No. 19-2005

IN THE UNITED STATES COURT OF APPEALS
FOR THE FIRST CIRCUIT

STUDENTS FOR FAIR ADMISSIONS, INC.,

Plaintiff-Appellant,

v.

PRESIDENT AND FELLOWS OF HARVARD COLLEGE & THE HONORABLE AND REVEREND THE BOARD OF OVERSEERS,

Defendants-Appellees.

On appeal from the U.S. District Court for the District of Massachusetts
No. 1:14-cv-14176-ADB

BRIEF OF ECONOMISTS MICHAEL KEANE, HANMING FANG, CHRISTOPHER FLINN, STEFAN HODERLEIN, YINGYAO HU, JOSEPH KABOSKI, GLENN LOURY, THOMAS MROZ, JOHN RUST & MATTHEW SHUM AS *AMICI CURIAE* IN SUPPORT OF APPELLANT

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**Not Admitted to the First Circuit*

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INTEREST OF *AMICI CURIAE*[1]

Amici—Dr. Michael P. Keane of the University of New South Wales; Dr. Hanming Fang of the University of Pennsylvania; Dr. Christopher J. Flinn of New York University; Dr. Stefan Hoderlein of Boston College; Dr. Yingyao Hu of Johns Hopkins University; Dr. Joseph P. Kaboski of the University of Notre Dame; Dr. Glenn C. Loury of Brown University; Dr. Thomas A. Mroz of Georgia State University; Dr. John P. Rust of Georgetown University; and Dr. Matthew S. Shum of California Institute of Technology—are leading economists and econometrics scholars who have extensively studied and written about discrete choice modeling and econometrics tools of the kind used by the experts in this case. Indeed, Harvard's statistician admitted that he

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[1] Counsel for *amici curiae* states pursuant to Fed. R. App. P. 29(a)(4)(E) that (1) this brief was authored by counsel for *amici curiae* and not by counsel for any party, in whole or in part; (2) no party or counsel for any party contributed money that was intended to fund preparing or submitting the brief; and (3) apart from *amici curiae* and their counsel, no person contributed money that was intended to fund preparing or submitting the brief. Institutional affiliations of individual *amici* are provided for identification purposes only. All parties have consented to the filing of this *amicus* brief pursuant to Fed. R. App. P. 29(a)(2).

assigns writings from *amicus* Dr. Keane to explain to his students the very tools used in this case. JA3232–34.

Amici are professionally interested in the proper use of such tools. *Amici* believe that the statistical model used by the plaintiff's expert is methodologically sound, and that the district court misunderstood statistical principles. Biographies of *amici* are summarized in Exhibit A to this brief.

INTRODUCTION AND SUMMARY OF ARGUMENT

This case turns on the inclusion or exclusion of one variable—the Harvard admissions office's "personal rating"—in the statistical tool used to determine the effect of race on Harvard's admissions decisions. This tool, "multiple regression" analysis, "includes a variable to be explained (the dependent variable) and explanatory (or independent) variables that have the potential to be associated with changes to the dependent variable." *Bricklayers & Trowel Trades Int'l Pension Fund v. Credit Suisse Sec. (USA) LLC*, 752 F.3d 82, 87 (1st Cir. 2014). A regression analysis measures the strength of the association between each individual explanatory variable and the dependent variable by controlling for the other dependent variables. *Id.* at 93. "Adding a

variable to a regression has both costs and benefits. On the one hand, omitting the variable could result in omitted variable bias," which is the omission of an important explanatory factor. James H. Stock & Mark W. Watson, *Introduction to Econometrics* 316–17 (3d. Ed. 2011). "On the other hand, including the variable when it does not belong … reduces the precision of the … regression." *Id*. Whether any given explanatory variable should be included or excluded from a regression analysis thus depends on whether it "may be," in the words of Harvard's own expert, "directly influenced by the variable of interest (here, race)." Report of David Card, Doc. 419-33, Ex. 33 at 10 (Card Report).

I. In light of the district court's finding of "a statistically significant and negative relationship between Asian American identity and the personal rating," the court clearly erred by including an explanatory variable that does not belong. *Students for Fair Admissions, Inc. v. President & Fellows of Harvard Coll.*, 397 F. Supp. 3d 126, 169 (D. Mass. 2019). As the district court found, the "disparity in personal ratings between Asian American and other minority groups" "suggests that at least some admissions officers might have subconsciously provided tips in the personal rating, particularly to

African American and Hispanic applicants, to create an alignment between the profile ratings and the race-conscious overall ratings that they were assigning." *Id.* at 171.

