

Benchmarking the racial/ethnic representation of executives in S&P 500[®] firms against the historical qualified labor supply

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Abstract

Racial/ethnic representation in U.S. corporate leadership is an important topic in academia and practice. Since profit-maximizing firms will seek to hire the most qualified candidates, and as corporate leadership develops over decades, we benchmark the racial/ethnic representation of S&P 500[®] executives against the racial/ethnic composition of the qualified labor supply at the time the executives were first hired, which for U.S. domestic executives we take to be the BA/BS graduating cohorts of the *New York Times* Top 100 U.S. colleges and universities plus two top HBCUs, matched to executive age. We show that when benchmarked in this way, the magnitudes of under- or over-representations across racial/ethnic groups are typically very much smaller than when the benchmark is the current U.S. population, and that at times inversions from racial/ethnic under-representation to over-representation and vice-versa occur across the two benchmarks. We conclude that our results do not support the view that inequitable hiring or promotion decisions by firms drive the U.S. population-benchmarked large over-representation of White and large under-representation of Black and Hispanic executives. We also suggest that social policy actions having to do with executive representation are likely to have the largest long-term results if they focus on current undergraduate and pre-college students, and if policy makers accept that the effects of such policy actions will likely take 20-40 years before they are seen in the racial/ethnic proportions of S&P 500[®] executives.

January 30, 2024

Keywords: Executives, race, ethnicity, representation, benchmarking, qualified labor supply
JEL classifications: A13, J01, J15, J29, M12
Data availability: The datasets generated and analyzed during the current study are available from mainly public sources.
Declarations of interest: None

* Corresponding author. The financial support of our respective business schools is greatly appreciated. We thank Gary Hoover, three anonymous referees, Peter Arcidiacono, Sreedhari Desai, Luca Flabbi, John Gallemlore, Stephen Glaeser, Brad Hendricks, Jeff Hoopes, Loukasz Langer, Dave Larcker, Bill Mayew, Hugh O'Neill, Paige Ouimet, Panos Patatoukas, Shiva Rajgopal, Richard Robb, Anywhere Sikochi, Young Soon, Suraj Srinivasan and workshop participants at UC Berkeley and UNC–Chapel Hill for their encouragement and/or helpful feedback on earlier versions of the paper. We are grateful to MaryKate Fitzpatrick for collecting executive photos from firms' websites and LinkedIn, Aurora D'Amico for gathering key NCEIPEDS data, and Kristy Honiotes of Crist | Kolder Associates for sharing their data on the racial/ethnic identities of CEOs and CFOs in the Fortune 500 and S&P 500[®]. Unless explicitly quotations from the work of others, all views expressed in the paper are ours, as are all errors.

1. Introduction and Summary of Results

The common view expressed by academics, activists, business leaders and commentators is that Black and Hispanic executives are greatly under-represented whereas White executives are greatly over-represented in the ranks of U.S firms, particularly in large public companies at the C-Suite level, and that this is evidence of passive and/or active racial/ethnic bias on the part of firms in their hiring and promotion decisions (Zimmerman 2010; Green, Holman and Paskin 2018; Chen 2020; Larcker and Tayan 2020).¹ However, the accurate evaluation of racial/ethnic representation requires an appropriate benchmark, an apples-to-apples yardstick against which racial/ethnic representation can be well measured and evaluated. If the benchmark is inappropriate, then assessments based on it are likely to be misplaced and/or flawed.

The dominant benchmark that has been used in academia and practice to evaluate the racial/ethnic representation of U.S. corporate executives is the U.S. population. We argue that the U.S. population is an inappropriate benchmark because it does not match in an apples-to-apples way with firms' economic incentives when they hire into their proto-executive pipelines, nor to the point in time when firms did such hiring, nor does it take into account that many firms are multinational and have in their executive ranks many who are not domestic U.S. individuals, who we define as those who have a U.S. BA/BS degree.

Based on these concerns, we propose and test an alternative benchmark to the U.S. population, one that reflects the racial/ethnic makeup of the qualified supply of proto-executives that was available to meet the demand from U.S. public companies at the point in time the proto-executives were likely hired, which for domestic executives we take to be when the BA/BS cohorts of the *New York Times* list of the Top 100 U.S. colleges and universities plus two top HBCUs graduated, matched to the age of the executive. Using this benchmark, we arrive at results as to the magnitudes and directions of racial/ethnic biases in firms that are frequently quite different to those of the common view. For example, when measured via our qualified proto-executive labor supply benchmark, we document that under- or over-racial/ethnic representations in domestic S&P 500[®] executives are typically much smaller than when they are measured via benchmarking against the U.S. population. We also observe certain directional reversals in under- vs. over-representations, such as that Asian executives become slightly under-represented and Black executives become slightly over-represented in domestic S&P 500[®] executives when our qualified labor supply benchmark is used instead of the U.S. population.

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."

We note that a key caveat to our focus on the racial/ethnic composition of the historical qualified supply of executive labor is that our benchmark does not capture under- or over-representation that existed before executives graduated with their BA/BS. It is also the case that because the time from initial hire to promotion to executive may take decades, a career can take complicated paths that are not captured by our benchmark. What our results most directly speak to is the selection by firms of individuals into their proto-executive pipelines when they graduate with their BA/BS, rather than other decisions such as hiring employees outside the qualified labor supply or the subsequent promotion or not of individuals.

The data we use consist of 6,931 executives who over the period June–August 2020 we identified were at S&P 500[®] firms. We select S&P 500[®] firms because they are large, globally important, and often the focus of societal attention. In contrast to prior studies that have relied on narrow definitions of who is an executive using only individuals at the very most senior levels of the firm (typically the five Named Executive Officers required to be disclosed by U.S. publicly traded firms in their SEC proxy statements), we define an executive as any individual who is publicly disclosed on the firm’s website as being on its leadership/management team. In judging an executive’s race or ethnicity, we studied their photo when available and their first and last names, ultimately classifying them into one of five racial/ethnic groups: American Indian/Alaska Native, Asian/Pacific Islander, Black, Hispanic, and White.² As European and non-European faces and names can sometimes appear to be similar to each other, we adjust for biases arising from our likely initially under-identifying non-White individuals and over-identifying White individuals by multiplying prima facie executive racial/ethnic densities (RAEDs) by adjustment factors that we separately calculate for Black, Hispanic and Asian executives, and then use only the adjusted RAEDs from this point on in our study.

We begin our empirical analyses by measuring the adjusted-RAEDs of our full set of 6,931 S&P 500[®] executives. In alphabetical order, they are: American Indian/Alaska Native 0.01%, Asian 7.6%, Black 3.9%, Hispanic 2.9%, and White 85.5%. We then compare these to the U.S. population benchmark as of the end of the prior year 2019. From U.S. Census data, we estimate that the 2019 U.S. population percentages are: American Indian/Alaska Native 1.0%, Asian 6.4%, Black 13.0%, Hispanic 18.5%, White 61.2%. After comparing the RAEDs of all our S&P 500[®] executives to those of the 2019 U.S. population, and using under-represented/over-represented to denote RAEDs that are significantly below/above the benchmark, we confirm the view that is commonly expressed by academics, activists, business leaders

² We employ these five racial/ethnicity categories in order 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 long historical window of time covered by our study. See Sections 2.2 and 3.2 for further details. For convenience only, because Pacific Islanders number very few in our data, from this point on we refer to Asian/Pacific Islander as “Asian”.

and commentators that Black and Hispanic executives are greatly under-represented in large U.S. public companies, while White executives are greatly over-represented.³

We then evaluate executive RAEDs against our top BA/BS qualified proto-executive benchmark, paying particular attention to the 1,628 S&P 500® executives for whom we can identify that they received their BA/BS from a U.S. college or university.⁴ We refer to such individuals as domestic executives, and to those who we can identify as having received their BA/BS from a non-U.S. college or university as foreign executives. For domestic executives we find that the results we obtain from using our top BA/BS qualified proto-executive benchmark are different from those using the U.S. population in two main ways.

First, the magnitudes of under- and over-representation that we observe using on our top BA/BS qualified proto-executive labor supply benchmark are typically much smaller than those based on using the U.S. population. Whereas for Asian, Black, Hispanic and White domestic executives the differences between their RAEDs and those of the U.S. population are -2.6%, -7.9%, -16.8% and 28.4%, respectively, the differences between these same executives' RAEDs and their top BA/BS qualified proto-executive RAEDs are -2.8%, 1.3%, -1.3% and 3.3%. Comparing across the two benchmarks, while the absolute magnitudes of under- and over-representation are essentially the same for Asian executives, those for Black, Hispanic and White executives are one sixth, one thirteenth and one ninth the magnitudes found when using the top BA/BS qualified proto-executive benchmark as compared to using the U.S. population.

Second, for some races/ethnicities we also observe directional shifts in whether they are under- vs. over-represented. Per the results above, in domestic executives Black individuals change from being materially under-represented by -7.9% when benchmarked against the U.S. population to being slightly over-represented by 1.3% using our top BA/BS qualified labor supply benchmark. When all executives as a set are benchmarked against the U.S. population, Black and Hispanic executives are greatly under-represented by -9.1% and -15.5%, and White executives greatly over-represented by 24.4%, whereas calibrated against our qualified labor supply benchmark the results are that Black and Hispanic executives are at-representation of 0.2% and 0.0%, and White executives are slightly under-represented at -1.0%.

After presenting additional findings, we seek to add to the ongoing debate on executive race and ethnicity by discussing some of the implications that we see our study as having for academics, practitioners and policy makers. For example, one implication we see is that our findings do not support

³ U.S. census data indicate that the RAEDs of the U.S. civilian workforce are similar to those of the U.S. population such that using the U.S. civilian workforce yields similar representation inferences to using the U.S. population. We also find that American Indian/Alaska Natives are under-represented, although the numbers involved are very small in magnitude.

⁴ We identify US-natives based on data from Revelio Labs. Due to Revelio's approach of collecting unstructured online public profiles, resumes and job posting, not by directly contacting individuals, we only have BA/BS degree data on a subset of 1,958 of our 6,931 executives (28%), the subset consisting of 1,628 domestic and 330 foreign executives.

the view that inequitable hiring or promotion decisions by firms drive the U.S. population-benchmarked large over-representation of White executives and under-representation of Black and Hispanic executives. An example of an important question that our study raises is: What will likely be racial/ethnic makeup of S&P 500[®] executives 10, 20 or 30 years into the future, and why? We suggest that one answer based on the results of our study is that social policy actions pertaining to equity in executive representation are only likely to have long-term effects if they focus on current undergraduates, not on those who are already well along in the executive pipeline, and only if policy makers accept that the effects of policy actions will take 20-40 years before they are seen in the racial/ethnic proportions of public company executives.

