-0.2	-0.6	1.2

Table 7

For **SEVPs/EVPs, SVPs and VPs** in the random sample (RS) and S&P 500® (SP), this table presents calibrations of their VIAF-based racial/ethnic densities (VRAEDs) against the RAEDs of the 2019 US population and their TBQ-based expected densities (ERAEDs). *Z*-statistics in red < –1.96 (green > 1.96). Percentages are rounded to the nearest 0.1%.

Panel A: SEVP + EVP

	Race/ethnicity of SEVP or EVP				
Random sample (RS) n = 744	aian	api	b	h	w
VRAED	0.0%	6.2%	3.4%	3.3%	87.1%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-0.2%	-9.6%	-15.1%	25.9%
z-stat (VRAED - US population)	**-2.8**	-0.2	**-7.8**	**-10.6**	**14.5**
ERAED	0.4%	6.4%	3.4%	2.9%	86.9%
VRAED - ERAED	-0.4%	-0.2%	0.0%	0.4%	0.2%
z-stat (VRAED - ERAED)	-1.8	-0.2	-0.1	0.7	0.2

S&P 500® (SP) n = 1,722	aian	api	b	h	w
VRAED	0.0%	6.2%	4.7%	2.8%	86.3%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-0.2%	-8.2%	-15.7%	25.1%
z-stat (VRAED - US population)	**-4.3**	-0.3	**-10.2**	**-16.8**	**21.4**
ERAED	0.4%	6.3%	3.4%	2.8%	87.1%
VRAED - ERAED	-0.4%	0.0%	1.3%	0.0%	-0.8%
z-stat (VRAED - ERAED)	**-2.6**	-0.1	**3.0**	-0.1	-1.0

Panel B: SVP

	Race/ethnicity of SVP				
Random sample (RS) n = 735	aian	api	b	h	w
VRAED	0.0%	5.7%	3.1%	4.8%	86.3%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-0.7%	-9.8%	-13.6%	25.2%
z-stat (VRAED - US population)	**-2.8**	-0.8	**-7.9**	**-9.5**	**14.0**
ERAED	0.4%	7.2%	3.6%	3.2%	85.6%
VRAED - ERAED	-0.4%	-1.5%	-0.4%	1.6%	0.8%
z-stat (VRAED - ERAED)	-1.8	-1.5	-0.7	**2.4**	0.6

S&P 500® (SP) n = 1,596	aian	api	b	h	w
VRAED	0.0%	8.1%	3.9%	3.5%	84.5%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	1.7%	-9.0%	-15.0%	23.4%
z-stat (VRAED - US population)	**-4.1**	**2.7**	**-10.7**	**-15.4**	**19.2**
ERAED	0.4%	6.7%	3.5%	3.0%	86.3%
VRAED - ERAED	-0.4%	1.4%	0.4%	0.4%	-1.8%
z-stat (VRAED - ERAED)	**-2.6**	**2.2**	0.9	1.0	**-2.1**

Table 7 (continued)

Panel C: VP

	Race/ethnicity of VP				
Random sample (RS) n = 607	aian	api	b	h	w
VRAED	0.2%	6.5%	2.7%	3.8%	86.8%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-0.9%	0.2%	-10.2%	-14.6%	25.6%
z-stat (VRAED - US population)	**-2.1**	0.2	**-7.5**	**-9.3**	**12.9**
ERAED	0.5%	7.6%	3.7%	3.4%	84.9%
VRAED - ERAED	-0.3%	-1.0%	-0.9%	0.4%	1.9%
z-stat (VRAED - ERAED)	-1.1	-1.0	-1.2	0.5	1.3
S&P 500® (SP) n = 1,033	aian	api	b	h	w
VRAED	0.0%	6.8%	3.5%	2.5%	87.2%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	0.4%	-9.4%	-15.9%	26.0%
z-stat (VRAED - US population)	**-3.3**	0.5	**-9.0**	**-13.2**	**17.2**
ERAED	0.4%	7.0%	3.6%	3.2%	85.9%
VRAED - ERAED	-0.4%	-0.2%	-0.1%	-0.6%	1.3%
z-stat (VRAED - ERAED)	**-2.1**	-0.3	-0.1	-1.1	1.2

Table 8

For **CEOs, CFOs, GCs, COOs, CHROs, CIOs and CTOs** in the random sample (RS) and S&P 500® (SP), this table presents calibrations of their VIAF-based racial/ethnic densities (VRAEDs) against the RAEDs of the 2019 US population and their TBQ-based expected densities (ERAEDs). Z-statistics in red < –1.96 (green > 1.96). Percentages are rounded to the nearest 0.1%.