Thus, the district court correctly concluded that "[t]here is a reasonable econometric basis for removing the personal ratings from the admissions models given the possibility that the personal ratings are affected by race." *Id.* at 173. This makes sense: a model cannot accurately measure the effect on admissions of the dependent variable of race if its explanatory variables are themselves affected by race.

But the district court blinded itself to the implications of its own common-sense and statistically correct conclusion. Instead of omitting the admittedly race-influenced explanatory variable, the court held that "including the personal rating results in a more comprehensive analysis," and thus accepted the Card model, which included the personal rating. *Id.* This violates accepted principles of statistical analysis and is clearly erroneous.

II. The district court tried to justify the inclusion of the personal rating variable by opining that its omission in Dr. Arcidiacono's model "expands the omitted variable bias." *Id.* But this too was clear error.

For Dr. Arcidiacono's model to suffer from omitted variable bias, the model must omit a variable that, if included, would produce a more accurate understanding of how race affects admissions. *See, e.g.*, *Reed Const. Data Inc. v. McGraw-Hill Companies, Inc.*, 49 F. Supp. 3d 385, 403 (S.D.N.Y. 2014), *aff'd*, 638 F. App'x 43 (2d Cir. 2016); *see* Stock & Watson, *supra* at 316. But the district court found no evidence that including the personal rating produced a more accurate description of the role of race in admissions.

Absent any evidence of omitted variable bias, the district court resorted to "[s]peculat[ion] on how unobserved variables may be influencing the model." 397 F. Supp. 3d 126 at 170 n.48. The district court conjured alternative explanations for Asian Americans' disproportionately low personal ratings. But none of the court's speculative explanations finds support in the record. The district court ultimately admits that "the disparity between white and Asian-American applicants' personal ratings has not been fully and satisfactorily explained." *Id*. The disparity is even greater between other applicants and Asian Americans. Because Harvard provided no evidence that Dr. Arcidiacono's model suffered from omitted variable

bias, the district court clearly erred when it rejected his model on that basis.

ARGUMENT

I. THE DISTRICT COURT CLEARLY ERRED WHEN IT ADOPTED A MODEL THAT INCLUDED HARVARD'S PERSONAL RATING AFTER FINDING THAT THE PERSONAL RATING WAS SKEWED BY RACE.

To support its argument that Harvard discriminates against Asian Americans in the admissions process, Students For Fair Admissions (SFFA) relies on a logistic regression model created by Dr. Peter Arcidiacono, based on his review of six years of Harvard admissions data. *See* Expert Report of Peter S. Arcidiacono, Doc. 415-1, Ex. A (Arcidiacono Report). Regression analysis "permits analysis of a group of variables simultaneously as part of an attempt to explain a particular phenomenon." *James v. Stockham Valves & Fittings Co.*, 559 F.2d 310, 332 (5th Cir. 1977).

To measure the effect of race on admissions, Dr. Arcidiacono's model controls for applicant characteristics correlated with Harvard's admission decisions, including academic performance, extracurricular activity, teacher and school-counselor recommendations, and alumni-

interview ratings. *See* JA2186 (T9:24:1–8); JA2211–12 (T9:49:25–50:5); JA2585 (T9:73:7–16); Arcidiacono Report at 62 (Model 5).

Importantly, Dr. Arcidiacono's model omits Harvard's "personal rating," a measure of "likability," "integrity," "helpfulness," "courage," "kindness," and other qualities based on admissions officers' review of applicants. JA1424 (T3:227:6–24); JA2264 (T9.102:9–10). This is significant because inclusion or exclusion of the personal rating as a dependent variable has the largest effect of any modeling decision on the estimated degree of bias against Asian-American applicants. JA2317–18 (T9.155:24–156:2); JA3149–52 (T14.7:1–10:3); JA3223 (81:2–13); *see also* Rebuttal Report of David Card, Doc. 419-37, Ex. 37 at 55, Ex. 13 (Card Rebuttal).

As a consequence, the primary statistical dispute between the parties in this case is over whether to include personal rating in a regression model for how race affects admission to Harvard. *See* SFFA Br. 29–30 ("The district court further understood that one of those modeling disputes was more important than all the rest combined: 'whether the personal rating should be included.'").

