CORRECTED EXPERT REPORT IN THE MATTER OF

Moussouris v. Microsoft

SUBMITTED BY:

Henry S. Farber, Ph. D.

December 5, 2017

I. INTRODUCTION

A. QUALIFICATIONS

1. I am Hughes-Rogers Professor of Economics at Princeton University, where I have served on the faculty since 1991. I served on the faculty of the Department of Economics of the Massachusetts Institute of Technology from 1977 through 1991. I received a Ph.D. in economics from Princeton University in 1977, a Master of Science in Industrial and Labor Relations from Cornell University in 1974, and a B.S. in economics from Rensselaer Polytechnic Institute in 1972. Among other topics, I teach courses in labor economics (the analysis of wages, hours, employment, unemployment, labor unions, and other topics related to the workforce) and econometrics (the application of statistics to problems in economics). I have written numerous scholarly articles in both of these subject areas, and my research has been widely published in academic and professional journals. I am a Research Associate of the National Bureau of Economic Research (NBER) and a Research Fellow of the Institute for the Study of Labor (IZA). I am a Fellow of the Econometric Society, a Fellow of the Society of Labor Economists, and a Fellow of the Labor and Employment Relations Association. I have served as President of the Society of Labor Economists. A complete description of my qualifications is contained in my curriculum vitae and a list of my recent testimony is attached as Appendix A to this report. I have also consulted and testified as an expert witness in numerous cases involving labor economics.

2. My time is being billed at the rate of $850 per hour for my work in this matter. This is my normal hourly rate for this type of work. Payment to me is not contingent on my opinions in or the outcome of this matter.

B. ASSIGNMENT

3. I understand that the Plaintiffs in this matter are a class of women at Microsoft. The class consists of female employees who are or have been employed in the "Engineering" or "IT Operations" Professions by Microsoft anywhere in the United States between September 16, 2012 and the present. I understand that Plaintiffs are alleging that women in the Engineering and IT Operations Professions in Stock Levels 59-67 are discriminated against with respect to compensation, and women in the Engineering and IT Operations Profession in Stock Levels 59-64 are discriminated against with respect to advancements in Stock Level and Career Stage. I refer to these women as the "compensation class" and the "advancement class" (if a distinction between the two groups is necessary) and as "the class" collectively. I refer to the group of workers (male and female) in the Engineering and IT Operations Professions as "Technical Employees."

4. Counsel for plaintiffs have asked me to study whether there is statistical evidence of (1) discrimination in compensation between male and female Technical Employees in Stock Levels 59-67, and (2) discrimination in Stock Level or Career Stage advancement rates between male and female Technical Employees in Stock Levels 59-64.

II. SUMMARY OF CONCLUSIONS

5. Women in the class at Microsoft are paid less than otherwise similar men, on average, and the average difference in pay is statistically significant. This gender pay gap persists after you control for standard human capital factors, location, performance reviews, and the type of work each employee performs.

6. This pay gap persists after controlling for workers' job titles. However, these job titles are defined in part by each worker's "Career Stage," and I find that women are systematically in lower Career Stages than men. Career Stage is at least partly the result of decisions made by Microsoft that occurred after each employee was hired. This implies that Career Stage is a tainted variable and controlling for Career Stage (whether directly or indirectly via job title) will understate the gender pay gap.

7. I also find that women in the class lag behind men in their rate of advancement at Microsoft. This is true using either "Stock Level" (which is what Microsoft calls its pay grades) or Career Stage to measure advancement.

III. BACKGROUND

A. DEFENDANT

8. Microsoft is a Washington-based corporation with its corporate headquarters in Redmond, Washington.[1] Microsoft employs approximately 73,000 people in the US and 51,000 people outside of the US.[2]

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[1] https://news.microsoft.com/facts-about-microsoft/#ImportantDates, Second Amended Class Action Complaint, April 6, 2016.

[2] http://www.shareholder.com/visitors/activeedgardoc.cfm?f=rtf&companyid=MSFT&id=12205633

B. PLAINTIFFS

9. Plaintiff Katherine Moussouris is a female former employee of Microsoft who lives in Washington. Ms. Moussouris was employed by Microsoft from approximately April 2007 to May 2014 in Redmond, Washington. During her tenure at Microsoft, Ms. Moussouris was employed as an Engineer.[3]

10. Plaintiff Holly Muenchow is a female employee of Microsoft who lives in Washington. Ms. Muenchow has been employed by Microsoft since September 2002, and remained employed at Microsoft through at least May 2016.[4] Ms. Muenchow works at Microsoft's Redmond, Washington facilities. Until April 2016, Ms. Muenchow was employed by Microsoft in the IT Operations Profession; in April 2016, she joined the Engineering Profession.[5]

11. The data provided to me by Microsoft identify 8,630 members of the compensation class, who worked a total of [redacted] person-years, and 8,037 members of the advancement class, who worked a total of [redacted] person-years.

Continued from previous page

[3] *See* the Second Amended Complaint at ¶¶ 5-6 and the backup to my report

[4] The HR data provided to me by Microsoft run from January 1, 2010 to May 31, 2016. I understand from Plaintiffs' counsel that Microsoft provided additional FY 2016 data on October 24, 2017. These data were provided too late for me to use in my analyses, but I reserve the right to include these in future supplemental work.

[5] *See* the Second Amended Complaint at ¶¶ 7-8 and the backup to my report

C. Data

12. In analyzing questions of compensation and advancement for this report, I have relied on several data sets provided to me by Microsoft. In particular, I have used data from the MS People database.[6]

13. The files produced from MS People cover the period January 1, 2010 through May 31, 2016 (the "discovery period") and contain, among other things, data on employees' compensation, geographic location, age, tenure at Microsoft, gender, hiring and termination dates, leave of absence dates and reasons, and performance ratings, as well as each employee's place within various organizational hierarchies (for example, employees' Stock Level, Career Stage, Discipline, and Standard Title).