Panel A: CEO

	Race / ethnicity of CEO				
Random sample (RS) n = 478	aian	api	b	h	w
VRAED	0.0%	4.3%	0.7%	1.6%	93.4%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-2.1%	-12.3%	-16.8%	32.3%
z-stat (VRAED - US population)	**-2.3**	-1.9	**-8.0**	**-9.5**	**14.5**
ERAED	0.4%	5.2%	3.2%	2.3%	89.0%
VRAED - ERAED	-0.4%	-0.9%	-2.5%	-0.7%	4.4%
z-stat (VRAED - ERAED)	-1.3	-0.9	**-3.1**	-1.0	**3.1**

S&P 500® (SP) n = 501	aian	api	b	h	w
VRAED	0.0%	4.9%	1.3%	2.8%	91.0%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-1.5%	-11.6%	-15.7%	29.8%
z-stat (VRAED - US population)	**-2.3**	-1.3	**-7.8**	**-9.0**	**13.7**
ERAED	0.4%	4.8%	3.1%	2.1%	89.5%
VRAED - ERAED	-0.4%	0.1%	-1.8%	0.6%	1.4%
z-stat (VRAED - ERAED)	-1.3	0.1	**-2.3**	1.0	1.0

Panel B: CFO

	Race / ethnicity of CFO				
Random sample (RS) n = 430	aian	api	b	h	w
VRAED	0.0%	6.7%	0.8%	3.6%	88.9%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	0.3%	-12.2%	-14.9%	27.7%
z-stat (VRAED - US population)	**-2.1**	0.3	**-7.5**	**-7.9**	**11.8**
ERAED	0.5%	7.2%	3.6%	3.3%	85.5%
VRAED - ERAED	-0.5%	-0.5%	-2.8%	0.3%	3.4%
z-stat (VRAED - ERAED)	-1.4	-0.4	**-3.2**	0.4	**2.0**

S&P 500® (SP) n = 482	aian	api	b	h	w
VRAED	0.0%	4.9%	1.4%	1.9%	91.8%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-1.5%	-11.6%	-16.5%	30.7%
z-stat (VRAED - US population)	**-2.3**	-1.3	**-7.6**	**-9.4**	**13.8**
ERAED	0.4%	7.1%	3.6%	3.2%	85.6%
VRAED - ERAED	-0.4%	-2.2%	-2.2%	-1.3%	6.2%
z-stat (VRAED - ERAED)	-1.5	-1.9	**-2.6**	-1.6	**3.9**

Table 8 (continued)

Panel C: GC or Chief Legal Officer

	Race/ethnicity General Counsel or Chief Legal Officer				
Random sample (RS) n = 276	aian	api	b	h	w
VRAED	0.0%	3.1%	3.6%	1.1%	92.2%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-3.3%	-9.4%	-17.3%	31.0%
z-stat (VRAED - US population)	-1.7	**-2.2**	**-4.6**	**-7.4**	**10.6**
ERAED	0.4%	6.9%	3.5%	3.1%	86.0%
VRAED - ERAED	-0.4%	-3.8%	0.1%	-2.0%	6.1%
z-stat (VRAED - ERAED)	-1.1	**-2.5**	0.1	-1.9	**2.9**

S&P 500® (SP) n = 432	aian	api	b	h	w
VRAED	0.0%	4.5%	8.4%	2.5%	84.6%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-1.9%	-4.6%	-15.9%	23.5%
z-stat (VRAED - US population)	**-2.1**	-1.6	**-2.8**	**-8.5**	**10.0**
ERAED	0.4%	6.1%	3.4%	2.8%	87.3%
VRAED - ERAED	-0.4%	-1.7%	5.0%	-0.3%	-2.7%
z-stat (VRAED - ERAED)	-1.3	-1.4	**5.7**	-0.3	-1.7