If the personal rating is excluded, even Harvard's expert concedes that his model shows racial disparities against Asian Americans. JA3221 (T14.81:2–13) (agreeing that without the personal rating, there is a "statistically significant Asian penalty."); JA3151 (T14.9:17–23). If the personal rating is included, however, the racial disparities are minimized in the statistical model. Thus the district court recognized that "[t]he questions" in the case reduce to, "why do Asian American applicants score lower on the personal rating, does it unfairly affect their chances of admission, and if so, is this an undue burden … ?" 397 F. Supp. 3d at 193.

If the personal rating is one of the means that Harvard uses to limit Asian American admissions, then it should not be controlled in the admissions model designed to determine whether Harvard limits Asian-American admissions. Indeed, Harvard's expert, Dr. David Card, omitted another racially skewed rating assigned by Harvard—the overall rating—from his own model because he "didn't want to include a variable" that is "in some sense, affected directly by race *per se*." JA3019 (T13:83:17–21); *see* JA3221 (T14.79:13–14) (Card) (variables that include racial "tips," *i.e.* racial preferences, "should be excluded.");

JA3220 (T14.77:22–78:4) (Card) (answering "Yes" to the question, "it is inappropriate to include any variables that themselves can be affected by race, correct?"); *see also* Card Report, at 10 ("[I]t is a well-accepted statistical practice to exclude variables from a regression model that may themselves be directly influenced by the variable of interest (here, race).").

The district court first found that the personal rating is skewed by race but then ignored its own finding and decided to rely on a model that included the personal rating. The court did this because it "believe[d] that including the personal rating results in a more comprehensive analysis." 397 F. Supp. 3d at 173. This internally contradictory decision was clear error and warrants reversal.

A. The district court acknowledged that the evidence shows the personal rating was skewed by race.

The district court found what the record demonstrates—that the personal rating, as an explanatory variable, was directly influenced by the variable of interest, race. The record demonstrates this through three critical pieces of the evidence: 1) Dr. Arcidiacono's separate regression model for the personal rating, which shows that Harvard gives Asian-American applicants systematically lower personal rating

scores than Whites, Hispanics, and African Americans, 2) the clear difference between how alumni reviewers and admissions officers rate Asian Americans, and 3) Harvard's disproportionately low personal ratings for the most academically qualified Asian American applicants.

1. The expert regression models show Harvard gives Asian Americans significantly lower personal rating scores than White, Hispanic, and African-American applicants.

Because "Harvard did not offer a competing regression model to show that no statistically significant relationship between Asian American identity and the personal rating exists," the district court relied on Dr. Arcidiacono's regression model of the personal rating. 397 F. Supp. 3d at 169. Based on that model, the court found that "the data demonstrates a statistically significant and negative relationship between Asian American identity and the personal rating assigned by Harvard admissions officers, holding constant any reasonable set of observable characteristics." *Id*.

This finding was well supported: The model coefficients for Asian-American applicants are significant and negative for the personal rating. JA6012, 6015 (PD38.30, 33) (coefficient -0.398). This means that Asian-American applicants "score significantly worse" than white

applicants on the personal rating, other things equal. JA2257–58 (T9.95:11–96:4); JA2217 (T9:55:21–22). By contrast, the model coefficients for African-American applicants and Hispanic applicants are significant and positive, meaning that they score significantly better on the personal rating than white applicants, other things equal. JA6012, 6015 (coefficients +0.682 and +0.279). These regression coefficients warrant the inference that just like the overall rating—a rating that both parties agree is affected by race—the personal rating assigned by Harvard is "significantly influenced by race." JA2258 (T9.96:5–12).[2]

Dr. Card did not dispute that Harvard gives Asian Americans lower personal ratings than whites. JA2216 (T9.54:13–21); JA5996 (PD38.9); JA6041 (DD10.10). And he admitted that racial bias could be behind that "unexplained" gap. JA3331–32 (T13.189:12–190:3).

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[2] These coefficients are derived from the "baseline" data sample that excludes athletes, legacies, Dean's List and Director's List, and children of faculty and staff applicants, but it is worth noting that the coefficients derived from the "expanded" sample that includes all applicants except athletes are nearly identical, and produce nearly identical results. Rebuttal Expert Report of Peter S. Arcidiacono, Doc. 415-2, Ex. B, Tables 6.1R, B.6.12.R (Arcidiacono Rebuttal).

On the basis of this evidence, the district court specifically recognized that "[t]he disparity in personal ratings between Asian American and other minority groups is considerably larger than between Asian American and white applicants." 397 F. Supp. 3d at 171. This disparity "suggests that at least some admissions officers might have subconsciously provided tips in the personal rating, particularly to African American and Hispanic applicants, to create an alignment between the profile ratings and the race-conscious overall ratings that they were assigning." *Id.*

2. The disparity between Harvard's personal-rating scores and alumni personal-rating scores further confirms that Harvard's personal rating is affected by race.