14. I have created "compensation years" from these data. The majority of Microsoft's compensation and advancement decisions occur on September 1 of a given calendar year. I have defined each compensation year as running from September 1 of the previous calendar year through August 31 of the current calendar year.[7] I calculate each worker's total compensation in a particular compensation year as: the first observed annual

[6] Bates files MSFT_MOUSSOURIS_00121406 through 00121416, and MSFT_MOUSSOURIS_00646650 through 00646655. I received additional data from Microsoft, such as data from "Performance@Microsoft" or ManageRewards Tool ("MRT"). Both of these are review cycle databases, but the final performance review outcomes are available in MS People. Hence, I do not rely on Performance@Microsoft or MRT directly.

[7] An exception to this is that I attach stock awards that occur in the last three days of August in a given year with the following compensation year, which begins on September 1.

salary in that compensation year, plus any non-relocation bonuses and stock award grants received during that compensation year.[8]

D. Career Stage and Promotions

15. In general, all workers at Microsoft are categorized into a "Job Title Taxonomy" ("JTT").[9] This JTT has three levels: Profession, Discipline, and Standard Title, where Profession is the broadest category and Standard Title is the narrowest.[10] Class members in this case are all women who worked for Microsoft in the United States in the Engineering or IT Operations Professions during the relevant time period.

16. Beyond Profession, Discipline, and Standard Title, employees are also assigned a "pay scale," which is also referred to interchangeably as a "level" or a "Stock Level."[11] Stock Level (along with two other variables, PayScaleType and PayScaleArea) determines each salary range.[12] PayScaleArea is constant among class members and their male counterparts, all of whom belong to the PayScaleArea "United States," while there are

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[8] For example, total compensation in compensation year 2012 would include annual salary as of September 1, 2011, plus any non-relocation bonuses received between September 1, 2011 and August 31, 2012, plus any stock award grants received between August 29, 2011 and August 28, 2012.

[9] Declaration of Joseph Whittinghill, May 9, 2016 ("Whittinghill Declaration") at ¶ 4. Mr. Whittinghill's role at Microsoft is: General Manager, Talent, Learning & Insights.

[10] Whittinghill Declaration at ¶¶ 4-8.

[11] *See* Whittinghill Declaration at ¶ 12 ("'Pay Scale' or 'Level' is identified in Column E….") *See also* Letter from Jessica Perry, August 25, 2016 at ¶ 17 ("A salary range is based on the salary structure *PayScaleArea* plus *PayScaleType*) and the level (also called Stock Level historically and in some existing systems). The salary ranges are typically updated for each Fiscal Year."

[12] *See* Letter from Jessica Perry, August 25, 2016 at ¶ 17.

eight PayScaleTypes for these employees.[13] PayScaleType refers to job groupings or narrower geographic pay regions.

17. Employees at Microsoft are also categorized into "Career Stages." Career Stage indicates the general degree of scope and impact of a role, and most roles fall into three Career Stage categories: Individual Contributor ("IC"); Lead ("L") and Manager ("M").[14] Numeric levels 1-9 are attached to Career Stage letter codes (e.g. IC1, L4, M7), though not all numeric levels are associated with each letter code.[15] "Individual Contributor" stages are numbered IC1-IC9. "Lead" stages are used in Engineering but not in IT Operations, and are numbered L3-L8. Prior to 2013, "Manager" Career Stages were numbered 1-3.[16] Starting in 2013, these Career Stages were updated and lower levels were eliminated and replaced with stages M4-M9.[17] Microsoft's FAQ note that during this realignment, a manager Career Stage changing (e.g. from M1 to M4) is not a promotion.[18] "Lead" Career Stages were also introduced in 2013. This realignment of Career Stages occurs during compensation year 2013, and comes into full effect during compensation year 2014. Since this realignment, Career Stages with the same number indicate roles that Microsoft considers to be "peer" roles that are equivalent in scope and impact: for example, IC4, L4, and M4 are considered peers.[19]

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[13] Deposition of John Adrian Ritchie, June 30, 2016 ("Ritchie Deposition") at pp. 401-405 and Exhibit 32 to Ritchie Deposition.

[14] *See* Whittinghill Declaration at ¶¶ 14-17.

[15] Exhibit 33 to Ritchie Deposition; MSFT_MOUSSOURIS_00001997. IC Career Stages can be in levels 1-9. L Career Stages can be in levels 3-8. Prior to Microsoft's releveling in 2013, M Career Stages were in levels 1-3; since this releveling, M Career Stages can be in levels 4-9.

[16] MSFT_MOUSSOURIS_00002378.pptx, at p. 19 ("New manager career stages", Speaker notes section)

[17] MSFT_MOUSSOURIS_00002378.pptx, at p. 19

[18] MSFT_MOUSSOURIS_00688508 at p. 9.

[19] Exhibit 33 to Ritchie Deposition, at page 1. See also MSFT_MOUSSOURIS_00058126.ppt at p. 7

18. A Microsoft document states "Career stage allows us to identify a common definition of scope, general complexity, and impact for every role at the company.[20] For example, across all of our professions, an employee in Stage 2 is considered to be in an early career stage while Stage 4 is considered a senior stage for a given area or specialization."[21] Under the heading "How do I determine what stages are comparable in different disciplines or professions?", the same document explains "A career stage describes a similar level of job scope and complexity; these range from early in career to senior stages. For example, a stage 4 Engineer and a stage 4 Finance Manager are both expected to have a similar level of mastery over their area of specialization."[22] An internal Microsoft presentation describes the "employee experience" of Career Stage as "based on the scope, complexity and impact of my job."[23]

19. Microsoft uses a combination of Discipline and Career Stage to define each role's job duties, competencies, and "key results." For instance, an internal Microsoft document defines "Key Discipline Results" for various Career Stages within the Discipline "Software Engineering" (a Discipline within the Engineering Profession).[24] A similar document describes the "Competencies" for the same group.[25] The combination of Discipline and Career Stage generally defines each "Standard Title."