Panel D: COO

	Race/ethnicity of COO				
Random sample (RS) n = 178	aian	api	b	h	w
VRAED	0.0%	6.6%	1.2%	2.6%	89.5%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	0.2%	-11.7%	-15.8%	28.4%
z-stat (VRAED - US population)	-1.4	0.1	**-4.7**	**-5.4**	**7.8**
ERAED	0.4%	6.9%	3.5%	3.1%	85.9%
VRAED - ERAED	-0.4%	-0.3%	-2.3%	-0.5%	3.6%
z-stat (VRAED - ERAED)	-0.9	-0.2	-1.7	-0.4	1.4

S&P 500® (SP) n = 165	aian	api	b	h	w
VRAED	0.0%	5.2%	2.7%	3.7%	88.4%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-1.2%	-10.3%	-14.7%	27.2%
z-stat (VRAED - US population)	-1.3	-0.6	**-3.9**	**-4.9**	**7.2**
ERAED	0.4%	6.0%	3.4%	2.7%	87.5%
VRAED - ERAED	-0.4%	-0.8%	-0.7%	1.0%	0.9%
z-stat (VRAED - ERAED)	-0.8	-0.5	-0.5	0.8	0.4

Table 8 (continued)

Panel E: Chief HR Officer

	Race/ethnicity Chief HR Officer, Chief People Officer				
Random sample (RS) n = 99	aian	api	b	h	w
VRAED	0.0%	2.2%	6.7%	3.1%	88.0%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-4.2%	-6.3%	-15.3%	26.9%
z-stat (VRAED - US population)	-1.0	-1.7	-1.9	**-3.9**	**5.5**
ERAED	0.4%	7.3%	3.7%	3.3%	85.2%
VRAED - ERAED	-0.4%	-5.2%	3.0%	-0.2%	2.8%
z-stat (VRAED - ERAED)	-0.7	**-2.0**	1.6	-0.1	0.8

S&P 500® (SP) n = 228	aian	api	b	h	w
VRAED	0.0%	4.7%	11.6%	2.7%	81.0%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	-1.7%	-1.4%	-15.7%	19.9%
z-stat (VRAED - US population)	-1.6	-1.0	-0.6	**-6.1**	**6.1**
ERAED	0.4%	6.9%	3.6%	3.1%	85.9%
VRAED - ERAED	-0.4%	-2.2%	8.0%	-0.4%	-4.9%
z-stat (VRAED - ERAED)	-1.0	-1.3	**6.5**	-0.4	**-2.1**

Panel F: CIO

	Race/ethnicity of Chief Information Officer				
Random sample (RS) n = 76	aian	api	b	h	w
VRAED	0.0%	11.3%	4.3%	2.0%	82.3%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	4.9%	-8.6%	-16.4%	21.2%
z-stat (VRAED - US population)	-0.9	1.7	**-2.2**	**-3.7**	**3.8**
ERAED	0.4%	7.0%	3.6%	3.2%	85.8%
VRAED - ERAED	-0.4%	4.3%	0.8%	-1.2%	-3.5%
z-stat (VRAED - ERAED)	-0.6	1.5	0.4	-0.6	-0.9

S&P 500® (SP) n = 166	aian	api	b	h	w
VRAED	0.0%	12.9%	1.3%	0.9%	84.8%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	6.5%	-11.6%	-17.5%	23.7%
z-stat (VRAED - US population)	-1.3	**3.4**	**-4.5**	**-5.8**	**6.3**
ERAED	0.4%	6.7%	3.5%	3.0%	86.4%
VRAED - ERAED	-0.4%	6.3%	-2.2%	-2.1%	-1.6%
z-stat (VRAED - ERAED)	-0.8	**3.2**	-1.5	-1.6	-0.6

Table 8 (continued)

Panel G: CTO

	Race/ethnicity of Chief Technology Officer				
Random sample (RS) n = 74	aian	api	b	h	w
VRAED	0.0%	18.9%	0.0%	2.1%	79.1%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	12.5%	-13.0%	-16.4%	17.9%
z-stat (VRAED - US population)	-0.9	**4.4**	**-3.3**	**-3.6**	**3.2**
ERAED	0.5%	7.4%	3.6%	3.4%	85.1%
VRAED - ERAED	-0.5%	11.4%	-3.6%	-1.3%	-6.0%
z-stat (VRAED - ERAED)	-0.6	**3.8**	-1.7	-0.6	-1.5