Overall, our study contributes to extant political and social discussions of unequal and inequitable representation in executive ranks by providing an appropriate, labor economics-based measure of the extent to which executive racial/ethnic representation in large U.S. firms differs from what was present in the qualified labor market at the time proto-executives were first hired by firms. We do so by filtering out those parts of executive racial/ethnic representations that are largely outside the firm's control, especially those that were in place prior to individuals graduating with their BA/BS. As such, our top BA/BS qualified labor supply benchmark may enable greater attention to be paid to understanding the size and causal determinants of what can be affected by the firm, such as, but not limited to, racial discrimination that may exist within the firm, and the fostering and development of proto-executive talent towards the goal of that talent assuming C-Suite level positions. At the same time, however, our results should not be misinterpreted as indicating that no racial bias and/or discrimination exists in firms' hiring or talent development decisions, and we leave investigations into these important decisions to future work.

2. Data

2.1 S&P 500[®] firms and executives

We gather executive race, ethnicity and other data on the firms that were in the S&P 500[®] Index at 12/31/2019. We follow the website-disclosure approach of Hunt, Layton, and Prince (2015) by defining an executive as any individual who is publicly disclosed by a firm to be on its leadership team, most often per the firm's website as of mid-2020.⁵ In the rare cases where no executives were found on the firm's website, we define a firm's executives as the employees listed on the firm's Bloomberg or Yahoo! Finance

⁵ Our approach differs from research that uses a broader set of firms but with a more limited set of executives (e.g., Guest 2017; Guo, Gupta, Jackson, and Mortal 2021). While a focus on only the most highly paid executives is important, we believe that often representation of executives is meant to refer to a broad set of executives. We therefore collect and use data from all executives who are available to us as researchers.

profile page, else the firm’s annual report, else (very rarely) judged from its comparably.com page.⁶ We capture 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 our data availability waterfall. Based on our definition of an executive and the availability of key data items, we arrive at a final set of 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 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, S&P 500[®] firms are most (least) dense in Finance and Business Equipment (Consumer Durables and Telephone & Television Transmission). Panel B shows that S&P 500[®] firms are profitable in terms of their gross margin %, ROE, ROA, and ROS. They are also somewhat levered.

Table 3 reports descriptive statistics for key executive characteristics using all the available data on each executive.⁸ Panel A indicates that S&P 500[®] firms have an average of 14.6 executives, with the median salary + bonus pay where data was available in the most recent prior fiscal year being \$2.4 million. Panel B reports that 78% (22%) of 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. However, Presidents are also common, as are GC/CLOs, Corporate Secretaries (who are often the same person as the GC), CHROs, and COOs. As of mid-2020, the number of Chief DEI (Diversity/Equity/Inclusion) Officers in S&P 500[®] firms was 19. In terms of seniority, the most senior level of Senior EVPs/EVPs slightly outnumber SVPs, who in turn outnumber VPs.

2.2 *Executive race/ethnicity*

In judging an executive’s race/ethnicity, we follow Hunt, Layton, and Prince (2015) by visually studying each executive’s photo and first and last names, and then classifying them into nine granular categories. With our lowercase tag for each category shown in parentheses, the categories 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 only diverge from Hunt, Layton, and Prince (2015) by redefining their Other category into either Pacific Islander (pi) or Alaska Native (an). To ensure as much consistency as possible, all race/ethnicity judgments were made by one coauthor.

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.

As the data we use in seeking to benchmark executive RAEDs come from the National Center for Educational Statistics' Integrated Postsecondary Education Data System (IPEDS), and IPEDS used five racial/ethnicity categories during the time period pertinent to our study (outside of Nonresident aliens, who we set aside), we collapse our initial nine race/ethnicity categories into IPEDS' five categories. With our lowercase tag for each broader category in parentheses, the IPEDS categories are American Indian/Alaska Native (aian), Asian/Pacific Islander (api), Black (b), Hispanic (h) and White (w), where $aian = ai + an$, $api = ea + sa + pi$, $b = aa$, $h = lat$, and $w = eur + ne$. IPEDS' categories closely match those used for U.S. executives in Hunt, Prince, Dixon-Fyle, and Yee (2018), Dixon-Fyle, Hunt, Dolan, and Prince (2020), and Dixon-Fyle, Hunt, Huber, del Mar Martinez Marquez, Prince, and Thomas (2023).

The strength of our method of classifying an executive's race/ethnicity based on their photo and first and last name(s) is that we obtain race/ethnicity estimates for 7,246 executives. However, because we do not employ in-depth biographical analysis of each executive, our approach is likely to undercount non-White individuals, mainly because Hispanic and European faces and names can be quite similar. We therefore calculate Visual Identification Adjustment Factors (VIAFs) so as to de-bias the numbers and densities of our prima facie judged races/ethnicities of executives. We estimate VIAFs for Asian, Black, and Hispanic executives, set the VIAF for American Indians/Alaska Natives at 1.0, and treat the VIAF-based number of White individuals as the plug. The executive-level data we use to calculate the VIAFs was provided by Crist|Kolder Associates from their 2020 Volatility Report. Crist|Kolder's data consist of the first and last names of all the CEOs and CFOs that they 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 Crist|Kolder's classification of the CEO's or CFO's race or ethnicity. Our approach to calculating VIAFs uses only the subset of Crist|Kolder's firms that are also in our database of S&P 500® firms, and only those CEOs and CFOs that both we and Crist|Kolder identify. We assume that Crist|Kolder's racial/ethnic identifications are the gold standard unless proved otherwise as in their identification process they go 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 Crist|Kolder agree on the coding. Where our coding of an executive's race or ethnicity differed from that of Crist|Kolder, we researched biographical and other sources to cross-check on Crist|Kolder's coding. Then, to use Asian/Pacific Islander (api) as the example, we calculate $VIAF_{api}$ as the ratio of the number of CEOs + CFOs that Crist|Kolder 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 Crist|Kolder correctly coded as api versus incorrectly coded as api, and the number of CEOs + CFOs that Crist|Kolder correctly coded as api. Similar calculations were performed for Black

and Hispanic executives. The resulting Visual Identification Adjustment Factors are $VIAF_{aian} = 1.00$, $VIAF_{api} = 1.073$, $VIAF_b = 1.100$, and $VIAF_h = 1.345$.⁹ $VIAF_h$ is larger than both $VIAF_{api}$ and $VIAF_b$ because Hispanic and European faces and names not infrequently are similar, leading U.S. 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 then apply the VIAFs to all our executive RAEDs.¹⁰ From this point on, the RAEDs we refer to and use in our empirical analyses are those that have been multiplied by their VIAFs.

Table 4 presents a detailed view of the raw and VIAF-based numbers and densities of executives. The top half of each panel classifies executives by the nine race/ethnicity categories of Hunt, Layton, and Prince (2015), and the bottom half by the five IPEDS race/ethnicity categories. For the 6,931 executives in our set of S&P 500® firms, panel A presents the proportions of executives classified using the granular categories of Hunt, Layton and Prince (2015). Collapsing these into those used by IPEDS, panel B reveals that the RAEDs for executives as a whole are: American Indian/Alaska Native 0.01%, Asian 7.6%, Black 3.9%, Hispanic 2.9% and White 85.5%. RAEDs do vary substantially across Chief position, in that Asian individuals are most/least dense in CTOs/Chief Accounting Officers, Black individuals are most/least dense in Chief Diversity, Equity & Inclusion Officers/CTOs, Hispanic individuals are most/least dense in Chief Diversity, Equity & Inclusion Officers/CIOs, and White individuals are most/least dense in the CFO/Chief Diversity, Equity & Inclusion position. In contrast, much less variation in RAEDs is seen across the ranks of SEVP/EVP, SVP and VP.

3. Top U.S. BA/BS-qualified executive labor supply racial/ethnic benchmark

3.1 Rationale and description

The dominant benchmark that has been used in academia and practice to evaluate the racial/ethnic representation of U.S. corporate executives is the U.S. population. We argue that the U.S. population is an inappropriate benchmark for evaluating the RAEDs of executives in U.S. publicly traded firms because it does not match in an apples-to-apples way with firms' economic incentives when they hire into their proto-executive pipelines, nor to the point in time when firms did such hiring, nor does it take into account

⁹ A full description of the calculations behind each VIAF is provided in Appendix B.

¹⁰ As a potential validation check on our VIAF-based RAEDs, we also obtained race/ethnicity estimates at the executive level from List Service Direct. List Service Direct uses a person's names to estimate their race/ethnicity. However, similar to other studies that have used List Service Direct (Brochet et al. 2019; Flam et al. 2020), we find that while our RAEDs for aian, api, and h are close to the RAEDs obtained from List Service Direct, List Service Direct's RAED for b (0.8%) is far smaller than is our VIAF-based RAED for b (3.5%). This is because many Black and White names are not distinguishable, leading List Service Direct to underidentify (overidentify) the number of Black (White) individuals.

that numerous firms are multinational and have in their executive ranks many who are not domestic U.S. individuals, who we define as those who have a U.S. BA/BS degree.

We therefore propose and test an alternative benchmark to the U.S. population that is designed to reflect the racial/ethnic makeup of the qualified supply of proto-executives that was available to meet the demand for such individuals from U.S. public firms when the proto-executives were likely hired, which for domestic executives we take to be when the BA/BS cohorts of the *New York Times* list of the Top 100 U.S. colleges and universities plus two top HBCUs graduated, matched to the age of the executive. Our qualified labor supply benchmark seeks to address the weaknesses of the U.S. population benchmark in two key ways. First, our benchmark captures the economic reality that the demand for executive talent by profit-maximizing U.S. public companies makes it unlikely that they will hire in a simplistically proportional manner from the current U.S. population. Instead, with a 20-40 year horizon in mind, they will seek to hire into their proto-executive pipelines the academically most qualified college graduates, then develop their leadership skills so that 20-40 years later they are ready to assume C-Suite level positions. Second, U.S. publicly traded firms are often multinational and operate in countries all around the world, not just in the U.S. As such, the racial/ethnic composition of their executives is likely to tilt towards being global rather than reflecting only the racial/ethnic composition of the U.S. population. These differences may also be magnified by systematic variation in racial/ethnic compositions across the working vs. non-working segments of the populations of many countries.¹¹ Given that our measure of the qualified labor supply of proto-executives is based on only U.S. colleges and universities, we therefore focus most in our empirical analyses on the executives for whom we are able to identify that they received their BA/BS degree from a U.S. college or university.

3.2 *Top BA/BS qualified labor supply*

The *New York Times* Top 100 U.S. colleges and universities consists of a broad set of 58 large public flagship schools (one per state, plus an additional eight from California), plus 42 private schools.¹² The 58 public schools account for 82% of the 218,716 graduating seniors in the *New York Times*' list in

¹¹ For example, 33% of people in India are aged 18 or under as compared to 22% in the U.S.