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[20] MSFT_MOUSSOURIS_00688508 at p. 6.
[21] MSFT_MOUSSOURIS_00688508 at p. 6.
[22] MSFT_MOUSSOURIS_00688508 at p. 8
[23] MSFT_MOUSSOURIS_00058126.ppt at p. 7.
[24] MSFT_ MOUSSOURIS _00642050
[25] MSFT_ MOUSSOURIS_00006414

20. In addition to the "Job Title Taxonomy" hierarchy and Career Stage, Microsoft also uses a structure called "Stock Level." Stock Levels are salary grades, and are sometimes also called "pay levels."[26] Class members are in Stock Levels 59-67 with respect to pay claims, and 59-64 with respect to advancement claims. A Microsoft document states "Pay levels (such as levels 50, 59, or 64) represent salary ranges, based on an ongoing analyses [sic] of local and discipline-specific labor markets and Microsoft's compensation strategy. Because the labor market pays differently for different career stages, Microsoft does too; this is reflected by the link between career stages, discipline, and pay level."[27] Table 1 presents the percent of each Stock Level that is occupied by workers of each gender, as well as the number of man- and woman-years represented in that level.

21. A "promotion" is understood by labor economists to entail an increase in one's job duties or responsibilities, and it is typically associated with an increase in pay. Microsoft describes at least two moves as constituting a promotion: (1) increases in Stock Level; (2) increases in Career Stage.[28] However, an increase in Stock Level (which is equivalent to an increase in pay band) is not necessarily a "promotion" in the sense of reflecting an increase in job duties or responsibilities. Within a single Discipline, Career Stages are usually comprised of pairs or triplets of Stock Levels. Therefore, I will discuss both increases in Career Stage and increases in Stock Level as "advancements."

[26] Declaration of Martin Loughlin at p. 31, heading "Salary Grade Level." "Stock Level is the current way in which we associate a level with an employee. Salary Grade Level is duplicative of Stock Level." *See also* MSFT_MOUSSOURIS_00688508 at page 8.

[27] MSFT_MOUSSOURIS_00688508 at page 8.

[28] *See* MSFT_MOUSSOURIS_00688508 at p. 8; MSFT_MOUSSOURIS_00004281 at -81.

E. REVIEW RATINGS

22. Throughout the class period, Microsoft has used various performance review regimes. The results of these performance reviews are used to make decisions about compensation (including merit raises, bonuses, and stock grants), and advancements.[29]

23. During the period for which I have data, Microsoft has employed three separate performance review regimes: (1) Contribution Ranking and Commitment Rating (2010); (2) Performance Rating (2011-2013); and (3) Reward Outcome (2014-2016).[30,31]

24. In 2010, Microsoft rated employees with two scores: Commitment Rating and Contribution Ranking. Commitment Rating took three values: (1) Underperformed; (2) Achieved; and (3) Exceeded. Contribution Ranking consisted of three categories and corresponding set percentages: (1) Low (bottom 10%); (2) Medium (middle 70%); and (3) High (top 20%).

25. Between 2011 and 2013, Microsoft used a performance measure called "Performance Rating," which is a scale from 1 (the best possible ranking) to 5 (the worst possible ranking).[32]

26. Beginning in 2014, Microsoft began using the performance measure "Reward Outcome," [redacted]. This process involves managers moving a "slider" in a software program called

[29] Declaration of Larissa Johnson, May 2, 2016 "Johnson Declaration" at ¶¶ 4-17.

[30] Ritchie Deposition at pp. 428-438.

[31] The date ranges listed are for calendar years. The corresponding ranges for my "compensation year" are as follows: Contribution Ranking and Commitment Rating (2011), Performance Rating (2012 – 2014), Reward Outcome (2015 – 2016).

[32] In analyses where I use performance ratings, I invert the scale of the Performance Rating system so that a higher number represents a better outcome across all ratings regimes.

"MRT" (ManageRewards Tool). Each individual's recommendation progresses through five layers of managers.[33]

27. All three performance rating regimes involved Calibration meetings or People Discussions where managers discussed and compared employees within peer groups to determine rewards and promotions.[34]

28. In several of the analyses that follow, I control for each worker's performance review outcome. Because the metrics have changed over the period of time for which I have data, I include separate control variables corresponding to each performance metric. In time periods where that metric was not in force, I assign a zero score to each individual. Additionally, during each time period, there are a number of workers who are not assigned performance review scores. These workers are typically either new hires, workers who took a leave of absence, or workers who were previously employed by a company that was recently acquired by Microsoft. I assign a zero score to all workers who were employed by Microsoft during a given performance regime but who were not given performance review scores, and I also include a separate indicator variable that identifies these individuals. This allows me to include these workers in analyses that include performance review as a control.

IV. METHODS

29. In this section, I discuss the three primary statistical techniques I use in the analyses that follow: multiple regression analysis, probit analysis, and ordered probit

[33] Johnson Declaration at ¶ 6.

[34] Ritchie Deposition at pp. 116-17, 136-38, 158-59, and 228-35.

analysis. I use multiple regression analysis in the compensation analyses that follow. I use probit analysis in the advancement analyses that follow. I use ordered probit analysis in my analyses of men and women's Stock Level and Career Stage distributions, as well as in the performance review analyses. All three of these methods are standard among labor economists.

A. TECHNIQUES FOR ANALYZING DIFFERENCES IN PAY

30. Economists define sex discrimination in pay to be differences in pay between men and women that cannot be explained by differences in productivity-related characteristics like work experience or differences in the type of work they perform.