S&P 500® (SP) n = 111	aian	api	b	h	w
VRAED	0.0%	24.2%	1.0%	2.8%	72.1%
2019 US population	1.1%	6.4%	13.0%	18.5%	61.2%
VRAED - US population	-1.1%	17.8%	-12.0%	-15.7%	10.9%
z-stat (VRAED - US population)	-1.1	**7.7**	**-3.8**	**-4.3**	**2.4**
ERAED	0.4%	6.7%	3.5%	3.0%	86.4%
VRAED - ERAED	-0.4%	17.5%	-2.5%	-0.2%	-14.3%
z-stat (VRAED - ERAED)	-0.7	**7.4**	-1.4	-0.1	**-4.4**

Table 9

VIAF-based racial/ethnic densities (VRAEDs) of all executives in the random sample and S&P 500® firms. ERAEDs are expected TBQ-based labor supply densities derived from the RAEDs of seniors graduating from the top 100 US colleges & universities (per Ashkenas, Park and Pearce 2017) in the same years as the executives. All percentages are visually but not intrinsically rounded to the nearest 0.1%.

Panel A: VRAEDs and ERAEDs

RS + S&P 500 samples			VRAED					ERAED				
Age bin	#	%	aian	api	b	h	w	aian	api	b	h	ERAED w
≥ 72.5	73	0.7%	0.0%	7.4%	0.0%	0.0%	92.6%	0.2%	0.5%	2.2%	0.0%	97.1%
(67.5, 72.5)	102	0.9%	0.0%	9.5%	0.0%	0.0%	90.5%	0.2%	0.5%	2.2%	0.0%	97.1%
(62.5, 67.5]	647	5.9%	0.0%	2.2%	1.0%	0.7%	96.1%	0.2%	2.2%	2.6%	0.9%	94.1%
(57.5, 62.5]	1,873	17.0%	0.0%	4.4%	1.5%	2.2%	91.9%	0.3%	4.2%	3.0%	1.8%	90.7%
(52.5, 57.5]	3,763	34.2%	0.0%	6.5%	3.2%	2.7%	87.6%	0.4%	5.9%	3.4%	2.7%	87.7%
(47.5, 52.5]	3,309	30.1%	0.0%	10.7%	5.0%	4.3%	80.0%	0.5%	8.0%	3.8%	3.7%	83.9%
(42.5, 47.5]	989	9.0%	0.1%	8.5%	5.4%	6.6%	79.4%	0.6%	11.6%	4.3%	5.2%	78.3%
(37.5,42.5]	193	1.8%	0.0%	7.8%	1.1%	4.0%	87.1%	0.7%	13.0%	4.9%	5.9%	75.4%
< 37.5	38	0.3%	0.0%	8.5%	2.9%	4.1%	84.6%	0.7%	14.2%	5.0%	6.7%	73.4%
Total execs	10.987	100.0%										

Panel B: VRAED – ERAED and Z-statistics

			VRAED - ERAED					Z-statistic on VRAED - ERAED				
Age bin	#	%	aian	api	b	h	w	aian	api	b	h	w
≥ 72.5	73	0.7%	-0.2%	6.9%	-2.2%	0.0%	-4.4%	-0.3	**8.6**	-1.3	-0.2	**-2.2**
(67.5, 72.5)	102	0.9%	-0.2%	9.0%	-2.2%	0.0%	-6.5%	-0.4	**13.3**	-1.5	-0.2	**-3.9**
(62.5, 67.5]	647	5.9%	-0.2%	0.0%	-1.6%	-0.1%	2.0%	-1.2	-0.1	**-2.5**	-0.4	**2.1**
(57.5, 62.5]	1,873	17.0%	-0.3%	0.2%	-1.5%	0.4%	1.3%	**-2.5**	0.4	**-3.9**	1.3	1.9
(52.5, 57.5]	3,763	34.2%	-0.4%	0.6%	-0.2%	0.1%	0.0%	**-3.9**	1.5	-0.7	0.2	-0.1
(47.5, 52.5]	3,309	30.1%	-0.5%	2.7%	1.2%	0.6%	-4.0%	**-3.9**	**5.6**	**3.5**	1.9	**-6.2**
(42.5, 47.5]	989	9.0%	-0.5%	-3.1%	1.1%	1.4%	1.2%	**-2.1**	**-3.1**	1.8	1.9	0.9
(37.5,42.5]	193	1.8%	-0.7%	-5.2%	-3.7%	-1.9%	11.6%	-1.2	**-2.2**	**-2.4**	-1.1	**3.8**
< 37.5	38	0.3%	-0.7%	-5.7%	-2.1%	-2.6%	11.1%	-0.5	-1.0	-0.6	-0.6	1.6
Total execs	10,987	100.0%										