Unlike Harvard's admissions staff, Harvard alumni reviewers do not rate Asian-American applicants significantly lower than non-Asian American applicants on the personal rating. Although there is also "some racial disparity in the alumni personal rating, it is less than *half* of the disparity" in the Harvard personal rating. Arcidiacono Report 50; *see* JA2217 (T9:55:7–12). This racial pattern in Harvard's personal rating—not present for other ratings, like the alumni personal rating—

shows that Harvard admissions officers put significant weight on race in assigning personal ratings. Notably, Admissions Office staff—unlike alumni—meet with only a very small fraction of applicants, and so Harvard admissions officers usually assign a personal rating based only on the paper application.[3]

Dr. Card attempted to explain the disparity between admissions office and alumni personal ratings by pointing out that the ratings are "based on different sources." Card Report 74; JA2972–73 (T13:36:1–37:16). He assumes, dubiously, that the paper materials considered by Harvard's admissions officers are more reliable indicators of whether a person is (for example) "likeable" than in-person interviews with alumni. Card Report 74.

Tellingly, the district court offered no explanation for the disparity between the personal ratings assigned by Harvard and the personal ratings assigned by Harvard's alumni.

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[3] Harvard staff interviews only 2.2% of all applicants, and only 1.2% of all Asian-American applicants. JA2199–2200 (T9:37:15–38:1); Arcidiacono Rebuttal 66.

3. Harvard's bias was most pronounced against the most academically competitive Asian-American applicants.

Asian-American applicants to Harvard are highly competitive relative to other applicants in *all* observable academic and non-academic measures that affect admission decisions *except* Harvard's personal rating. JA5992 (PD38.5); JA4527 (PX621), 4529 (PX623); *see also* Arcidiacono Report 36–37. As to non-academic measures, Asian Americans have scores similar to whites' scores, and generally higher than African Americans' and Hispanics' scores, with two exceptions: the athletic rating (which is not correlated with a significantly increased chance of admission outside the special category of recruited athletes) and the personal rating. *Id.* at 37; *see* Arcidiacono Rebuttal, *supra* note 3, at 29, Table 3.1N. Applicants with stronger test scores and high school grades tend to have significantly higher personal ratings—for every race except Asian Americans. JA2267 (T9.105:6–17); *see also* Arcidiacono Report 47–48.

For Asian-American applicants, this correlation between test scores and high school grades and personal rating is exceptionally weak. Inexplicably, the *most* academically competitive Asian Americans

do much worse in Harvard's personal-rating score than do academically comparable applicants of other races. JA2217–24 (T9:55:7–62:14); Arcidiacono Report at 49–50.

Asian-American applicants in *the very top* academic decile (the top 10%) are less likely to receive a good personal-rating score (2 or lower, lowest being best) than whites in the *top five* deciles (the top 50%), Hispanics in the *top six* deciles (the top 60%), and African Americans in the *top eight* deciles (the top 80%). JA6005 (PD38.18). This striking pattern is not replicated in other measures used by the Office of Admissions: the academic rating, extracurricular rating, alumni personal rating, teacher letter scores, and high-school counselor scores.

In other words, personal-rating scores make the academically top-performing Asian-American applicants *less* competitive while making other top-performing applicants *more* competitive. This is exactly what one would expect if Harvard's biases were aimed at suppressing Asian American admissions. Even Dr. Card was forced to concede in his testimony that he could not "rule out racial bias" as the explanation for "the unexplained gap between whites and Asians in the personal rating." JA3125–26 (T13.189:12–190:3).

Most important, the district court found that these "statistical disparities in personal ratings and admissions probabilities" resulted from "some slight implicit biases among some admissions officers that, while regrettable, cannot be completely eliminated in a process that must rely on judgments about individuals." 397 F. Supp. 3d at 203 n.62. In other words, Harvard's personal rating was a variable tainted by race.

B. The district court's alternative explanations for the low personal rating scores Harvard gave to Asian Americans have no basis in the record.

After finding that the personal rating was skewed by race, the district court should have accepted Dr. Arcidiacono's model, which properly omits that variable. The district court clearly erred by accepting Dr. Card's model, which includes the admittedly race-affected variable.