31. An individual's pay is related to his or her work experience. More experienced workers have higher average pay than workers with less experience. These differences reflect the increase in productivity that is associated with additional work experience.

32. Average pay also varies across types of jobs, even for workers with otherwise similar characteristics. For example, engineers typically earn more than librarians. This is true even for engineers and librarians with similar levels of work experience. These differentials result from differences in supply of workers to the different jobs relative to demand. For example, careers that are less popular, that require unusual skills, or that are in particularly high demand need to offer higher wages in order to attract workers into that type of work.

33. Thus, in studying the salaries of male and female employees at Microsoft, in some specifications I adjust for differences between them in work experience, and the type of work they perform (that is, each worker's Discipline or Standard Title).[35]

34. The key statistical technique I use when analyzing differences in pay is multiple regression analysis. This is a standard statistical technique. The first step in this analysis is to specify a model of pay determination that includes the factors that are related to pay and to generate measures of these factors. These factors include age and work experience at Microsoft, each worker's Discipline, and indicators related to the geographic location where each employee works.[36] I also include models with each worker's performance review metrics, and Standard Title. Note that IT Operations and Engineering have separate Disciplines and Standard Titles, so controlling for either Discipline or Standard Title will also serve to control for Profession. Most of my regression analyses (with the exception of the first, which controls only for gender) also include specifications that control for compensation year in order to account for common factors that influence pay. A multiple

[35] In principle, I would like to be able to additionally control for a worker's education level. However, Microsoft has only provided data on workers' education level for approximately half of its workers. I have examined the compensation of workers for whom I have education information as compared to those workers for whom I am missing these data, and I find that employees with non-missing education data earn higher compensation than employees with missing education data. The difference is significant; employees who are not missing education data earn approximately 10% more (on average) than those for whom that data is missing. In order to control for education in my regression analyses, I would need to exclude data from those workers for whom I am missing education data, even if I have otherwise-complete data on that person. Because the presence or absence of education data is not random with respect to income, limiting my analysis only to those workers for whom I have education data could introduce bias to my analyses.

[36] To allow for a non-linear relationship between experience and pay, my models additionally include the square of age and the square of experience at Microsoft.

regression analysis yields an estimate for each factor of its impact on pay. These estimates are called the coefficients of the model.

35. While the factors listed in the previous paragraph are the central systematic factors that determine pay in a non-discriminatory compensation system, there is some variation in pay that is not accounted for by these factors. The multiple regression model accounts for these unmeasured factors through a random component.

36. The coefficients of the model are estimated using multiple regression analysis, and these estimated coefficients are used to compute a prediction of pay for each worker based strictly on the factors included in the model. Estimates of the unmeasured factors are then computed as the difference between the actual pay level and the predicted pay level. This difference is called the residual.

37. If pay is determined in a non-discriminatory fashion, then these residuals will not be systematically related to the gender of the worker. If it were found that there is a systematic relationship such that women are paid less, on average, than predicted by the factors included in the model, then I would conclude that the analysis provides statistical evidence of discrimination.

38. The actual calculation is done in a single step by including in the model a variable that indicates which observations relate to women. The central result of the multiple regression analysis in this case is an estimate of the difference in pay between women and men, accounting for differences between men and women in all of the other factors included in the model. The estimated difference in pay between women and men in this model is a measure of the relationship between gender and the unmeasured factors affecting

compensation. If it is found that there is a statistically significant negative effect of being a woman on pay (an effect that was unlikely to have arisen by chance) after accounting for differences in the workers' characteristics and job characteristics included in the model, then I conclude that there is statistical evidence of discrimination against women in pay.

39. In order to draw an inference that there has been discrimination, it is important to determine how likely it would be to find the observed difference in pay if there had not been discrimination. To make this clear, consider the following example. Suppose that, in fact, pay is non-discriminatory so that, all other things equal, men and women would earn the same level of pay. However, there are many factors that affect pay in any particular case. Some of these, such as experience and the type of work performed, are measurable and appropriate to consider in pay determination. Others are not measured and assumed to be the same, on average, for men and women. These unmeasured characteristics are captured by the random component.

40. What this means is that, for any group of men and women who are paid on a non-discriminatory basis, there will be some average difference in pay due to variation in the random component even after accounting for individual and job characteristics. The multiple regression analysis provides a measure of how likely it is that the estimated average difference in pay accounting for the included factors is due to random variation (which is assumed equal on average for men and women) rather than to systematic variation in pay by gender (discrimination).

41. A statistic provided by the multiple regression analysis is called a "t-statistic" (sometimes called the "number of standard deviations") of the estimated coefficient in the

pay regression on the variable indicating being a woman (the average difference in pay between women and men accounting for the other factors). Larger absolute values of the t-statistic indicate that the estimated pay difference is less likely to have occurred by chance. The usual standard used by labor economists for a conclusion that an estimated pay difference is statistical evidence of discrimination is a t-statistic greater than 1.96 (in absolute value), which indicates that the observed difference would have occurred randomly in the absence of discrimination less than five percent of the time. A related statistic provided by the multiple regression analysis is called a p-value. The p-value represents the probability that the observed difference arose from random chance and translates directly into the level of statistical significance. For example, a p-value of 0.0005 would indicate that there is a 0.05% probability that the observed difference arose by random chance and, equivalently, that the difference is statistically significant at the 0.05% level.[37]

B. TECHNIQUES FOR ANALYZING DIFFERENCES IN ADVANCEMENT

42. In statistical analysis, certain outcome variables may be binary. For instance, a worker is promoted or not promoted, a worker is hired or not hired, a worker is fired or not fired. There are several statistical methods that allow for the outcome variable to be binary in nature. The statistical technique I use is called a "probit" model. A probit model is a form of multivariate analysis that can be used when the outcome can take on one of two discrete values, for instance, whether or not an employee had been promoted or whether or not an

[37] Similarly, a p-value of 0.1 would indicate that there is a 10% probability that the observed difference arose by random chance and, equivalently, that the difference is statistically significant at the 10% level.

employee received a top performance rating. Probit models can include a number of control variables, and a probit analysis yields, for each factor in the model, an estimate of that factor's influence on the outcome. These are called the coefficients of the model. However, in a probit model, the magnitudes of the model coefficients do not have a straightforward interpretation; rather, the coefficients are used, in turn, to compute "marginal effects."