¹² A full description of the *New York Times*' Top 100 U.S. 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 *New York Times*' Top 100 rather than, for example, the top 100 colleges and universities in the prominent *U.S. News & World Report*'s rankings of the Best U.S. Colleges and Universities because the colleges and universities in the latter tilt more heavily toward smaller private institutions (63% for *U.S. News & World Report* versus 42% for the *New York Times*). In our judgment the *U.S. News & World Report* top 100 U.S. colleges and universities moves away from, rather than toward, obtaining a qualified proto-executive labor supply measure that accurately reflects the size of the pool of academically qualified undergraduates whom we posit firms are most likely to seek to hire with a view to building their pipeline of future executives.

1987 and 84% of the 300,308 in 2008; these degrees comprise 22.8% (19.8%) of all bachelor's degrees conferred by postsecondary U.S. institutions in 1987 (2008), excluding degrees conferred to nonresident aliens. We add all the graduating seniors from the two Morehouse/Spelman brother/sister top HBCUs to the *New York Times* list to recognize that top HBCUs represent a source of qualified proto-executive labor supply that for historical reasons related to racial discrimination against Black individuals is outside the set of the *New York Times*' top colleges and universities.¹³ We refer to the *New York Times* list plus the 2 top HBCUs as the NYT+ list.¹⁴

We obtained the numbers and races/ethnicities of the graduating cohorts in each college and university in the NYT+ list for 1987–2022 from the IPEDS database, enabling U.S. to compute the RAEDs for each year. They are shown in solid lines in Figure 1, and in the unshaded rows of Table 5. Because the median executive graduated from college in 1988, and IPEDS data are unavailable before 1987, we estimate the annual RAEDs of graduating seniors in the NYT+ list in 1971–1986 using straight-line backwards-in-time extrapolation as described in the heading to Figure 1. The resulting estimated annual RAEDs for 1971–1986 are shown in dashed lines in Figure 1 and in the tan-shaded area in Table 5.

By design, we then match S&P 500® executives to the top U.S. college and university graduates who were in the same talent pool as the executive per the NYT+ list based on their age. For example, if a given executive is aged 60 in 2020, we assume they graduated with their BA/BS in 1982, and we define the racial/ethnic densities of the graduating cohorts in the set of colleges and universities in the NYT+ list in 1982 as the executive's qualified labor supply-based expected RAEDs, which we denote by ERAEDs.

We arrived at each executive's age in three stages. First, for those S&P 500® 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.¹⁵ Second, we were able to identify the true age of 2,234 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

¹³ In Appendix E we present evidence that we interpret as indicating that the *New York Times* list is a good proxy for the set of colleges and universities that supply proto-executive talent to S&P 500® firms.

¹⁴ An important caveat to our choice of NYT+ list of colleges and universities is that companies in the S&P 500® may have viewed a more selective list of U.S. colleges and universities than these as supplying qualified candidates. Using a more selective list may alter the racial/ethnic composition of what we infer to be the pool of qualified candidates. Alternatively, companies may have viewed a broader list as supplying qualified candidates and the same issue applies. By using the broad NYT+ set of colleges and universities that represent a large population of graduating BA/BS students, we seek to capture a representative set of the qualified labor supply. A similar caveat is that our qualified labor supply benchmark assumes that the primary supply of executive talent comes from U.S. colleges and universities. If the pool of potential executive talent comes from a population outside of those graduating from a U.S. college or university, the racial/ethnic composition of the qualified labor supply may differ from the one we put forward.

¹⁵ All age judgments were made by the same coauthor who made all of the judgments about executive race/ethnicity.

characteristics, enabling U.S. to use the estimated regression parameters to calculate improved estimates of the ages of executives for whom we only have a judged age.¹⁶ 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

In Table 6, we report the results of benchmarking the racial/ethnic representations of executives in S&P 500[®] firms in 2020. We begin in panels A.1 and A.2 by benchmarking executive RAEDs against the U.S. population versus their qualified labor supply ERAEDs. With the difference between RAEDs and the U.S. population or ERAED benchmarks presented in parentheses, two main results stand out.

First, per panel A.1, Black (-9.1%) and Hispanic executives (-15.5%) are greatly under-represented whereas White executives are greatly over-represented (24.4%) when the RAEDs of S&P 500[®] executives are benchmarked against the end of 2019 U.S. population. Asian executives are slightly over-represented (1.3%).¹⁷ These findings confirm the predominant view held by academics, activists, business leaders and commentators that Black and Hispanic individuals are greatly under-represented whereas White individuals are greatly over-represented in the ranks of U.S. corporate executives in large U.S. public companies. Second, per panel A.2, when benchmarked against the qualified labor supply ERAEDs metric, Black and Hispanic executives in S&P 500[®] companies are statistically at their qualified labor supply ERAEDs, not over- nor under-represented (0.2% and 0.0%). Asian executives are slightly over-represented (1.3%) and White executives are slightly under-represented (-1.0%).

The results in panel A therefore seem to indicate that [1] the benchmark against which executive racial/ethnic proportions are benchmarked greatly affects the inferences made as to which races/ethnicities are under-, at- or over-represented, and [2] qualified labor supply ERAEDs come close to matching the actual mid-2020 proportions of races/ethnicities present in S&P 500[®] firms. We caution, however, that the ERAED to RAED comparison in panel A.2 is not an apples-to-apples one—because the global nature of S&P 500[®] firms means that their executives are unlikely to be 100% domestic, viz. executives who received their BA/BS from a U.S. college or university. Consequently, whereas ERAEDs are based solely on domestic executives, RAEDs are based on a combination of domestic and foreign executives. As such, the results in panel A.2 are an example of the argument we put forward in Section 1 that the accurate evaluation of racial/ethnic representation requires a carefully appropriate benchmark, a tight apples-to-

¹⁶ A full description of our approach and our regressions is provided in Appendix F.

¹⁷ We use the terms under-represented and over-represented to denote representations that are statistically significantly greater than and less than the benchmark that is being applied, respectively. We use the term at-representation to denote representation that is not statistically significantly different to the benchmark to which it is being applied.

apples yardstick against which racial/ethnic representation can be well measured and evaluated, and that if the benchmark is inappropriate then assessments based on it are likely to be misplaced or flawed.

We proceed to obtain an appropriate apples-to-apples benchmarking of RAEDs with ERAEDs by redoing the calculations in panel A but using only U.S. domestic executives who we are confident in identifying as domestic, per our definition of having obtained their BA/BS from a U.S. college or university, using data obtained from Revelio Labs. Revelio collects a wide variety of HR-oriented data on private and public entities and sells it to investors, corporate strategists, HR teams and governments. However, since the data Revelio collects comes mainly from unstructured online public profiles, resumes and job postings, rather than through direct contact with individuals, Revelio has U.S. vs. non-U.S. BA/BS degree data on only 1,958 of our 6,931 executives, 1,628 of whom are domestic and 330 are foreign. As Revelio's data collection approach might inadvertently lead to race/ethnicity-based biases, before using the data we assess whether there are material differences between the RAEDs of the full set of 6,931 executives and the subset of 1,958 executives for whom Revelio has U.S. vs. non-U.S. BA/BS degree data. The results in panel B of Table 6 indicate that this is not the case in that there are no statistically significant differences between the RAEDs of all 6,931 executives and the RAEDs of the 1,958 executives for whom Revelio has U.S. vs. non-U.S. BA/BS degree information.

Panel C of Table 6 then reports the results of repeating the analyses done in panel A but restricted to the 1,628 identified domestic S&P 500[®] executives. We highlight four findings from these tests, the first of which is that panel C.1 indicates that similar to the results in panel A.1 based on using all executives, when the RAEDs of only domestic executives are benchmarked against the U.S. population, Black (-7.9%) and Hispanic executives (-16.8%) are greatly under-represented while White executives are greatly over-represented (28.4%). Second, however, per panel C.1 using only domestic executives Asian executives are moderately under-represented in domestic executives (-2.6%) whereas per panel A.1 using all executives they are slightly over-represented (1.3%).

Third, when domestic executives are calibrated against our qualified labor supply benchmark, none of the inferences as to which races/ethnicities are under-, at- or over-represented are the same in panel C.2 as in panel A.2. Thus, whereas for all executives per panel A.2 Asian executives are slightly over-represented (1.3%), Black and Hispanic executives are at-benchmark-represented (0.2% and 0.0%) and White executives are slightly under-represented (-1.0%), in panel C.2 for domestic executives only, Asian executives are moderately under-represented (-2.8%), Black executives are slightly over-represented (1.3%), Hispanic executives are slightly under-represented (-1.3%) and White executives are moderately over-represented (3.3%).

Fourth, these results therefore indicate that simultaneously changing the set of executives who are calibrated and the benchmark against which they are calibrated from all executives benchmarked against the 2019 U.S. population per panel A.1 to only domestic executives benchmarked against our qualified labor supply ERAEDs metric per panel C.2 inverts the slight over-representation of Asian executives into moderate under-representation (1.3% to -2.8%) and the substantial under-representation of Black executives into slight over-representation (-9.1% to 1.3%). It also lowers the substantial under-representation of Hispanic executives into slight under-representation (-15.5% to -1.3%) and the very large over-representation of White executives to moderate over-representation (24.4% to 3.3%).

In light of the potentially surprising nature of the results just described, we explore the source(s) of the under- to over- and over- to under- representation inversions and changes in the magnitudes of under- and over-representation by evaluating the relative contributions of the U.S. population vs. qualified labor supply ERAED benchmarks, and whether the executives are domestic or foreign. We find that both the benchmark that is applied and the set of executives to whom it is applied matter and contribute.

We assess the effect of the benchmark by keeping the set of executives who are benchmarked to U.S. domestic executives (panel C), and then comparing under-, at- and over-representations across the U.S. population (panel C.1) versus ERAED (panel C.2) benchmarks. The results indicate that while there is no difference in the magnitudes of under-representation in Asian executives, going from the U.S. population benchmark to the ERAED benchmark inverts large Black executive large under-representation (-7.9%) to slight over-representation (1.3%), and greatly reduces the magnitude of under-representation in Hispanic executives (-16.8% to -1.3%) and over-representation in White executives (28.4% to 3.3%).