To justify its self-contradictory decision, the court veered into conjecture that something other than racial bias could have caused the clear racial disparities in the personal ratings. The district court frankly acknowledged that it was "[s]peculating on how unobserved variables may be influencing the model's implied effect of race on the

personal ratings," an endeavor "fraught with difficulty." 397 F. Supp. 3d at 170 n.48.

In this "fraught" project, the district court predominantly relied on two unobserved variables to provide an alternative explanation for the racial disparities in the personal rating: racial bias in Asian-American applicants' high schools, and underlying differences in the personal qualities of Asian-American applicants as a group. Neither factor explains away the racial disparity in Harvard's personal rating because both are facially implausible and find no basis in the record.

1. The difference in school support ratings is small.

The district court correctly noted that it "has not received statistical evidence on the effect of race on specific high school achievements," but nevertheless found "it is *likely* that some high school achievements are themselves effected by racial biases." 397 F. Supp. 3d at 170 n.48 (emphasis added). "One might question the effect, positive or negative, of being Asian American," the district court suggests, "on the probability of being selected to a leadership position such as class president, captain of a sports, math, or debate team," or "being

identified as an outspoken advocate, a natural leader, or an intellectual superstar." *Id.*

The district court pointed to only one piece of evidence to support the "racist high school" theory: "teacher and guidance counselor recommendations *seemingly* presented Asian Americans as having less favorable personal characteristics than similarly situated non-Asian American applicants," such that "school support ratings do not *fully* reflect more subtle racial disparities." 397 F. Supp. 3d at 170 (emphasis added).

But this evidence does not support the "racist high school" explanation for the disparity in personal ratings.

For one, the difference in school support ratings between whites and Asian Americans is small. The group of white and Asian-American applicants receiving the highest or second highest school support rating were within 1 percentage point of each other: the data showed that 0.18% more Asian-American applicants scored a highest or second highest rank for their first teacher rating, while 0.45% more white applicants scored a highest or second highest rank on their school counselor rating and 0.82% more white applicants scored a highest or

second highest rank of their second teacher rating compared to Asian Americans. *See* JA4527 (PX621), 5996 (PD38.9). On these markers of high school support, the difference is small.

For another, this "racist high-school" theory doesn't explain why Harvard gives African Americans and Hispanics much higher personal rating scores compared to both Asian Americans *and* whites when *all* factors that affect the personal rating, including high-school support letters, are held constant. *See* JA2227–2229 (T9.65:18–67:12); JA6005–06 (PD38.18–19), JA4534–37 (PX628, PX629, PX630, PX631). These disparities are statistically significant. JA2226 (T9.64:19–25). So even if high schools treated Asian Americans worse than other racial groups, Harvard's own bias would still be evident in the tips it gives to other minority groups when assigning the personal rating.

The district court's suggestion—that high school letters of recommendation, including extra-curricular instructor letters, might explain the racial bias in the personal-rating scores—is implausible given that Asian Americans have the highest extracurricular-rating scores of any racial group. JA2217 (T9:55:18–19); *see* Arcidiacono Report at 36, Table 4.1.

2. The district court could cite no evidence for its suggestion that Asian Americans lack the personal qualities Harvard is looking for.

The district court did not limit its speculation to the "racist high-school" theory. The court conjured another possible reason to explain why Harvard's personal rating scores are so much lower for Asian Americans—that Asian-American applicants simply lack the personal traits Harvard seeks. The court speculated, "It is possible that the self-selected group of Asian Americans that applied to Harvard during the years included in the data set used in this case *did not possess the personal qualities that Harvard is looking for at the same rate as white applicants*." 397 F. Supp. 3d at 193 (emphasis added). This possibility—that the "self-selected" group of Asian Americans lack attractive personal qualities—is supported by no evidence.

But even if this possibility were supported by evidence, the court offered no possible explanation for Harvard's treatment of Asian Americans compared to other minority applicants except for race: "[t]he disparity in personal ratings between Asian American and other minority groups … suggests that at least some admissions officers might have subconsciously provided tips in the personal rating,

particularly to African American and Hispanic applicants, to create an alignment between the profile ratings and the race-conscious overall ratings that they were assigning." *Id*. at 171.

Nothing in the record supports the theory that Asian Americans systematically lack attractive personal qualities over the course of six years of Harvard admissions data. If the district court had "any support for *why* Asian-American applicants have weaker personal qualities than other racial groups," it did not cite or provide it. Arcidiacono Rebuttal 25 n.12. When "alternative explanations" are "less plausible than the proposed causal link," they do not rebut an inference of causality. Federal Judicial Ctr. & Nat'l Research Council, *Reference Manual on Scientific Evidence* 221 (3rd ed. 2011) (Reference Manual).