Figure 1

Racial and ethnic densities of seniors graduating in 1974-2008 from the top 100 US colleges and universities as defined by Ashkenas, Park and Pearce (2017). Year is the academic year ending May; so 1987 is June 1986-May 1987. Actual data values from NCES IPEDS are shown in thicker solid lines, and linear extrapolations for years that before the first year of data available in NCES IPEDS are shown in dotted lines.

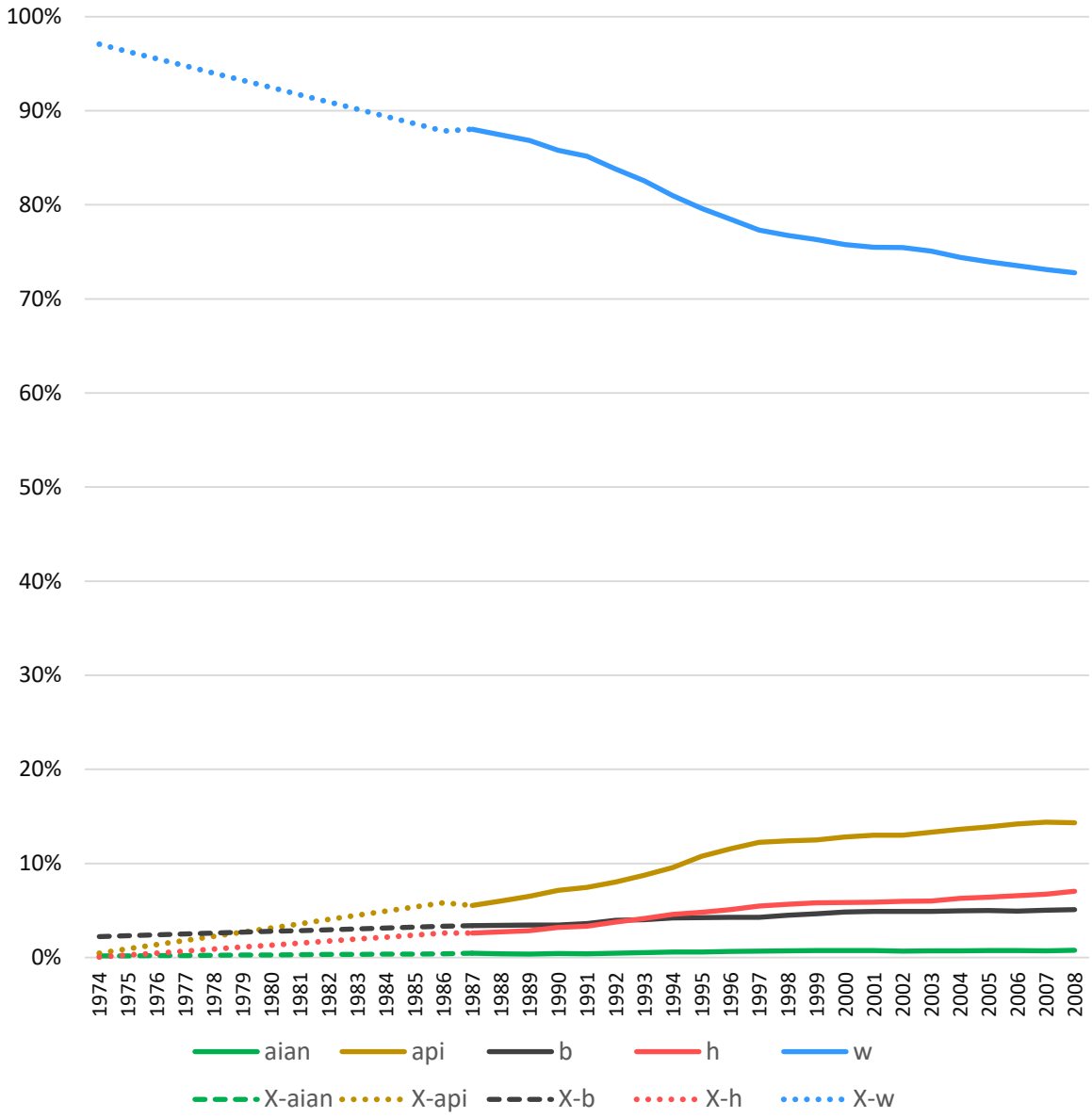


Figure 2

Graphical summary of the Z-statistics reported in Tables 6-8 for executive VIAF-based racial/ethnic densities (VRAEDs) calibrated against the 2019 RAEDs of the US population and against TBQ-based expected densities (ERAEDs). Z-statistics in red < –1.96 (green > 1.96). Percentages are rounded to the nearest 0.1%.

Panel A: Distribution of statistically significant and insignificant Z-statistics

Executive group	Benchmark that executive VRAEDs are calibrated against	Executive race or ethnicity: American Indian / Alaska Native RS	American Indian / Alaska Native SP	Asian / Pacific Islander RS	Asian / Pacific Islander SP	Black RS	Black SP	Hispanic RS	Hispanic SP	White RS	White SP
All execs	US population	**-6.4**	**-8.5**	1.4	**4.2**	**-19.7**	**-22.4**	**-24.8**	**-32.5**	**33.9**	**41.0**
	BA-qualified ERAED	**-4.0**	**-5.2**	0.1	**4.1**	**-3.3**	**2.1**	0.9	**2.1**	**2.0**	**-4.1**
SEVP + EVP	US population	**-2.8**	**-4.3**	-0.2	-0.3	**-7.8**	**-10.2**	**-10.6**	**-16.8**	**14.5**	**21.4**
	BA-qualified ERAED	-1.8	**-2.6**	-0.2	-0.1	-0.1	**3.0**	0.7	-0.1	0.2	-1.0
SVP	US population	**-2.8**	**-4.1**	-0.8	**2.7**	**-7.9**	**-10.7**	**-9.5**	**-15.4**	**14.0**	**19.2**