Next, we assess the effect of whether the executives being benchmarked are domestic or foreign in two ways. First, we keep the benchmark applied to ERAEDs and compare under-, at- and over-representations across domestic executives (panel C.2) versus foreign executives (panel D). The results of doing this show that all of the under- or over-representations seen in domestic executives when RAEDs are calibrated against ERAEDs invert when ERAEDs are applied to only domestic executives. Thus, comparing domestic with foreign executives by moving from panel C.2 to panel D, the moderate under-representation of Asian executives (-2.8%) inverts to large over-representation (17.9%), the slight over-representation of Black executives (1.3%) inverts to slight under-representation (-1.7%), the slight under-representation of Hispanic executives (-1.3%) inverts to moderate over-representation (2.7%), and the moderate over-representation of White executives (3.3%) inverts to large under-representation (-18.4%). Second, we compare the differences between RAEDs and ERAEDs across domestic-only versus foreign-only executives. These results are shown in panel E and they indicate that the largest differences pertain to Asian and White executives, in that Asian executives are far less represented in domestic executives

[3.8%] than they are in foreign executives [24.4%], whereas White executives are materially more represented in domestic executives [89.5%] than they are in foreign executives [67.9%].

Taken together, the analyses described above indicate that the under- to over- and over- to under-representation inversions and the changes in the magnitudes of under- and over-representations found across panels A.1 and C.2 are due both to differences in the benchmark used and to differences in the domestic versus foreign status of the executive to whom the benchmark is applied. As such, these results reinforce a key message of our paper, namely that inferences made about whether and by how much a given race/ethnicity is assessed as being under-, at- or over-represented can and frequently does depend on both the benchmark used and the degree to which the benchmark appropriately matches in an apples-to-apples manner against what is being benchmarked.

5. Discussion

Racial/ethnic representation in U.S. corporate leadership is an important matter in academia and business practice. However, any assessment about whether and to what degree a demographic group is under-represented or over-represented is necessarily based on a reference point or benchmark, the benefit of which comes with the cost/risk that once the benchmark is established and widely held, it becomes institutionalized and may subsequently elude close scrutiny and re-evaluation. We suggest that this has occurred in the dialogue surrounding top executive racial/ethnic representation in U.S. firms where the dominant, if not only, benchmark used is the current U.S. population. This is problematic in that research in the area of managerial careers shows that CEO appointments are preceded by numerous selection and promotion decisions that are made over previous decades (Dalton 1951, Briscoe and Kellogg 2011).

By focusing on initial career selection via our assumption that when an individual is appointed to the upper echelons of a firm, he/she was selected from a cohort of top BA/BS-qualified individuals who entered the labor pool at the same time as the executive some 20 - 40 years earlier, we have proposed an alternative benchmark to the current U.S. population that explicitly seeks take into account key aspects of the historical, international and organizational labor supply/demand factors that we argue should and do affect executive racial/ethnic representation in U.S. firms. As such, our study contributes to the debate on executive race and ethnicity not only through its empirical findings, but also through the implications we see it as having for academia and business. We enumerate several of these below, emphasizing that our goal is to put forward a set of challenging, different and even competing perspectives, all of which we hope benefit from connecting to our top BA/BS qualified labor supply framework.

1. Our qualified labor supply findings suggest that the dynamics of racial and ethnic representation in executives are related to both supply side and demand side factors (Fernandez-Mateo and Fernandez, 2016). From the supply side of the labor market, when firms hire highly qualified proto-executives

as they graduate from their BA/BS programs, the number and racial composition of proto-executives available to firms is partially constrained. Firms do not decide which students are accepted to the top educational institutions, nor which students continue to matriculate through the program and graduate. However, firms do have control over which educational institutions to search over and target for their hiring. To the extent that firms continue to hire from colleges with RAEDs that differ from the general population, they play a role in the differences in representation between executive RAEDs and U.S. population RAEDs. On the demand side of the labor market, firms have a degree of control over the racial/ethnic composition of the individuals they select to hire. In our analysis, we attempted to isolate, through our calculation of RAED – ERAED, the portion of executive RAEDs that is more squarely within the firm’s human capital selection function as opposed to its search function. This leads us to propose that our qualified labor supply approach may enable greater future attention to be paid to understanding the size and determinants of any racial discrimination that may exist in firms, as well as the impartial fostering and development of executive talent.¹⁸

2. Matching as it does to executive age, our qualified labor supply benchmark accommodates the fact that the racial/ethnic background of top undergraduates has substantially and systematically changed over the past 50 years (see 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 inappropriate to benchmark the density of, say, Hispanic CEOs in 2019 against the density of Hispanic individuals in the 2019 U.S. population because the fraction of seniors graduating from top U.S. colleges and universities in 1987 who were Hispanic was far smaller than is the fraction of Hispanic individuals in the 2019 U.S. population or seniors graduating in 2019 from the top 100 U.S. colleges and universities. In this sense, we propose that, defined with regard to comparisons made against the U.S. population, there does exist what is sometimes referred to as a “pipeline problem” with regard to non-Asian non-White individuals—primarily Black and Hispanic—both in the domain of C-suite executives such as CEOs as well as other ranks or groups of executives (Mac Donald, 2020).
3. Taking a qualified labor supply benchmark perspective suggests that a rapid resolution of the pipeline problem is unlikely to be feasible for two reasons. First, based on the historical criterion of graduating with a BA/BS from a highly-ranked college or university, the large supply of executive-qualified Black and Hispanic individuals that would be required to rapidly solve the pipeline problem likely does not currently exist. Per panel A.1 of Table 6, the ratios of the densities of Black and Hispanic individuals in the U.S. population to those in our S&P 500[®] dataset are 3.3 and 6.4, respectively—far higher than 1.0 (see Gayton 2021 and Epstein 2021 for differing perspectives in the context of corporate legal work). Second, rapid and widespread promotions of American Indian/Alaska Native, Black and Hispanic individuals who do not have the top BA/BS qualifications or credentialing that are likely needed to successfully move into executive positions to the degree required to remove existing under-representation may impose net costs on firms, such as firm-value-reducing financing, investing, and/or operating decisions that could accrue if firms have individuals who are not part of the qualified labor supply in C-suite or other leadership positions.
4. Does the pure passing of time help fix the pipeline problem that is highlighted by the qualified supply benchmark? We suggest Yes and No. On the side of Yes is that all else held equal it seems likely that the very different RAEDs of the graduating cohorts of proto-executives from top U.S. colleges

¹⁸ In recognition of the potential that firms may have to exert longer-term influence on the racial/ethnic composition of the supply of proto-executive talent facing them, some firms have begun to support 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/>.

and universities in 2019 as compared to those in 1980 per Figure 1 are likely to ‘naturally’ make their way over time through the corporate hierarchy. On the No side of the coin there are three limitations to mention. First, 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 U.S. colleges and universities differ from those of the U.S. population in material ways. For example, in the group of seniors graduating from the top 100 U.S. colleges and universities, American Indian/Alaska Native, Hispanic, and Black individuals are currently under-represented relative to the U.S. population by 0.7%, 7.6%, and 6.2%, respectively, and Asian and White individuals are over-represented by 9.1% and 4.0%, respectively. As such, social policy actions having to do with equity in executive representation are likely to have larger long-term effects if they focus on current undergraduates and pre-college students, and if policy makers accept that the effects of policy actions will take 20-40 years before they are seen in the racial/ethnic proportions of executives. Third, given that the racial/ethnic makeup of top undergraduates has substantially and systematically changed over the past 50 years (Figure 1), there is no reason to think that it will not also substantially change over the next 50 years. However, without knowing how it will change, there is no guarantee that the pure passing of time will help fix the pipeline problem highlighted by the qualified supply benchmark.

5. Prior research into leaders of S&P 500[®] firms has studied their impacts on firm policies (Bertrand and Schoar, 2003), managerial style (Fee, Hadlock and Pierce, 2013), overconfidence and investment (Malmendier and Tate, 2005) and systematic risk (Schoar, Yeung and Zuo, 2020). Future research could examine whether, to what degree and why the over- or under- racial/ethnic representation of corporate executives based on our qualified labor supply framework and benchmarking contributes to or is different from the effects of other executive characteristics on corporate decision making.
6. A qualified labor supply approach could also be applied to corporate boards in that board members could be classified into racial/ethnic groups and have their RAEDs historically benchmarked against the U.S. population and the RAEDs of top U.S. colleges and universities based on Board member age.
7. A qualified labor supply approach could also be applied to the gender representations of executives. Such an approach might start with the gender densities of the cohorts of seniors who graduated with a BA/BS from the top U.S. colleges and universities, or it could focus on seniors graduating with a business major and/or individuals graduating with an MBA or other professional qualification(s). Given that the median executive age of 54 in our data points to a median executive BA/BS graduation year of 1987 (panel E of Appendix F), and given that women earned 47% of bachelor’s and 33% of U.S. master’s degrees in business and management conferred in 1986–1987,¹⁹ after taking into account child-care-based departures from the workforce, a qualified labor supply benchmark might arrive at a lower level than the commonly presumed and/or argued-for level of 50%.
8. Our qualified labor supply benchmark approach has focused on comparing unconditional differences between executive RAEDs, the U.S. population, and qualified labor supply ERAEDs. Future studies might extend our analyses by examining the degree to which unconditional inferences about under-, at- and over-representation across executive race/ethnicity are affected if conditioning factors 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) were included. Such conditional analyses might also be able to separate under-versus over-representation into two components: One that is informative about “mismatch”, the degree to which outcomes for minority BA/BS graduates may be worse as a result of attending a top U.S.

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

college or university (Arcidiacono et al., 2011), and a second separate component that speaks to the degree of racial bias or discrimination that occurs within a firm after a proto-executive is hired.

9. Lastly, the economic labor demand vs. supply underpinning of our qualified labor supply benchmark may suggest 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, we argue that the word ‘diversity’ is rarely defined in a way that facilitates quantitative benchmarking, analysis or critique. A notable exception to this 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 apparent correlations between their samples’ firms’ financial performance over years t-3 thru t-1 and the subsequent racial/ethnic diversity in their executives measured at the end of year t. For firm *j*, McKinsey defines *DIV_McK* as: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 the $i = 1$ to N races/ethnicities used in classifying executives. This is problematic in that neither the U.S. population nor the U.S. 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 Bermiss, Green and Hand (2023), denoted *DIV_QLS*, that maximizes when executive RAEDs match qualified labor supply ERAEDs:²²

$$DIV_QLS_j = 1 - \sum_{i=1}^N (RAED_{ij} - ERAED_{ij})^2 \quad (2)$$

Since ERAED conditionally flexes to take into account the key supply and demand features of a given labor market, *DIV_QLS* or a similar metric could be used to quantitatively measure the degree of racial/ethnic diversity in a variety of private and/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 a normative goal such as attaining U.S. population representation among a firm’s executives.

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 with the same RAEDs as the U.S. population is no more diverse than a firm with the same RAED percentages but that are 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 U.S. population 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_QLS* per equation (2) is intended to be illustrative not definitive. 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.