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The court recognized that racial bias by Harvard admissions officers is a plausible explanation for the racial disparity in the personal rating: "It is also *possible* … that part of the statistical disparity resulted from admissions officers' implicit biases that disadvantaged Asian American applicants in the personal rating." 397 F. Supp. 3d at 171 (emphasis added). This explanation is even more plausible

considering the lack of clear instructions for Harvard admissions officers to avoid racial tips in the personal rating. While the other ratings Harvard assigns (academic, extracurricular, and athletic ratings) are based on detailed scoring instructions, JA3727–29, the district court found that "Harvard's reading procedures did not instruct readers not to consider race in assigning [ratings other than the overall rating] until 2018, when Harvard amended the reading procedures for the class of 2023 to provide more explicit guidance on the appropriate use and non-use of race." *Id*. at 146.

Nevertheless, the court erroneously chose to accept either of its unsupported alternative explanations rather than the most plausible explanation:

> [T]he Court concludes that the majority of the disparity in the personal rating … was more likely caused by race-affected inputs to the admissions process (e.g. recommendations or high school accomplishments) *or* underlying differences in the attributes that may have resulted in stronger personal ratings.

397 F. Supp. 3d at 171 (emphasis added).

The district court's decision to accept Dr. Card's model, which controls for the racially-influenced personal rating, is "statistically rather like saying that once you correct for racial bias, Harvard is not

racially biased."[4] To accept this model on the basis of such unsupported speculation was clear error.

II. THE DISTRICT COURT CLEARLY ERRED WHEN IT FOUND THAT DR. ARCIDIACONO'S ADMISSIONS MODEL SUFFERED FROM OMITTED VARIABLE BIAS WITHOUT EVIDENCE.

The district court justified its decision to include the personal rating variable, even though it was affected by race, because the court concluded that "[r]emoving the personal rating … expands the omitted variable bias." 397 F. Supp. 3d at 173. To support this finding of omitted variable bias, the district court suggested that "the relationship between race and the personal rating is likely partially reflective of biases external to the Admissions Office, characteristics that are correlated with race, and life experiences that are impacted by race." *Id.* This holding reflects a clearly erroneous understanding of the statistical concept of omitted variable bias.

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[4] The Economist, *A Lawsuit Reveals How Peculiar Harvard's Definition of Merit Is* (Jun. 23, 2018), https://econ.st/2MmJeYx.

A. The district court misunderstood the concept of omitted variable bias.

Omitted variable bias is a statistical term of art. It is not simply the omission of any variable. Instead, courts have described omitted variable bias as "the failure to control for an *important* causal factor." *United States v. Johnson*, 122 F. Supp. 3d 272, 366 (M.D.N.C. 2015) (emphasis added). "There must be some indication that the excluded variables would have impacted the results." *In re Live Concert Antitrust Litig.*, 863 F. Supp. 2d 966, 974 (C.D. Cal. 2012).[5] In order to "challeng[e] the validity of a multiple regression analysis," a party must "make a showing that the factors it contends ought to have been

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[5] *See also Ne. Ohio Coal. for the Homeless v. Husted*, No. 2:06-CV-896, 2016 WL 3166251, at *22 (S.D. Ohio June 7, 2016), *aff'd in part, rev'd in part on other grounds*, 837 F.3d 612 (6th Cir. 2016) ("Omitted variable bias arises when a regression analysis does not account for other variables that could be responsible for the statistical relationships observed."); *Reed*, 49 F. Supp. 3d at 403 ("Omitted-variable problems—as the name suggests—arise when important control variables are left out of the model. Imagine trying to calculate the effect of location on the price of an apartment without considering the size of the apartments in the sample. One might end up with what looks like a correlation between location and price, but the result would be meaningless because the entire effect could just as easily be explained by the fact that larger apartments are concentrated in certain locations.").

included would weaken ... the analysis." *Sobel v. Yeshiva University*, 839 F.2d 18, 34 (2d Cir.1988).

Stated more formally, omitted variable bias occurs when "a variable that is a determinant of [the variable of interest] *Y* and is correlated with [an explanatory variable] regressor has been omitted from the regression." Stock & Watson, *supra* at 768. Or, as the Federal Judicial Center describes it, "Failure to include a major explanatory variable that is correlated with the variable of interest in a regression model may cause an included variable to be credited with an effect that actually is caused by the excluded variable." Reference Manual, *supra* at 314.