43. For a probit model, the "marginal effect" of a factor is the estimate of that factor's effect on the probability of the binary outcome, or the difference in probabilities due to that factor. For instance, a probit model allows estimation of the difference between women and men in the probability of promotion or in the difference in the probability of obtaining the top score. The sign of the coefficient in a probit model indicates the direction of the marginal effect. For instance, a negative sign on the "female" coefficient, indicates that, compared to men, women are less likely to be promoted or that women are less likely to obtain a top score.

C. Techniques for Analyzing Differences in Levels and Performance

44. "Ordered probit" models are a generalization of probit models, and are a form of multivariate analysis that can be used to model discrete outcomes with more than two possible values that can be rank-ordered, but do not have a cardinal relationship. For instance, in this case, Stock Levels are discrete (e.g. 60, 61, 62, etc.) and have a natural order. However the difference between levels may not always have the same interpretation: a move from 61 to 62 may represent a different change than a move from 64 to 65. A multiple regression analysis like those discussed in Section IV.A above would require that one-level

moves are of identical magnitude, no matter the starting point, while ordered probit makes no such assumption. Similarly, Career Stage and performance metrics are discrete and have a meaningful order, therefore when I perform an analysis using Stock Level, Career Stage, or performance metrics as the dependent variable, I use an ordered probit model.

D. Variable Selection and Tainted Variables

45. It is typically the case that an employee's compensation is positively related to his or her length of employment at his or her current employer ("tenure"). Typically, as a worker gains tenure at a company, he or she obtains additional human capital that makes him or her more productive (and hence, more valuable to the employer). Labor economists typically also control for age in order to account for differences in workers' accumulated skills.[38] However, it is also possible that the return to both of these factors may diminish over time, therefore I include age and time at company in a non-linear fashion by additionally including the square of both age and time at company. A company may have other structural factors that influence an employee's pay. For example, offices may be located in cities with differences in cost of living. In order to account for this, I include indicators for the location in which the individual works. Another example is that an employee's compensation may be directly tied to concrete outcomes. A company may make some components of a person's compensation (e.g. bonuses) contingent on performance. In order to account for this, I include performance evaluation measures in some models.

[38] Labor economists also typically control for education level when studying compensation, if possible. However, as discussed at fn 35, I did not receive usable education data from Microsoft.

46. The control variables included in a multiple regression analysis of compensation are meant to account for differences across workers in the legitimate factors affecting pay including worker skill, the type of work being done, and related factors. However, variables that are correlated both with gender and pay through potentially discriminatory employer decisions are known as "tainted" variables, and inclusion of such variables would lead to underestimation of the gender difference in pay due to employer discrimination. For instance, if a company has two divisions and women are systematically assigned to a division with lower average compensation (that has lower stock awards, or less opportunity for advancement) controlling for division in multiple regression analysis of compensation would lead to an underestimation of the gender difference in pay.

47. There is a conceptual problem with controlling for Stock Level in a compensation regression: namely, that Stock Level is a pay band.[39] If you were to regress compensation on Stock Level, then you would simply be regressing pay on a proxy for pay, which is inappropriate.

48. In addition to the conceptual problems with including Stock Level as a control in a compensation regression, there may be an additional problem: at Microsoft, class members are in lower Stock Levels and Career Stages on average as compared to men.[40] Thus, controlling for Career Stage or Stock Level in the multiple regression analysis would lead me to underestimate the true pay gap. If women are systematically assigned to lower pay

[39] This issue also affects the inclusion of Career Stage, which (within Discipline) is typically simply a pair or triplet of Stock Levels.

[40] See discussion of evidence that class members are in lower Stock Levels and Career Stages than men in Section VI. See discussion of the relationship between Career Stages, Stock Levels, and Standard Titles in Section III.D.

bands (Stock Levels), then controlling for Stock Level will mask some of the gender difference in pay. Stock Level and Career Stage are both examples of a "tainted" variable. Inclusion of these variables appears to reduce the pay gap, but this is a result of women being in lower Stock Levels or Career Stages than men.

V. COMPENSATION ANALYSES

49. Compensation for salaried workers at Microsoft is comprised of four components: signing bonus, annual salary, annual bonus, and annual stock awards.[41] Annual bonuses are lump sum payments, and are generally targeted to be a percentage of each employee's base salary.[42] Annual stock awards are given in order to recognize and retain employees based on anticipated future contribution. These are granted annually, and vest over five years at a rate of 20% per year. Stock Awards are expressed in U.S. dollars, and are valued at the Fair Market Value of the stock price on the date the stock is awarded.[43,44]

50. In Table 2, I present the difference in average total compensation for male and female Technical Employees in Stock Levels 59-67 at Microsoft, by compensation year, expressed in both "levels" (i.e. dollars) and as a percentage. This analysis shows that on

[41] All class members are salaried workers. Approximately 85% of stock grants (83% by value, 86% by occurrence) are granted in the last three days of August in any year. The remainder are spread throughout the year. On average, non-August stock grants are larger than August stock grants.

[42] MSFT_MOUSSOURIS_00741588 at slide 41

[43] *See* Letter from Jessica Perry, August 25, 2016 at ¶8 (ValueAwarded represents StockGrantQty multiplied by TranslationFMV (stock price on the grant date).)