6. Limitations and cautions

As with any study, ours comes with limitations and cautions. First, while our aims have been to critique the validity of the U.S. population as a benchmark in providing evidence of passive and/or active racial/ethnic bias by firms in their hiring and promotion decisions, and to propose and empirically evaluate a method of measuring and more appropriately benchmarking the racial/ethnic densities of executives in the S&P 500[®] in a way that is grounded in labor demand/supply economics, we make no claim that our top BA/BS qualified labor supply benchmark is ‘the best’ that could be developed or that the results we obtain automatically generalize beyond the convex hull of our data. Similarly, our qualified labor supply benchmark does not apply to evaluating the representation of individuals before they enter college.

Second, as we study only S&P 500[®] firms and only as of mid-2020, our results do not necessarily or automatically speak to small public firms, start-ups, established private firms, non-U.S. firms, partnerships or governmental entities, non-profit entities, or to years before or after mid-2020. Each of the aforementioned types of organization likely warrant their own cross-sectional as well as intertemporal analyses, as do other time periods, and we encourage others to pursue such research.²³

Third, the measures of race/ethnicity that we employ are subjectively coded and are thus may contain inaccuracies and/or errors. This is unavoidable outside of obtaining self-reported identification from every executive, which is infeasible if not impossible. While we make no claim to perfect accuracy, we did undertake a number of steps to arrive at executive race/ethnicity classifications that are of high quality. Future research may wish to explore alternative methods of classifying the race/ethnicity of large numbers of executives, such the DeepFace facial recognition system created by a research group at Facebook that uses digital images of human faces to make predictions about age, gender, facial expression and race/ethnicity.

Lastly, the focus of our study has been on benchmarking the racial/ethnic diversity of executives. Our results do not therefore necessarily extrapolate to outcomes connected to the racial/ethnic diversity of other stakeholder groups such as middle managers, front-line employees, and boards of directors. Future research could combine data on executive racial/ethnic diversity with similar types of diversity data in other stakeholder groups to assess if our results for executives generalize to these groups.

²³ In unreported analyses, we repeated our benchmarking approach to a random sample of U.S. public companies, and arrive at similar inferences—namely, that the magnitudes of over/under-representation among executives is smaller using our qualified labor supply benchmark than when using the U.S. population benchmark and that some inferences as to which races/ethnicities are under-, at- or over-represented change.

7. Conclusions

In this study we have proposed and developed an economically appropriate benchmark against which to measure and evaluate racial/ethnic representation in executives by starting from the proposition that the appropriate benchmarking of racial/ethnic representation requires that it be done in an apples-to-apples manner where the benchmark used matches tightly to what is being benchmarked. This does not happen when the U.S. population is the benchmark that is applied to the executives in U.S. companies, particularly those in large public firms such as the S&P 500[®], because the racial/ethnic characteristics of the U.S. population differ substantially from those of these executives. Instead, we put forward a qualified labor supply alternative benchmark that we argue more appropriately accounts for key features of the historical labor market supply pipeline of qualified U.S. domestic proto-executive talent, who we define to be the graduating cohorts of BA/BS undergraduates from top U.S. colleges and universities.

Using S&P 500[®] firms in 2020, we then empirically showed that whether and the degree to which a particular race/ethnicity is under-, at- or over-represented in executives often depends on the benchmark used and the extent to which the benchmark matches in an apples-to-apples manner with what is being benchmarked. Thus we find that while Black and Hispanic executives are greatly under-represented and White executives greatly over-represented amongst S&P 500[®] executives when the benchmark used is the entire U.S. population, when the benchmark used is the historical qualified labor supply of proto-executive talent matching to the age of the executive being benchmarked, such as for domestic executives, the racial/ethnic composition of individuals graduating from the top U.S. colleges and universities in the same year as the domestic executive, Asian and Hispanic executives are slightly under-represented while Black and White executives are slightly over-represented.

We see our results as indicating that both positive-economics-based analyses of and normative prescriptions about U.S. racial/ethnic challenges and opportunities are likely to be misplaced or erroneous if they base their conclusions solely on the magnitudes of under/over-representations measured through benchmarking racial/ethnic proportions against those of the U.S. population. We emphasize, however, that our results do not suggest or imply that no racial bias and/or discrimination can or does exist in firms' hiring or talent development (Bertrand and Mullainathan 2004, Carlsson and Rooth 2007, Méon and Szafarz 2011, Borowczyk-Martins, Bradley and Tarasonis 2018). Rather, we see our study as showing that the choice of benchmark against which to evaluate executive racial/ethnic representations matters to inferences, and at times a great deal. We see this as worthy of being highlighted because the under-representation of a given race or ethnicity in firms' employees based on benchmarking against the U.S. population is often taken as indicating the presence of passive and/or active racial/ethnic bias on the part of firms in their hiring and promotion decisions against that race/ethnicity, and as such often substantially

influences public narratives and policy prescriptions. Our hope is that by measuring, benchmarking, and comparing executive RAEDs in a qualified labor supply manner such as that we have proposed and empirically evaluated, richer and deeper understandings can be gained by academics and better decisions can be made by executives, firms, journalists, politicians, policy makers, and regulators about the important issues surrounding race and ethnicity in companies, not only in the U.S. but around the world.

Declarations

- Ethical Approval and Consent to participate:
Not applicable.

- Human and Animal Ethics:
Not applicable.

- Consent for publication
Is hereby provided by all three authors.

- Availability of supporting data:
The datasets generated and analyzed during the current study are available from mainly public sources.

- Competing interests:
None.

- Funding:
None beyond the general not-project-specific research budgets provided to each author by his respective business school.

- Authors' contributions:
Sekou Bermiss, Jeremiah Green and John Hand each contributed to the conception or design of the study, the acquisition, analysis, or interpretation of its data, and the writing of the text.

- Acknowledgements:
We thank Peter Arcidiacono, Sekou Bermiss, Sreedhari Desai, Luca Flabbi, John Gallemore, Stephen Glaeser, Brad Hendricks, Jeff Hoopes, Loukas Langer, Dave Larcker, Bill Mayew, Hugh O'Neill, Paige Ouimet, Panos Patatoukas, Shiva Rajgopal, Richard Robb, Anywhere Sikochi, Young Soon, Suraj Srinivasan and workshop participants at UC Berkeley and UNC–Chapel Hill for their encouragement and/or feedback. We are also grateful to MaryKate Fitzpatrick for collecting executive photos from firms' websites and LinkedIn, Aurora D'Amico for gathering key NCES IPEDS data, and Kristy Honiotes of Crist | Kolder Associates for sharing their data on the racial/ethnic identities of CEOs and CFOs in the Fortune 500 and S&P 500[®]. Unless explicitly quotations from the work of others, all views expressed in the paper are ours.

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Appendix A

This appendix presents screenshots of the raw firm and executive data items for three example firms in the S&P 500® as of mid-2020 dataset, along with an explanation of what each data item means, how it was collected, and how it was coded.

Panel A: Items 1-19

SP Firm ID	SP Company Name	SP Webpg1	SP Webpg2	SP Webpg3	SP Webpg4	YWP, YWN or NWN?	SP Exec #	SP Last name(s)	SP First name(s)	SP Middle initial(s)	SP Chief or Officer 1	SP Chief or Officer 2	SP Chief or Officer Domain	SP Rank or Title	SP Rank or Title Domain	SP Area	SP Photo
1	CITRIX SYSTEMS INC	About Us	Executives			YWP	1	Henshall	David	J	CEO	President	CEO-PRES				y
1	CITRIX SYSTEMS INC					YWP	2	Shenkman	Arlen		CFO		Finance	EVP	EVP		y
1	CITRIX SYSTEMS INC					YWP	3	Gomes	Tony		GC		Legal	EVP	EVP		y
1	CITRIX SYSTEMS INC					YWP	4	Ferrer	Mark		Chief Revenue Officer		Revenue	EVP	EVP		y
1	CITRIX SYSTEMS INC					YWP	5	Hough	PJ		Chief Product Officer		Product	EVP	EVP		y
1	CITRIX SYSTEMS INC					YWP	6	Kimmel	Donna		Chief People Officer		HR	EVP	EVP		y
1	CITRIX SYSTEMS INC					YWP	7	Minahan	Tim		Chief Marketing Officer		Marketing	EVP	EVP	Business St	y
1	CITRIX SYSTEMS INC					YWP	8	Schmitz	Mark	J	COO		Operations	EVP	EVP		y
1	CITRIX SYSTEMS INC					YWP	9	van Rotterdam	Jeroen		Chief Information Secu		IT	EVP	EVP	Engineering	y
9	NORTHERN TRUST CORP	About Us	Investor Rela	Governance	Senior Leader	YWN	1	O'Grady	Michael	G	CEO	President	CEO-PRES				y
9	NORTHERN TRUST CORP					YWN	2	Browne	Robert	P	Chief Investment Office		Finance	EVP	EVP		y
9	NORTHERN TRUST CORP					YWN	3	Cherewich	Peter	B				EVP	EVP	Corporate	y
9	NORTHERN TRUST CORP					YWN	4	Fradkin	Steven	L				EVP	EVP	Wealth Ma	y
9	NORTHERN TRUST CORP					YWN	5	Gossett	Mark	C	Chief Risk Officer		Risk	EVP	EVP		y
9	NORTHERN TRUST CORP					YWN	6	Levy	Susan	C	CS	GC	Legal	EVP	EVP		y
9	NORTHERN TRUST CORP					YWN	7	Parker	Teresa	A				EVP	EVP	EMEA	y
9	NORTHERN TRUST CORP					YWN	8	South	Thomas	A	Chief Information Secu		IT	EVP	EVP		y
9	NORTHERN TRUST CORP					YWN	9	St. Clair	Joyce		Chief HR Officer		HR	EVP	EVP		y
9	NORTHERN TRUST CORP					YWN	10	Thomas	Shundrawn	A				EVP	EVP		y
9	NORTHERN TRUST CORP					YWN	11	Tyler	Jason	J	CFO		Finance	EVP	EVP		y
17	MONSTER BEVERAGE CORP					NWN	1	Sacks	Rodney	C	CEO		CEO-PRES				n
17	MONSTER BEVERAGE CORP					NWN	2	Schlosberg	Hilton	H	President	COO	CEO-PRES				n
17	MONSTER BEVERAGE CORP					NWN	3	McHugh	Daniel		Chief Marketing Officer		Marketing				y
17	MONSTER BEVERAGE CORP					NWN	4	Kelly	Thomas	J				EVP	EVP	Finance	n
17	MONSTER BEVERAGE CORP					NWN	5	Carling	Guy	P				President	BU-CEO-PR-EMEA		n
17	MONSTER BEVERAGE CORP					NWN	6	Tirre	Emelie					President	BU-CEO-PR-Americas		y

- Item 1 Firm ID.
- Item 2 Company Name = Firm name per Compustat.
- Item 3 Webpg 1 = 1st level in firm's website address identifying the page with the executive on it.
- Item 4 Webpg 2 = 2nd level in firm's website address identifying the page with the executive on it.
- Item 5 Webpg 3 = 3rd level in firm's website address identifying the page with the executive on it.
- Item 6 Webpg 4 = 4th level in firm's website address identifying the page with the executive on it.
- Item 7 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 8 Executive #, coded in the order shown on firm's website (if in a row, order taken is left to right).
- Item 9 Last name(s) of executive.
- Item 10 First name(s) of executive.
- Item 11 Middle initial(s) of executive.
- Item 12 Chief or Officer 1 = 1st of a maximum of two Chief or Officer positions ascribed to the executive.
- Item 13 Chief or Officer 2 = 2nd of a maximum of two Chief or Officer positions ascribed to the executive.
- Item 15 Chief or Officer Domain = category covering one or more Chief or Officer 1 or 2 positions.
- Item 16 Rank or Title = rank or title of executive, outside of Chief or Officer 1 and 2.
- Item 17 Rank or Title Domain = category covering one or more Ranks or Titles.
- Item 18 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.
- Item 19 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).