	BA-qualified ERAED	-1.8	**-2.6**	-1.5	**2.2**	-0.7	0.9	**2.4**	1.0	0.6	**-2.1**
VP	US population	**-2.1**	**-3.3**	0.2	0.5	**-7.5**	**-9.0**	**-9.3**	**-13.2**	**12.9**	**17.2**
	BA-qualified ERAED	-1.1	**-2.1**	-1.0	-0.3	-1.2	-0.1	0.5	-1.1	1.3	1.2
CEO	US population	**-2.3**	**-2.3**	-1.9	-1.3	**-8.0**	**-7.8**	**-9.5**	**-9.0**	**14.5**	**13.7**
	BA-qualified ERAED	-1.3	-1.3	-0.9	0.1	**-3.1**	**-2.3**	-1.0	1.0	**3.1**	1.0
CFO	US population	**-2.1**	**-2.3**	0.3	-1.3	**-7.5**	**-7.6**	**-7.9**	**-9.4**	**11.8**	**13.8**
	BA-qualified ERAED	-1.4	-1.5	-0.4	-1.9	**-3.2**	**-2.6**	0.4	-1.6	**2.0**	**3.9**
GC	US population	-1.7	**-2.1**	**-2.2**	-1.6	**-4.6**	**-2.8**	**-7.4**	**-8.5**	**10.6**	**10.0**
	BA-qualified ERAED	-1.1	-1.3	**-2.5**	-1.4	0.1	**5.7**	-1.9	-0.3	**2.9**	-1.7
COO	US population	-1.4	-1.3	0.1	-0.6	**-4.7**	**-3.9**	**-5.4**	**-4.9**	**7.8**	**7.2**
	BA-qualified ERAED	-0.9	-0.8	-0.2	-0.5	-1.7	-0.5	-0.4	0.8	1.4	0.4
CHRO	US population	-1.0	-1.6	-1.7	-1.0	-1.9	-0.6	**-3.9**	**-6.1**	**5.5**	**6.1**
	BA-qualified ERAED	-0.7	-1.0	**-2.0**	-1.3	1.6	**6.5**	-0.1	-0.4	0.8	**-2.1**
CIO	US population	-0.9	-1.3	1.7	**3.4**	**-2.2**	**-4.5**	**-3.7**	**-5.8**	**3.8**	**6.3**
	BA-qualified ERAED	-0.6	-0.8	1.5	**3.2**	0.4	-1.5	-0.6	-1.6	-0.9	-0.6
CTO	US population	-0.9	-1.1	**4.4**	**7.7**	**-3.3**	**-3.8**	**-3.6**	**-4.3**	**3.2**	**2.4**
	BA-qualified ERAED	-0.6	-0.7	**3.8**	**7.4**	-1.7	-1.4	-0.6	-0.1	-1.5	**-4.4**
Number of Z-statistics ≤ -1.96		**18**		**3**		**23**		**20**		**3**	
Number of Z-statistics ≥ 1.96		**0**		**6**		**4**		**2**		**25**	
% Z-statistics ≤ -1.96		**41%**		**7%**		**57%**		**50%**		**9%**	
% Z-statistics ≥ 1.96		**0%**		**23%**		**9%**		**5%**		**61%**	