[44] MSFT_MOUSSOURIS_00741588 at slide 41.

average, women earn $[redacted] (8.6%) less than men, and this difference is statistically significant.[45]

A. Regression Analyses

51. The analysis presented in Table 2 (described above) compares raw averages between compensation of male and female Technical Employees at Microsoft. However, as explained in Section IV.A, above, there may be non-discriminatory reasons for at least some of the differences in pay between men and women. For example, this may be the case if men, on average, have more experience than women. In Table 3, I present the results of a multiple regression analysis of compensation between men and women after controlling for various factors that might affect compensation.

52. The first row of Table 3, Model 1, presents the results of regressing the natural logarithm ("log") of compensation on an indicator variable that takes a value of 1 if the employee is female and 0 otherwise. In this analysis, there are no control variables other than gender, and it reflects the raw average pay difference between male and female Technical Employees at Microsoft. On average, female Technical Employees earn 8.9 log points (8.6%)

[45] The individuals included in this analysis are those who also appear in the analyses in Table 3. In particular, this sample includes workers in Engineering or IT Operations Professions in Stock Levels 59-67 who are not employed in any professions other than Engineering or IT Operations at any point in the salary year, and who begin the year in Stock Levels 59-67. Additionally, this sample is limited to employee-years with non-missing values for tenure and age. I have also dropped employee-years in which annual salary is 1, or in which Career Stage is one of the following: ATR-C; ATR-D; ATR-E; IC-0; or MA. Career Stage ATR refers to "Administrative, Technical, and Retail" and Career Stages IC-0 and MA were described in a letter from counsel for Microsoft as "most likely old data entry errors or reflect data that wasn't available at the time." (Letter from Lauri Damrell, January 20, 2017).

less than male Technical Employees. The p-value for this difference is less than 0.0005, indicating that this difference is statistically significant at the 0.05% level.[46]

53. The second row of Table 3, Model 2, includes the gender effect, and additionally controls for each worker's work experience at Microsoft ("tenure") and tenure squared, each worker's age and age squared, the state where each employee works, each employee's PayScaleType, the city where each employee works,[47] and indicator variables for each compensation year. Controlling for these standard human capital factors reduces the estimate of the gender pay gap slightly to 7.7 log points (7.4%). The p-value for this difference is less than 0.0005, indicating that this difference is statistically significant at the 0.05% level.

54. The third row of Table 3, Model 3, controls for the same human capital factors as controlled for in the previous row, but additionally controls for each employee's performance review outcomes. To the extent that compensation is related to performance reviews, controlling for each employee's performance review may be appropriate. Adding performance review measures makes virtually no difference in the estimate of the pay gap, which remains at 7.7 log points (7.4%). The p-value for this difference is less than 0.0005, indicating that this difference is statistically significant at the 0.05% level.

55. The fourth row of Table 3, Model 4, controls for the same factors as the previous row, but additionally controls for the "Discipline" of each worker. Disciplines are

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[46] See ¶ 41 and fn 37 for a discussion of p-values.

[47] I have controlled individually for each city with at least 500 employee-years. These cities are: Bellevue, WA; Cambridge, MA; Durham, NC; Fargo, ND; Issaquah, WA; Kirkland, WA; Mountain View, CA; Palo Alto, CA; Redmond, WA; Seattle, WA; and Sunnyvale, CA. I group all other cities of work into an "Other" category.

described by Microsoft as "job families within a Profession [e.g.: Engineering or IT Operations] that produce similar business results."[48] There are 16 Disciplines within the Engineering profession, and 8 within IT Operations.[49,50] The pay difference between men and women persists even after controlling for each Discipline: my estimate of the gender pay gap is 6.5 log points (6.3%). The p-value for this difference is less than 0.0005, indicating that this difference is statistically significant at the 0.05% level.

56. Lastly, the fifth row in Table 3, Model 5, controls for the same factors as in Row 4, but also controls for each worker's "Standard Title." This is each worker's job title. Among Technical Employees in Stock Levels 59-67, there are 275 Standard Titles (206 in Engineering, and 69 in IT Operations). After controlling for Standard Title (in addition to human capital factors, performance review metrics, and Discipline), the gender pay gap is smaller at (2.8 log points (2.8%)) but remains statistically significant. The p-value for this difference is less than 0.0005, indicating that this difference is statistically significant at the 0.05% level. However, Standard Title is assigned by Microsoft based on each employee's

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[48] MSFT_MOUSSOURIS_00002378 at p. 21.

[49] The 16 disciplines in Engineering are Art, Audio, Build, Content Publishing, Data & Applied Sciences, Design, Design Research, Engineering General Management, Game Design, Intl Project Engineering, Product Planning, Program Management, SDET, Service Engineering, Software Development, and Software Engineering. 14 of these disciplines are in use throughout the entire observation period, while two of them – Data & Applied Sciences, and Software Engineering – are used from 2014 on. I have combined the smallest nine Engineering Disciplines a single category, "Other-Engineering." These nine smallest Engineering Disciplines are: Art, Audio, Build, Data & Applied Sciences, Design Research, Engineering General Management, Game Design, Intl Project Engineering, and Product Planning, and I have combined them because they have relatively few employee-years.

[50] The 8 Disciplines in IT Operations are IT Operations Leadership, IT Operations Program Management, IT SDET, IT Service Engineering, IT Service Operations, IT Software Development Engineering, IT Solution Management, and IT Solutions Architect. I have combined the smallest 3 IT Operations Disciplines into a single category, "Other-IT," because they have relatively few employee years. These 3 IT Operations Disciplines are IT Operations Leadership, IT SDET, and IT Solutions Architect.

Career Stage and Discipline. As I show below, Career Stage is a tainted variable, with women being systematically under-leveled relative to men. As such, I believe that including Standard Title (which depends on Career Stage) will understate the true gender pay gap between men and women.