Appendix A (continued)

Panel B: Items 20-32

SP Firm ID	SP Company Name	SP Photo	SP Photo Source	Gender	McK 2015 code race/ethnicity: aa,eur,ne,ea,sa,lat,na,pi,an	McK 2018 US + NCES IPEDS race/ethnicity w,b,h,api,aian	SP Visual est age	SP Formal attire?	SP Jacket?	SP Tie?	SP Smile (1-10)	SP Pay (\$M) Yahoo! Finance	SP Year Born Yahoo! Finance	SP True Age @ Feb-20
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	55	y	y	n	6	\$ 3.03	1968	52
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	55	y	y	n	4	\$ 0.83	1971	49
1	CITRIX SYSTEMS INC	y	Website	m	lat	h	55	y	y	n	7	\$ 1.14	1966	54
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	60	y	y	y	6	\$ 1.33	1960	60
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	55	n	n	n	8			
1	CITRIX SYSTEMS INC	y	Website	f	eur	w	45	y	y	n	9			
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	45	y	y	n	7			
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	40	y	y	n	8			
1	CITRIX SYSTEMS INC	y	Website	m	eur	w	50	y	n	n	6			
9	NORTHERN TRUST CORP	y	BB	m	eur	w	60	y	y	y	6	\$ 3.05	1966	54
9	NORTHERN TRUST CORP	y	LIN	m	eur	w	55	y	y	y	6	\$ 1.50	1965	55
9	NORTHERN TRUST CORP	y	LIN	m	eur	w	55	y	y	y	6	\$ 1.71	1965	55
9	NORTHERN TRUST CORP	y	LIN	m	eur	w	55	y	y	y	6	\$ 1.76	1962	58
9	NORTHERN TRUST CORP	y	LIN	m	eur	w	55	y	y	y	5			
9	NORTHERN TRUST CORP	y	LIN	f	eur	w	55	y	y	n	7			
9	NORTHERN TRUST CORP	y	LIN	f	eur	w	60	y	y	n	6			
9	NORTHERN TRUST CORP	y	LIN	m	eur	w	50	y	y	y	5			
9	NORTHERN TRUST CORP	y	OTH	f	eur	w	55	y	n	n	8			
9	NORTHERN TRUST CORP	y	LIN	m	aa	b	45	y	y	y	5			
9	NORTHERN TRUST CORP	y	LIN	m	aa	b	50	y	y	y	7		1972	48
17	MONSTER BEVERAGE CORP	n		m								\$ 1.48	1950	70
17	MONSTER BEVERAGE CORP	n		m								\$ 1.44	1953	67
17	MONSTER BEVERAGE CORP	y	LIN	m	eur	w	55	y	y	y	8			
17	MONSTER BEVERAGE CORP	n		m								\$ 0.71	1954	66
17	MONSTER BEVERAGE CORP	n		m								\$ 0.87	1977	43
17	MONSTER BEVERAGE CORP	y	LIN	f	eur	w	50	y	y	n	9	\$ 0.99	1970	50

- Item 20 Photo Source: If photo = y, photo source = firm’s website, LIN, BB or OTH.
- Item 21 Gender: Male or female, based on the executive’s photo and/or bio, where available.
- Item 22 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 comparing executives’ racial and ethnic densities against their expected executive labor supply metric densities.
- Item 23 NCES IPEDS race/ethnicity. For the historical data we use to benchmark executives’ 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 U.S. executives in McKinsey’s 2018 and 2020 studies (Hunt, Prince, Dixon-Fyle, and Yee, 2018; Dixon-Fyle, Hunt, Dolan, and Prince, 2020).
- Item 24 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 25 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 26 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 27 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 28 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 29 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 30 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 31 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 S&P 500® dataset to take into account the likely undercounting of non-White individuals. VIAFs are estimated for Asian, Black, and Hispanic executives, with the VIAF-based number and density of White individuals being a plug. The data we use to calculate the VIAFs were generously provided by Crist|Kolder Associates 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 Crist|Kolder 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) Crist|Kolder’s classification of the CEO’s or CFO’s race/ethnicity. Our approach to calculating VIAFs uses only the subset of Crist|Kolder’s firms that are also in our database of S&P 500® firms, and only those CEOs and CFOs who are identified by both Crist|Kolder and ourselves. We define an executive’s race/ethnicity coding as being correct if both we and Crist|Kolder agree on the coding. For every case where our coding of an executive’s race/ethnicity differed from Crist|Kolder’s, we carefully researched biographical and other data sources to confirm the classification. In testimony to the resources that Crist|Kolder spend on their highly visible and respected Volatility Report, we found only 2 executives out of 82 whose Crist|Kolder classification we believe is incorrect, as compared to 12 out of 80 from our own less resource-intensive classification process. Using Black executives as the example, we calculate VIAF_b as the ratio of the number of CEOs + CFOs that Crist|Kolder 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 GHS set of S&P® 500 firms + the CK executive is the same as the		CK race/ethnicity using NCES IPEDS classifications				
GHS executive:		aian	api	b	h	Total
i	# CK CEOs + CFOs coded correctly	0	44	11	25	80
ii	# CK CEOs + CFOs coded incorrectly	0	0	0	2	2
iii	# GHS CEOs + CFOs coded correctly	0	41	10	17	68
iv	# GHS CEOs + CFOs coded incorrectly	0	3	1	8	12
VIAF = (i / iii) * [(i - ii)/i]		1.0	1.07	1.10	1.35	

Note: VIAF for aian is set at 1.0 since denomination in VIAF calculation = 0.
 VIAF for w is not calculated as it is best thought of as a plug.

Appendix C

Derivation of the estimated racial/ethnic densities of the U.S. population at July 1, 2019 using the race and ethnicity categories defined in the U.S. 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 NCES 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 U.S. 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 U.S. 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 under-represented at top colleges than 35 years ago”](#) (August 24, 2017) plus 2 top-ranked HBCUs (Spelman College and Morehouse College).

Public, 4-year or above				Private not-for-profit, 4-year or above			
One per State (+8 additional from California)		# students		Spanning 21 States + DC + 2 top HBCUs		# students	
UnitID	Institution Name	1987	2008	UnitID	Institution Name	1987	2008
151351	Indiana University-Bloomington	4,546	5,779	164465	Amherst College	392	445
159391	Louisiana State Univ & Ag & Mech College	3,173	4,600	161004	Bowdoin College	345	451
204796	Ohio State University-Main Campus	6,853	8,721	217156	Brown University	1,515	1,542
214777	Pennsylvania State University-Main Campus	7,415	9,442	110404	California Institute of Technology	176	208
186380	Rutgers University-New Brunswick	5,148	5,454	173258	Carleton College	426	461
100751	The University of Alabama	2,247	3,398	112260	Claremont McKenna College	203	281
180489	The University of Montana	1,131	1,712	161086	Colby College	479	521
221759	The University of Tennessee-Knoxville	3,226	3,655	190099	Colgate University	619	675
228778	The University of Texas at Austin	6,751	8,669	190150	Columbia University	1,298	1,824
196088	University at Buffalo	2,454	3,966	190415	Cornell University	1,735	3,431
102614	University of Alaska Fairbanks	466	444	182670	Dartmouth College	1,053	1,084
104179	University of Arizona	3,598	5,619	198385	Davidson College	342	432
106397	University of Arkansas	1,655	2,343	198419	Duke University	1,654	1,505
110635	University of California-Berkeley	5,264	6,960	139658	Emory University	1,109	1,513
110644	University of California-Davis	3,031	5,785	131496	Georgetown University	1,399	1,730
110653	University of California-Irvine	2,040	5,209	153384	Grinnell College	304	408
110662	University of California-Los Angeles	4,909	7,089	191515	Hamilton College	419	442
445188	University of California-Merced	0	74	166027	Harvard University	1,766	1,755
110671	University of California-Riverside	665	3,544	115409	Harvey Mudd College	124	179
110680	University of California-San Diego	2,177	5,328	212911	Haverford College	288	301
110705	University of California-Santa Barbara	3,194	4,977	162928	Johns Hopkins University	733	1,548
110714	University of California-Santa Cruz	1,288	3,450	166683	MIT	1,159	1,217
126614	University of Colorado Boulder	3,515	5,790	230959	Middlebury College	558	636
129020	University of Connecticut	2,906	4,591	147767	Northwestern University	2,027	2,037
130943	University of Delaware	2,639	3,500	121345	Pomona College	333	385
134130	University of Florida	5,260	8,737	186131	Princeton University	1,129	1,137
139959	University of Georgia	3,871	6,414	227757	Rice University	629	792
141574	University of Hawaii at Manoa	2,594	2,994	167835	Smith College	684	708
142285	University of Idaho	1,110	1,833	243744	Stanford University	1,628	1,646
145637	University of Illinois at Urbana-Champaign	5,938	7,314	216287	Swarthmore College	353	374
153658	University of Iowa	3,826	4,488	144050	University of Chicago	717	1,185
155317	University of Kansas	2,887	3,997	152080	University of Notre Dame	1,867	2,087
157085	University of Kentucky	2,606	3,775	215062	University of Pennsylvania	2,363	2,766
161253	University of Maine	1,438	1,622	123961	University of Southern California	2,774	4,528
163286	University of Maryland-College Park	5,570	6,307	221999	Vanderbilt University	1,245	1,542
166629	University of Massachusetts-Amherst	4,167	4,431	197133	Vassar College	558	638
170976	University of Michigan-Ann Arbor	4,981	6,258	234207	Washington and Lee University	290	449
174066	University of Minnesota-Twin Cities	5,525	6,650	179867	Washington University in St Louis	1,355	1,760
176017	University of Mississippi	1,434	2,450	168218	Wellesley College	545	604
178396	University of Missouri-Columbia	3,494	4,779	130697	Wesleyan University	654	732
181464	University of Nebraska-Lincoln	2,937	3,246	168342	Williams College	522	510
182290	University of Nevada-Reno	904	2,119	130794	Yale University	1,283	1,319
183044	University of New Hampshire-Main Campus	1,934	2,377	141060	Spelman College (HBCU)	298	483
187985	University of New Mexico-Main Campus	1,803	3,052	140553	Morehouse College (HBCU)	234	521
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		Total for Private not-for-profit 4-yr or above	39,584	48,792
209551	University of Oregon	2,274	3,636				
217484	University of Rhode Island	1,673	2,201		Total for Public + not-for-profit Private 4-yr or above	219,248	301,312
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		Total all Bachelor's degrees conferred by post-secondary US institutions, excl. non-resident aliens	959,813	1,518,747
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		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%
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				

Note: 4-yr or above refers to US colleges & universities with a 4-year BA/BS.