This means a model should not be rejected simply because it is missing data. "That would be the downfall of empirical economics … because all models have unobservables." JA2243 (T9.81:18–21) (Arcidiacono); *see also* Stock & Watson, *supra* at 322 ("Missing data are a common feature of economic data sets."). If the omission of any possible explanatory variable resulted in omitted variable bias, then every regression model could be disregarded for that reason.

Rather, omitted-variable bias arises *only* when (1) a relevant explanatory variable (here, race) is significantly correlated with a missing variable (here, the unobserved qualitative data that allegedly inform the personal rating), and (2) the missing variable significantly affects the variable (here, the personal-rating score). *See* Stock & Watson, *supra* at 180–82.

Under accepted econometric practice, for the district court to conclude that Dr. Arcidiacono's model was biased because it omitted the personal rating, the district court would have had to reach two conclusions based on the record: that the personal rating (1) "is a determinant" of the outcome *and* (2) also actually correlates with race rather than being skewed by race, "and thus is likely to cause a demonstrable, rather than an assumed, [omitted-variable] bias." *Sobel*, 839 F.2d at 36. To reject a model, there must be at least a *substantial* risk that the omission is causing a bias in the model's estimated coefficients, such that inferences drawn from the coefficients are likely misleading. *See* Br. of Dr. Keane, *et al.,* Doc. 450, at 7–8, 13.

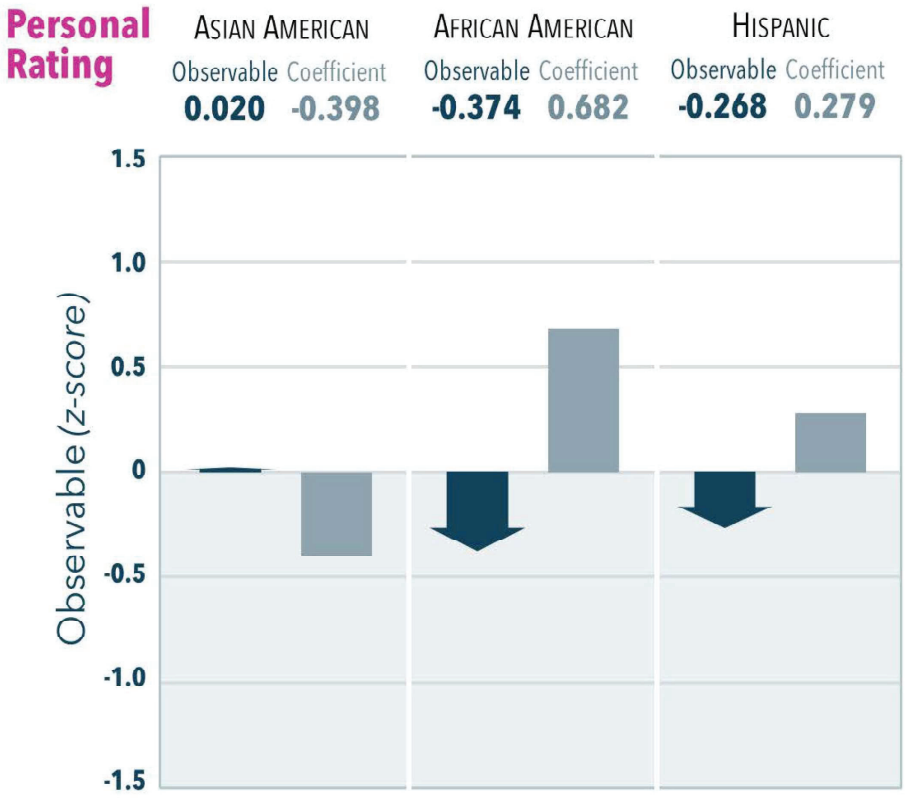
The district court failed to find any risk, let alone a substantial risk, that omitting the personal rating biased the model's estimated

coefficients. Nothing in the record warrants the district court's conclusion that omitting the personal rating would expand omitted variable bias in the admissions model. In fact, it is so implausible that the differences in personal ratings for Asians are based on "characteristics that are correlated with race," 397 F. Supp. 3d at 173, that the district court clearly erred when it concluded the personal rating belonged in the admissions model.

B. The district court's suggestion that Asian Americans' lower personal ratings could be explained by unobservable data is contradicted by testimony and evidence.