B. The Role of Performance Reviews

57. In order to examine whether or not class members are subject to discrimination in performance review scores, I have performed ordered probit analyses in which performance metrics are the outcome, and the only explanatory variable is gender. I perform a separate analysis for each performance metric used by Microsoft, which I present in Table 4. In each row of Table 4, I present the coefficient on the "female" variable, as well as the t-statistic. Row 1 covers Contribution Ranking, Row 2 covers the Commitment Rating, Row 3 covers Performance Rating, and Row 4 covers Reward Outcome. This analysis shows that there are no statistically significant differences between men and women in Performance Rating or Reward Outcome, but that women receive statistically significantly lower Contribution Rankings and Commitment Ratings than men.

VI. DISPARITY IN CAREER STAGE AND STOCK LEVEL

58. In the analysis described in paragraph 56 above (Model 5 of Table 3), I have included each worker's Standard Title. However, I believe that inclusion of this variable may result in an understatement of the gender pay gap between men and women. This is because Standard Title is dependent on Career Stage, and women are, on average, assigned to lower Career Stages than men. Women are also systematically assigned to lower Stock

Levels than men. In this section, I discuss the evidence that women are systematically underrepresented with respect to each of these factors.

A. DISPARITY IN CAREER STAGES

59. Career Stages at Microsoft are designated with a number from 1 to 9 preceded by one of the following prefixes: "IC", "L", or "M." Given the same prefix, higher numbers correspond to higher Career Stages. Thus, "IC4" is a higher Career Stage than "IC3", and "L4" is a higher Career Stage than "L3." However, the definition of "M" stages changed in calendar year 2013. Prior to that change, Microsoft designated employees as M1–M3, while since then employees have been designated M4–M9. For this reason, I cannot compare Career Stages M1–M3 to IC Career Stages, but I can compare IC to L and M.[51]

60. Figures 1-2 compare Career Stages of male and female Technical Employees in Stock Levels 59-67 at Microsoft. In performing these analyses, I ignore the "IC", "L", and "M" prefixes, because according to Microsoft employees in the same numeric category are comparable regardless of prefix, and look only at the numeric part of Career Stage. Figure 1 covers the entire discovery period, though I exclude M career stages 1-3 from this analysis because they are not directly comparable to other stages of the same number. The top panel compares the distribution of men and women's Career Stages and demonstrates that women are overrepresented in the lower stages (2 and 3) and underrepresented in the higher stages (4 and 5). Since the distribution of men and women might differ due to factors like experience and Discipline, I also compare women's actual distribution to the distribution I would expect

[51] L Career Stages were introduced at the same time as M1-M3 Career Stages were eliminated.

them to have if there were no gender discrimination in Career Stage assignment. To do this, I perform an ordered probit analysis where the Career Stage number is the outcome and I control for the same factors as in Model 4 of Table 3.[52] Then, I use the results of this analysis to predict what the distribution of women among Career Stages *would be* if the coefficient on "female" were 0. The results of this analysis are presented in the bottom panel, and these results imply that women are overrepresented in low stages (2 and 3) and underrepresented in high stages (4 and 5). The coefficient on the female indicator variable in the ordered probit analysis is negative (-0.29) and is statistically significant.

61. Figure 2 covers only the years since Microsoft's change in Career Stage taxonomy (compensation years 2014-2016), and once again both panels demonstrates that women are overrepresented in the low stages (2 and 3) but underrepresented in the high stages (4 and 5). The coefficient on the female indicator variable in the ordered probit analysis is negative (-0.3) and is statistically significant.

62. Because women are systematically in lower Career Stages than would be predicted in the absence of discrimination, controlling for Career Stage when performing pay regressions (as I did by controlling for Standard Title, which is a function of Career Stage and Discipline, in Row 5 of Table 3), will underestimate the gender pay gap. Because Standard Title is a function of Discipline and Career Stage, and because Career Stage is a tainted variable, so too is Standard Title. Therefore, even though there remains a statistically significant 2.8% pay gap even after including controls for Standard Title, this likely

[52] Namely: each worker's tenure and tenure squared, each worker's age and age squared, the state where each employee works, each employee's PayScaleType and Discipline, the city where each employee works, performance ratings, and indicator variables for each compensation year.

understates the true effect of gender discrimination against female Technical Employees at Microsoft.

B. DISPARITY IN STOCK LEVELS

63. In addition to examining the gender disparity in Career Stages (as described above), I have performed a similar analysis using Stock Level as the dependent variable. Unlike Career Stage, there remains a consistent ranking over time, and I am able to present these results in a single histogram.

64. The top panel of Figure 3 compares the actual distribution of men and women among stock levels at Microsoft and demonstrates that women are overrepresented in the lower levels (59–62) and underrepresented in the higher levels (63–67). As I did with Career Stages, I next perform an ordered probit analysis, again controlling for the factors from Model 4 of Table 3, and use the results to predict what the distribution of women among stock levels *would be* in the absence of discrimination.[53] The bottom panel of Figure 3 compares this predicted distribution to women's actual distribution and demonstrates that if women were assigned to stock levels in the same manner as men, there would be fewer women in the lowest levels (59–62) and more women in the highest levels (63–67). The coefficient on the female indicator variable in the ordered probit analysis is negative (-0.28) and is statistically significant.

[53] Namely, I control for: each worker's tenure and tenure squared, each worker's age and age squared, the state where each employee works, each employee's PayScaleType and Discipline, the city where each employee works, performance ratings, and indicator variables for each compensation year.