Color key: **RED** = Z-statistic ≤ -1.96
WHITE = Z-statistic between -1.96 and 1.96
GREEN = Z-statistic ≥ 1.96

Figure 2 (continued)

Panel B: Distribution of same versus dissimilar/non-same inferences about whether executive VRAEDs are under-, at- or overrepresented versus under-, at, or overdense, using the Z-statistics in panel A. Denoting Z_{ijk}[USPopRAED] as the Z-statistic on $VRAED_{ijk}$ – USPopRAEDj, and Z_{ijk}[ERAED] as the Z-statistic on $VRAED_{ijk}$ – $ERAED_{ijk}$, non-same inferences are classified as different or opposite. Different inferences arise when Z_{ijk}[USPopRAED] ≥ 1.96 and –1.96 < Z_{ijk}[ERAED] < 1.96, or when Z_{ijk}[USPopRAED] ≤ –1.96 and –1.96 < Z_{ijk}[ERAED] < 1.96. Opposite inferences arise when Z_{ijk}[USPopRAED] ≥ 1.96 and Z_{ijk}[ERAED] ≤ –1.96, or when Z_{ijk}[USPopRAED] ≤ –1.96 and Z_{ijk}[ERAED] ≥ 1.96. Executive groups are indexed by i = 1 (all executives) to 11 (CTOs), race and ethnicity by j = 1 (aian) to 5 (w), and datasets by k = 1 (random sample) and 2 (S&P 500®)