Source: NCES IPEDS Digest of Education Statistics

Appendix E

This appendix presents descriptive statistics on the overlaps between the U.S. colleges and universities (CUs) from which the executives in our S&P 500[®] dataset come and (1) all colleges and universities, (2) colleges and universities ranked by U.S. News & World Report, (3) the subset of colleges and universities consisting of those that supplied 6+ executives to S&P 500[®] firms, and (4) the subset of the colleges and universities in (3) that are also in the *New York Times* 2017 list of the 100 Top colleges and universities. We obtained executives' education background from BoardEx. BoardEx's data provided U.S. 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 S&P 500[®] dataset. 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 and Central Index Key. 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		
# CUs in US per Statista in 2018-2019	2,698		
# CUs ranked by USNRW @ 2/15/2019	1,400		
# CUs that sample executives come from	1,312		
% of all CUs that sample executives come from	49%		
	S&P 500 [®] firms		
# executives in sample dataset	6814		
# of sample executives with BA data in BoardEx	5470		
% sample executives with BA data in BoardEx	80%		
	S&P 500 [®] firms		
Of executives in dataset with BA/BS data in BoardEx:	# CUs	# execs	% execs
# CUs with 1 exec	661	661	12%
# CUs with 2 executives	214	428	8%
# CUs with 3 executives	109	327	6%
# CUs with 4 executives	58	232	4%
# CUs with 5 executives	47	235	4%
# CUs with 6+ executives	223	3,587	66%
	1,312	5,470	100%
	S&P 500 [®] 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%		

Appendix E (continued)

We also estimated the fraction of Black executives in our S&P 500[®] dataset who graduated with their BA/BS from an Historically Black College or University (HBCU). We propose that the smaller this fraction, the more accurate is the 2017 *New York Times* Top 100 U.S. colleges and universities list as a baseline proxy for the schools that S&P 500[®] firms hire their proto-executive talent from, given that our qualified labor supply criteria led U.S. to add just two HBCUs to the U.S. colleges and universities in the *New York Times* Top 100 list. Based on the 2020 list of 79 HBCUs on the U.S. News & World Report website, we find that 13% of S&P 500[®] Black executives are from HBCUs (33 of 246 in S&P 500[®] firms).

Our conclusion from these statistics is that the 2017 *New York Times* Top 100 U.S. colleges and universities is a good baseline proxy for the set of U.S. colleges and universities from which U.S. public companies hire proto-executive talent, in the form of BA/BS-graduating seniors. We calculate that the 223 “material supplier” U.S. colleges and universities have supplied 66% of all the executives in S&P 500[®] firms, where we define a U.S. college and university 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 U.S. colleges and universities. For S&P 500[®] firms, of the executives coming from these 223 U.S. colleges and universities, 53% come from the *New York Times* Top 100 U.S. colleges and universities, leading us to conclude that because the *New York Times* Top 100 U.S. colleges and universities are well scattered within the 223 6+ execs U.S. colleges and universities, and not unduly clumped in the 1st thru 100th of the 223 material supplier U.S. colleges and universities, that the *New York Times* Top 100 is a good baseline proxy for the full set of U.S. colleges and universities from which U.S. public companies hire proto-executive talent, even before the addition of the two top HBCUs, namely Spelman College and Morehouse College.

Appendix F

Results of analysis that seeks to improve the judged age of an S&P 500[®] executive when their 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	Est. coef. (t-stat)
Intercept	24.0 (18.9)
Visually estimated age of executive (in 5-year bins, 25 - 90)	0.62 (37.1)
Executive gender (male = 0, female = 1)	1.77 (4.5)
Is exec in formal attire? (y = 1, n = 0)	-0.46 (-0.7)
Is exec wearing a jacket? (y = 1, n = 0)	-0.72 (-1.3)
Is exec wearing a tie? (y = 1, n = 0)	1.08 (3.9)
Degree of smile on exec's face (1-10)	-0.20 (-1.8)
Exec is African ancestry? (y = 1, n = 0)	-0.35 (-0.5)
Exec is Near Eastern? (y = 1, n = 0)	-0.63 (-0.7)
Exec is East Asian? (y = 1, n = 0)	1.70 (2.2)
Exec is South Asian? (y = 1, n = 0)	-0.97 (-1.7)
Exec is Latino? (y = 1, n = 0)	-1.02 (-1.3)
Exec is CEO or President (y = 1, n = 0)	-0.50 (-1.6)
Exec is non-CEO Chief (y = 1, n = 0)	-1.02 (-4.3)
Exec is EVP or Senior EVP (y = 1, n = 0)	0.11 (0.4)
Exec is SVP (y = 1, n = 0)	-0.36 (-1.0)
Exec is VP (y = 1, n = 0)	-0.36 (-1.0)
# observations with required data items	2,192
Adj. R ²	44.9%

Appendix F (continued)

Panel B: Executives with a Visually Estimated Age

# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
6,930	30	45	50	51.7	60	90	7.0

Panel C: Executives with a True Age

# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
2,234	33	47	56	55.5	63	91	6.7

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

# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.	
True executive age (T)	2,194	33	47	56	55.5	63	91	6.7
Visually estimated age for T obs. (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 mean{T - V}					10.7			

Panel E: Executives' True Age, else OLS-model Age, else Visually Estimated Age

# execs	Min.	10%	Median	Mean	90%	Max	Std. Dev.
6,970	33	48.2	53.7	54.2	60.2	91	5.2

Table 1

Criteria applied in arriving at the set of S&P 500[®] firms as of 12/31/19 included in the study and for which at least one named executive was found on the firm's website, the firm's Yahoo! Finance profile page, the firm's Bloomberg profile page, the firm's Annual Report, or 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.

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

Table 2

Descriptive statistics on the industry composition and key financial characteristics at 12/31/19 or for FYE on or before 12/31/19 for the S&P 500[®] firms in the study.

<i>Panel A: Industry composition</i>		<i>Panel B: Selected firm financial characteristics at 12/31/19 or for fiscal year 2019</i>			
Fama-French 12-industry:	# firms		10%	Median	90%
Business Equipment	82	Market cap	\$ 9,258	\$ 22,422	\$ 125,125
Chemicals and Allied Products	19	Total assets	\$ 5,027	\$ 20,497	\$ 14,498
Consumer Durables	9	Total liabilities	\$ 2,693	\$ 13,411	\$ 104,156
Consumer Nondurables	31	Total equity	\$ 1,103	\$ 6,266	\$ 33,742
Finance	97	Revenue	\$ 2,640	\$ 10,168	\$ 64,888
Healthcare, Medical Equipment, and Drugs	37	R&D	\$ 0	\$ 0	\$ 1,276
Manufacturing	39	EBIT	\$ 509	\$ 1,600	\$ 8,150
Oil, Gas, and Coal Extraction and Products	20	Net Income	\$ 215	\$ 1,001	\$ 5,889
Other	52	CFOPS	\$ 529	\$ 1,685	\$ 8,772
Telephone and Television Transmission	11	CAPEX	\$ 43	\$ 392	\$ 3,498
Utilities	30	Gross margin	19%	43%	78%
Wholesale, Retail, and Some Services	44	ROE	0%	15%	45%
	471	ROA	1%	6%	15%
		ROS	2%	11%	29%
		TATO	0.1	0.5	1.3
		LEVX	1.5	2.9	9.2
		# firms	471	471	471

Table 3

Descriptive statistics on key personal characteristics, excluding age and judged race/ethnicity, of the named executives with a facial photo in the S&P 500[®] firms in the study.

<i>Panel A:</i>	Executives	Min.	Mean	Max	# execs
	# executives per firm	\$ 2.0	\$ 14.6	\$ 79.0	7,246
	Salary + bonus pay MRFY (\$ mil)	\$ -	\$ 2.4	\$ 47.1	2,108

<i>Panel B:</i>	Gender	Male	Female	# execs
	#	5,533	1,713	7,246
	%	76%	24%	

<i>Panel C:</i> Chief or Officer position(outright or Co-)	C-Label	# execs
	CEO	501
	President	351
	Chief Financial Officer	491
	General Counsel or Chief Legal Officer	452
	Chief Operating Officer	170
	Corporate Secretary	242
	Chief Human Resources (or People) Officer	228
	Chief Information Officer	143
	Chief Technology Officer	113
	Chief Marketing Officer	87
	Chief Accounting Officer	84
	Executive Chairman	39
	Chief Diversity/Equity/Inclusion Officer	19
	Senior Executive Vice-President	65
	Executive Vice-President	1,686
	Senior Vice-President	1,676
	Vice-President	1,162

<i>Panel D:</i>	Business attire	Yes	No	# execs
	Exec in formal attire? #	6,243	670	6,913
	%	90%	10%	
	Exec wearing a jacket? #	5,835	1,078	6,913
	%	84%	16%	
	Exec wearing a tie? #	3,421	3,485	6,906
	%	50%	50%	