Both parties' experts agreed that unobservable data is likely to be consistent with or even follow the observable data. JA2265 (T9.103:2–25) (Arcidiacono) (testifying that because Asian Americans are relatively strong on the observables that affect the personal rating, econometric theory suggests that they are also likely to be relatively strong on the unobservable "missing data" that inform the personal rating); JA3010 (T13.74:14–17) (Card) ("[E]conomists often argue that if the observed factors inside the data that inform a particular variable are in one direction, then the unobserved factors may well be in that same direction.").

Here, the observable data suggests that Asian-American applicants should have higher personal ratings, not lower personal ratings compared to applicants from other groups. JA6015 (PD38.33) (Asian American Observable +0.020; African American Observable -0.374, Hispanic Observable -0.268). The following chart based on Dr. Arcidiacono's baseline dataset illustrates the trend in observable data compared to the trend for the personal rating for each race: the observable data moves in the opposite direction from Harvard's personal rating score:



JA6015 (PD38.33); JA2273–2274 (T9.111:19–112:8).[6] The district court's unfounded suggestion that the personal ratings might reflect some unobservable data is therefore clearly erroneous.

It is no answer that the admissions model might better predict who would gain admission to Harvard with the inclusion of the personal rating. The purpose of the model in this case is to predict the effect of race on admission to Harvard, not to perfectly predict whether a student is likely to be admitted. As Dr. Card admitted, "there is no real standard for goodness of fit" and some models "could have potentially quite a low R-squared [or predictive fit] and yet the model could be extremely informative." JA3122 (T13:187:4–23). For a variable such as the personal rating that is itself affected by race to be properly included in the model, it is not enough to just look at whether the inclusion of such a variable improves the model's predictive power along the narrow lines of admission probability.

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[6] This chart is created through Dr. Arcidiacono's baseline dataset, but other data sets demonstrate a similar trend holds between observables and unobservables with respect to Asian-American, Hispanic, and African-American applicants.

Moreover, Dr. Arcidiacono's model mitigated the risk of omitted variable bias through the explanatory variables that it includes—variables which inform the personal rating score. For example, Dr. Arcidiacono's model controls for alumni interviewers' personality scores as well as high school teacher and counsellor recommendations. JA2585 (T9:73:7–16); *see supra* at pp. 6–7. These variables capture many of the potential inputs to Harvard's personality rating. As Dr. Card testified, "for the personal rating, my understanding is a lot of that information is coming from the teacher letters," "what the guidance counselor says," and "the letter that any alumni interviewer is providing." JA2968–2969 (T13:32:22–33:3). Because Dr. Arcidiacono controls for these variables, which inform the personal rating score, his model further reduces any risk of omitted variable bias.

Finally, the district court's omitted variable bias reasoning suffered from a fatal internal inconsistency. On the one hand, the district court agreed that the personal rating was skewed by race. 397 F. Supp. 3d at 169; *see supra* at pp. 9–12, 21–23. On the other hand, the district court agreed with both SFFA and Harvard's experts that "the overall rating should not be included because Harvard acknowledges

that it is directly affected by racial identity." 397 F. Supp. 3d at 171–72. Thus, the district court's decision suffers from a stark internal contradiction: the court excluded the overall rating—without any concern about omitted variable bias—because it was affected by race, but the court included personal rating even though the court found it too was affected by race. Such self-contradiction was clear error. *See Aponte v. Calderon*, 284 F.3d 184, 194 (1st Cir. 2002) ("factual findings which are internally inconsistent are clearly erroneous" (citing *Alfaro De Quevedo v. De Jesus Schuck*, 556 F.2d 591, 593 (1st Cir. 1977))).

CONCLUSION

The judgment of the district court should be reversed.

Respectfully submitted,

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February 25, 2020

CERTIFICATE OF COMPLIACE

This document complies with the word limit of Fed. R. App. P. 29(a)(5) because, excluding the parts of the document exempted by Fed. R. App. P. 32(f), it contains 5,614 words.

The brief also complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6) because it has been prepared in a proportionally spaced typeface using Microsoft Word in 14- point Century Schoolbook type.

Dated: February 25, 2020

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CERTIFICATE OF SERVICE

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John P. Rust is the Gallagher Family Professor of Economics at Georgetown University. He was previously professor of economics at the University of Maryland, Yale University, and the University of Wisconsin. Professor Rust is best known for his research on the development of computationally tractable methods for empirically modelling dynamic decision-making under uncertainty. In a series of publications, Professor Rust demonstrated that these discrete dynamic programming models provide accurate predictions of actual human decision-making in a variety of contexts. Professor Rust was awarded the Ragnar Frisch Medal by the Econometric Society in 1992 for his research. He is a Fellow of the Econometric Society.

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