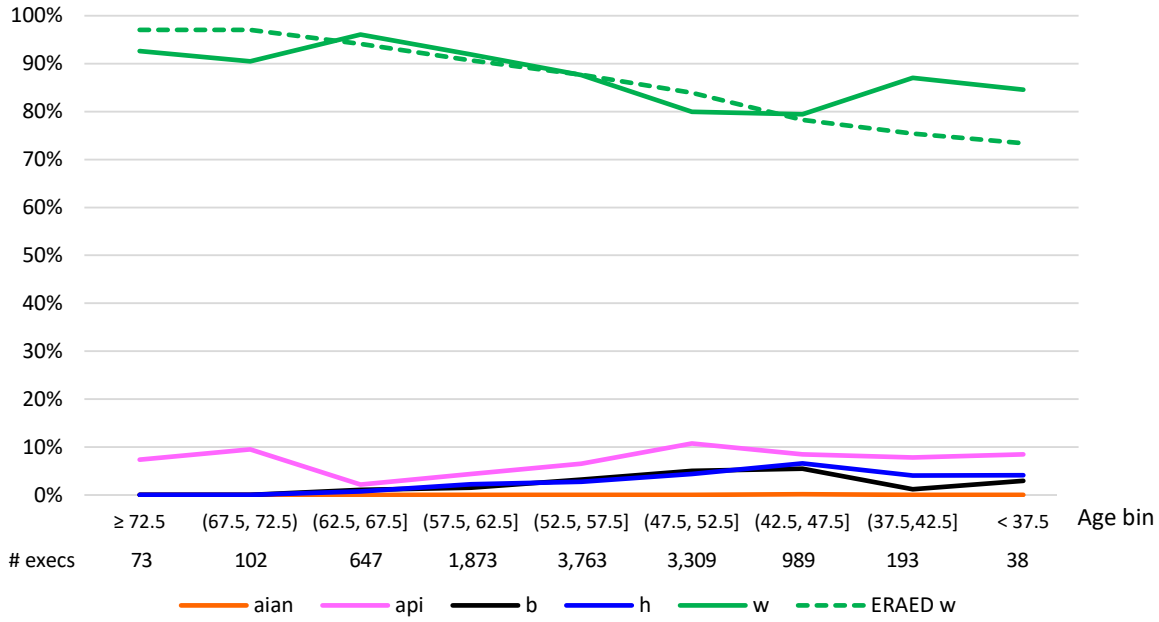
Executive group	Benchmark that executive VRAEDs are calibrated against	Executive race or ethnicity: American Indian / Alaska Native RS	American Indian / Alaska Native SP	Asian / Pacific Islander RS	Asian / Pacific Islander SP	Black RS	Black SP	Hispanic RS	Hispanic SP	White RS	White SP	Dissimilar inferences fraction
All execs	US population BA-qualified ERAED	Same	Same	Same	Same	Same	Opposite	Different	Opposite	Same	Opposite	40%
SEVP + EVP	US population BA-qualified ERAED	Different	Same	Same	Same	Different	Opposite	Different	Different	Different	Different	70%
SVP	US population BA-qualified ERAED	Different	Same	Same	Same	Different	Different	Opposite	Different	Different	Opposite	70%
VP	US population BA-qualified ERAED	Different	Same	Same	Same	Different	Different	Different	Different	Different	Different	70%
CEO	US population BA-qualified ERAED	Different	Different	Same	Same	Same	Same	Different	Different	Same	Different	50%
CFO	US population BA-qualified ERAED	Different	Different	Same	Same	Same	Same	Different	Different	Same	Same	40%
GC	US population BA-qualified ERAED	Same	Different	Same	Same	Different	Opposite	Different	Different	Same	Different	60%
COO	US population BA-qualified ERAED	Same	Same	Same	Same	Different	Different	Different	Different	Different	Different	60%
CHRO	US population BA-qualified ERAED	Same	Same	Different	Same	Same	Different	Different	Different	Different	Opposite	60%
CIO	US population BA-qualified ERAED	Same	Same	Same	Same	Different	Different	Different	Different	Different	Different	60%
CTO	US population BA-qualified ERAED	Same	Same	Same	Same	Different	Different	Different	Different	Different	Opposite	60%
Dissimilar inferences fraction		36%		5%		68%		100%		72%		58%

Color key:		Fractions:
Same	= Z_{ijk}[USPopRAED] ≥ 1.96 and Z_{ijk}[ERAED] ≥ 1.96 , or Zijk[USPopRAED] ≤ 1.96 and Zijk[ERAED] ≤ 1.96, or -1.96 < Zijk[USPopRAED] < 1.96 and -1.96 < Zijk[ERAED] <	42%
Different	= Z_{ijk}[USPopRAED] ≥ 1.96 and -1.96 < Z_{ijk}[ERAED] < 1.96, or when Z_{ijk}[USPopRAED] ≤ -1.96 and -1.96 < Z_{iik}[ERAED] < 1.96	50%
Opposite	= Z_{ijk}[USPopRAED] ≥ 1.96 and Z_{ijk}[ERAED] ≤ -1.96, or Z_{ijk}[USPopRAED] ≤ -1.96 and Z_{iik}[ERAED] ≥ 1.96.	8%

Figure 3

Panel A shows VIAF-based racial/ethnic densities (VRAEDs) of all executives in union of the random sample (RS) of US publicly traded firms and S&P 500® firms (SP) at 12/31/19, and the ERAED for White executives, by executive age in 5-year bins. ERAEDs are the expected TBQ-based labor supply densities derived from the RAEDs of seniors graduating from the top 100 US colleges & universities (per Ashkenas, Park and Pearce 2017) matched to the same year that each executive graduated. VRAEDs – ERAEDs are shown in panel B.

Panel A: VRAEDs of all RS + SP executives, and ERAEDs for White executives, by executive age in 5-year bins



Panel B: VRAEDs – ERAEDs of all RS + SP executives, by executive age in 5-year bins