Table 4

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

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

<i>Panel B:</i> Classifications per National Center for Education Statistics' Integrated Post-Secondary Education System (NCES IPEDS)						
Racial/ethnic category	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	
All Executives #	1	493	246	149	6,042	6,931
Non-VIAF-based raw RAED %	0.01%	7.1%	3.5%	2.1%	87.2%	100%
VIAF applied to RAEDs	1.00	1.07	1.10	1.35	Residual < 1.00	
VIAF-based VRAEDs						
All Executives #	1	529	271	201	5,929	6,931
VRAED %	0.0%	7.6%	3.9%	2.9%	85.5%	100%
CEO #	0	25	7	12	458	501
%	0.0%	4.9%	1.3%	2.4%	91.3%	100%
President #	0	25	4	9	311	350
%	0.0%	7.1%	1.3%	2.7%	89.0%	100%
CFO #	0	24	7	8	443	481
%	0.0%	4.9%	1.4%	1.7%	92.0%	100%
GC or CLO #	0	19	36	9	372	437
%	0.0%	4.4%	8.3%	2.2%	85.1%	100%
COO #	0	9	4	5	148	166
%	0.0%	5.2%	2.7%	3.3%	88.9%	100%
Corporate Secretary #	0	13	15	4	197	229
%	0.0%	5.6%	6.7%	1.8%	85.9%	100%
CHRO #	0	13	28	7	200	247
%	0.0%	5.2%	11.1%	2.7%	80.9%	100%
CIO #	0	23	3	1	145	172
%	0.0%	13.1%	1.9%	0.8%	84.2%	100%
CTO #	0	27	1	3	86	117
%	0.0%	22.9%	0.9%	2.3%	73.8%	100%
CMO #	0	11	3	3	115	132
%	0.0%	8.1%	2.5%	2.0%	87.3%	100%
Chief Accounting Officer #	0	3	3	1	89	97
%	0.0%	3.3%	3.4%	1.4%	91.9%	100%
CDO/CIO/CDIO/DIO #	0	1	9	1	10	21
%	0.0%	5.1%	41.9%	6.4%	46.6%	100%
SEVP or EVP #	0	107	80	42	1,493	1,722
%	0.0%	6.2%	4.7%	2.4%	86.7%	100%
SVP #	0	128	62	85	1,322	1,596
%	0.0%	8.0%	3.9%	5.3%	82.8%	100%
VP #	0	70	36	23	904	1,033
%	0.0%	6.8%	3.5%	2.2%	87.5%	100%

Table 5

Numbers and racial/ethnic densities (RAEDs) of conferred BA/BS degrees in 1971-2022 from the top 100 U.S. colleges and universities as defined by Ashkenas, Park, and Pearce (*New York Times*, 2017) plus 2 top HBCUs (Spelman, Morehouse). Actual values from NCES IPEDS are shown in white; linear interpolations of missing-data years that are bounded by non-missing years are in grey; linear extrapolations for years prior to 1987 (the first year of data available in NCES IPEDS) are in light tan. For aian, api, b and h, 1971 = 1988 x 1988/2004; 1972-1987 were straight-line extrapolated based on 1971 as compared ratio-wise to 1988, subject to ensuring that the SL extrapolations for 1971-1987 did not result in a decrease in the RAED of w.

	Race/ethnicity of conferred undergraduate degrees				
	aian	api	b	h	w
1971	0.3%	2.3%	2.5%	1.1%	93.9%
1972	0.3%	2.5%	2.5%	1.2%	93.5%
1973	0.3%	2.7%	2.6%	1.3%	93.2%
1974	0.3%	2.9%	2.7%	1.4%	92.8%
1975	0.3%	3.0%	2.7%	1.4%	92.5%
1976	0.3%	3.2%	2.8%	1.5%	92.1%
1977	0.3%	3.4%	2.9%	1.6%	91.7%
1978	0.3%	3.6%	2.9%	1.7%	91.4%
1979	0.4%	3.8%	3.0%	1.8%	91.0%
1980	0.4%	4.0%	3.1%	1.9%	90.7%
1981	0.4%	4.2%	3.1%	2.0%	90.3%
1982	0.4%	4.4%	3.2%	2.1%	90.0%
1983	0.4%	4.6%	3.3%	2.2%	89.6%
1984	0.4%	4.7%	3.3%	2.2%	89.3%
1985	0.4%	4.9%	3.4%	2.3%	88.9%
1986	0.4%	5.1%	3.5%	2.4%	88.5%
1987	0.4%	5.3%	3.5%	2.5%	88.2%
1988	0.4%	5.5%	3.6%	2.6%	87.8%
1989	0.4%	6.5%	3.7%	2.9%	86.6%
1990	0.4%	7.1%	3.7%	3.2%	85.6%
1991	0.4%	7.4%	3.9%	3.3%	85.0%
1992	0.5%	7.9%	4.3%	3.7%	83.6%
1993	0.5%	8.6%	4.4%	4.1%	82.4%
1994	0.6%	9.4%	4.6%	4.5%	80.8%
1995	0.6%	10.6%	4.6%	4.8%	79.5%
1996	0.6%	11.4%	4.7%	5.0%	78.3%
1997	0.7%	12.1%	4.7%	5.4%	77.2%
1998	0.7%	12.2%	4.8%	5.6%	76.7%
1999	0.7%	12.2%	5.0%	5.7%	76.3%
2000	0.7%	12.5%	5.2%	5.8%	75.8%
2001	0.7%	12.6%	5.3%	5.8%	75.6%
2002	0.7%	12.6%	5.3%	5.9%	75.6%
2003	0.7%	12.9%	5.2%	5.9%	75.2%
2004	0.7%	13.3%	5.3%	6.2%	74.6%
2005	0.7%	13.5%	5.4%	6.3%	74.1%
2006	0.7%	13.9%	5.2%	6.5%	73.7%
2007	0.7%	14.1%	5.4%	6.6%	73.2%
2008	0.8%	14.0%	5.4%	6.9%	72.9%
2009	0.8%	14.2%	5.4%	7.1%	72.6%
2010	0.7%	14.6%	5.5%	7.6%	71.7%
2011	0.7%	14.7%	5.4%	8.2%	71.1%
2012	0.6%	14.7%	5.5%	8.7%	70.4%
2013	0.6%	14.8%	5.4%	9.4%	69.8%
2014	0.5%	14.7%	5.5%	10.2%	69.1%
2015	0.4%	14.6%	5.5%	10.9%	68.5%
2016	0.4%	15.1%	5.5%	11.7%	67.4%
2017	0.4%	15.3%	5.4%	12.3%	66.6%
2018	0.4%	15.5%	5.5%	12.7%	65.9%
2019	0.4%	15.7%	5.6%	13.3%	65.0%
2020	0.4%	16.3%	5.7%	14.4%	63.2%
2021	0.4%	16.7%	5.9%	15.2%	61.8%
2022	0.4%	17.4%	5.8%	14.9%	61.5%

Table 6

Benchmarking the mid-2020 VIAF-based racial/ethnic densities (RAEDs) of S&P 500[®] executives against [1] RAEDs of the 2019 U.S. population (USPopRAED) and [2] the qualified labor supply expected densities (ERAEDs) derived per Appendix E and Table 5 from the 2017 *New York Times* List of the Top 100 U.S. colleges and universities plus 2 top HBCUs. Z- and t-statistics in bold red are < -1.96 (bold green > 1.96).

		Racial/ethnic densities of S&P 500 [®] executives as of mid-2020			
<i>Panel A: All executives (n = 6,931)</i>					
A.1	Benchmark = USPopRAED	api	b	h	w
	RAED	7.6%	3.9%	2.9%	85.5%
	USPopRAED	6.4%	13.0%	18.5%	61.2%
	RAED – USPopRAED	1.3%	-9.1%	-15.5%	24.4%
	z-stat. on difference in {RAED – USPopRAED} proportions	4.3	-22.4	-33.4	41.7
A.2	Benchmark = ERAED				
	mean ERAED	6.4%	3.7%	3.0%	86.5%
	mean {RAED – ERAED}	1.3%	0.2%	0.0%	-1.0%
	t-stat. on mean {RAED – ERAED}	4.1	0.8	-0.2	-2.4
<i>Panel B: All executives (n = 6,931) versus only executives who have an identified U.S. or non-U.S. BA/BS degree per Revelio (n = 1,958)</i>					
		api	b	h	w
	RAED all executives	7.6%	3.9%	2.9%	85.5%
	RAED only executives with an identified U.S. or non-U.S. BA/BS	7.2%	4.6%	2.4%	85.9%
	z-stat. on difference in {RAED all executives – RAED only executives with an identified U.S. or non-U.S. BA/BS}	0.6	-1.3	1.3	-0.4
<i>Panel C: Domestic executives = those with an identified U.S. BA/BS (n = 1,628)</i>					
C.1	Benchmark = USPopRAED	api	b	h	w
	RAED	3.8%	5.1%	1.7%	89.5%
	USPopRAED	6.4%	13.0%	18.5%	61.2%
	RAED – USPopRAED	-2.6%	-7.9%	-16.8%	28.4%
	z-stat (RAED – USPopRAED)	-4.3	-9.5	-17.5	23.5
C.2	Benchmark = ERAED				
	mean ERAED	6.6%	3.8%	3.0%	86.2%
	mean {RAED – ERAED}	-2.8%	1.3%	-1.3%	3.3%
	t-stat. on mean {RAED – ERAED}	-6.0	2.4	-4.3	4.4
<i>Panel D: Foreign executives = those with an identified non- U.S. BA/BS degree (n = 330)</i>					
		api	b	h	w
	RAED	24.4%	2.0%	5.7%	67.9%
	mean ERAED	6.5%	3.7%	3.0%	86.3%
	RAED – ERAED	17.9%	-1.7%	2.7%	-18.4%
	t-stat. on mean {RAED – ERAED}	7.6	-2.3	2.1	-7.2

Table 6 (continued)

Panel E: Domestic executives (n = 1,628) vs. foreign executives (n = 330)

	api	b	h	w
RAED domestic executives	3.8%	5.1%	1.7%	89.5%
RAED foreign executives	24.4%	2.0%	5.7%	67.9%
RAED domestic executives – RAED foreign executives	-20.6%	3.1%	-4.1%	21.6%
z-stat. on difference in {RAED domestic executives – RAED foreign executives}	-13.2	2.4	-4.5	10.3

Figure 1

Racial/ethnic densities (RAEDs) of conferred undergraduate degrees in 1971-2022 from the top 100 U.S. colleges and universities as defined by Ashkenas, Park, and Pearce (*New York Times*, 2017) plus 2 top-ranked HBCUs (Spelman, Morehouse). Year is the academic year ending May; so 1987 is June 1986-May 1987. Actual data from NCES IPEDS are shown in thicker solid lines, and linear extrapolations for years before the first year of data available in NCES IPEDS are shown in dotted and dashed lines. Extrapolations for aian, api, b and h are denoted via an X- prefix, and are calculated as: [1] 1971 = 1988 x 1988/2004; [2] 1972-1987 = straight-line interpolated using 1971 and 1988 as end points, subject to the SL extrapolations for 1971-1987 not resulting in a decrease in the RAED of w, which itself is the residual from subtracting the estimated extrapolations for aian, api, b and h from 100%.