VII. DISPARITY IN ADVANCEMENT

65. Microsoft employees are assigned a Stock Level (which functions as a pay band) and a Career Stage (which is a by-Discipline classification that defines levels of expertise). As shown above, class members are systematically under-leveled with respect to each of these measures. Gender differences in pay may arise in part from the fact that women advance to the next Stock Level (or Career Stage) at a different rate compared to men. If women advance at a slower rate than do men, this is evidence that a portion of the Stock Level or Career Stage gap (as discussed in Section VI above) is due to decisions made by Microsoft after each individual was hired. In this section, I discuss differences in advancement as measured by progression in Stock Levels and Career Stages for men and women at Microsoft.

66. I first discuss differences in advancement as measured by progression in Stock Levels. I define a Stock Level progression as a movement from a lower Stock Level to a higher Stock Level, for instance, level 60 to level 61. I limit my analysis to Stock Levels 59 to 64. I then discuss differences in advancement as measured by progression in Career Stage.

67. I use probit analysis to study differences in the probability of advancement (by Stock Level and Career Stage) between men and women at Microsoft. I estimate the number of expected Stock Level changes for women at Microsoft by predicting the advancement rates for women as if they were men, but with their actual characteristics (other than gender) and comparing it to the actual advancement rates by Stock Level.

68. A change in Stock Level between two years (for instance, between 2012 and 2013) is an event that has a discrete outcome: a change either occurs or does not. I identify a

Stock Level advancement as having occurred if an individual's Stock Level on September 1 of year *t* is greater than that individual's Stock Level on September 1 of year *t*-1. I estimate a probit model of the likelihood of Stock Level advancement as a function of year, experience at Microsoft, experience at Microsoft squared, age, and age squared, Discipline, city and state of work, Stock Level as of September 1 of the previous year, and performance metrics for the performance review that took place in year *t*-1. Since an advancement in Stock Level is defined as a year-on-year increase in Stock Level, the first potential change that I can observe takes place on September 1, 2011 (which is the beginning of compensation year 2012), and is relative to Stock Level on September 1, 2010.[54]

69. A change in Career Stage is also a binary event: it either occurs, or it does not. I estimate a probit model of the likelihood of Career Stage advancement as a function of controls listed above (for advancement in Stock Levels). Microsoft changed its Career Stage structure in calendar year 2013, a change that went into effect at the beginning of compensation year 2014. Prior to this change, Microsoft had two main Career Stages: Individual Contributor (IC) and Manager (M). The individual contributor Career Stage included levels 1 through 9. The manager Career Stage included levels 1 through 3. After this change, Microsoft introduced a new Career Stage – Lead (L), which included levels 3 through 8. Microsoft also eliminated Career Stages M1 through M3 and introduced new manager Career Stages M4 through M9.[55] Prior to compensation year 2014, I define an

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[54] In performing this analysis, I compare the stock level on September 1 of each year to the stock level on September 1 of the previous year, which will capture stock level advancements that occurred at any point in the year.

[55] See discussion of Career Stages at ¶¶ 17-19.

advancement in Career Stage as an increase (within a Discipline) in level within a Career Stage type (for instance, from IC3 to IC4, or M1 to M2). After 2014, I define a Career Stage advancement as an increase (within a Discipline) in level, regardless of Career Stage code (for instance, moves from IC3 to IC4, L4 to M5, or M4 to IC5 would all be identified as "advancements"). Given the change in the Career Stage structure at Microsoft I only analyze the Career Stage advancement for two time periods: (1) for years prior to compensation year 2014, and (2) between compensation years 2015 and 2016. I do not include compensation year 2014 in my analyses of Career Stage advancement. I identify changes in Career Stages as an increase on September 1 of a particular year relative to the Career Stage on September 1 of the previous year.

70. Table 5 shows the advancement rate (by gender) out of each listed Stock Level. For instance, among workers in Stock Level 60, female Technical Employees advance to a higher level at a rate of 43.5% per year (on average), while male Technical Employees will advance to a higher level at a rate of 44.4% per year (on average).

71. Table 6 presents the results of multivariate probit analyses that account for the prior year's Stock Level or Career Stage. Column 1 presents the average advancement rate in Stock Level or Career Stage. Column 2 shows the "marginal effect," or the difference in the probability of moving from one Stock Level or Career Stage to the next for women relative to men, where a negative sign indicates a lower likelihood of advancement for women. Column 3 gives a test statistic, called a z-statistic, that shows whether or not the difference in probability is statistically significant at the five percent level. As with a t-statistic, a z-statistic greater or equal to 1.96 indicates that the difference is statistically significant at the five

percent level. I find that women are 2.1 percentage points less likely to advance from one Stock Level to the next and the difference is statistically significant. I find that the probability of moving up a Career Stage prior to compensation year 2014 is 2.7 percentage points lower for women, and the difference is statistically significant at the five percent level. In the period following compensation year 2014, women are about 3.4 percentage points less likely to advance in their Career Stage, and this difference is statistically significant at the five percent level.

72. Next I calculate an expected number of Stock Level changes for women and compare it to the actual rate of Stock Level changes at Microsoft. In order to calculate the expected number of changes for women, I estimate a benchmark Stock Level advancement model for men only and use the resulting coefficient estimates to predict Stock Level advancement probabilities for women using their observed characteristics (experience at Microsoft, experience at Microsoft squared, age, and age squared, Discipline, city and state of work, previous Stock Level, and performance metrics). The sum of these probabilities across the group of women is the number of women one would have expected to have advanced if a woman with a given set of characteristics had the same probability of advancement as a man with the same characteristics.

73. This calculation indicates the number of Stock Level changes among women one would expect in the absence of discrimination. This "expected number" of women's advancements can then be compared to the actual number of advancements among women to determine whether actual advancements are below the number that one would expect in the absence of discrimination.

74. I use a standard statistical technique known as "bootstrapping" in order to test for the statistical significance of the difference between the expected and the actual number of advancements. This analysis is done by resampling the complete dataset multiple times, and calculating for each sample a number of statistics of interest—in particular, the difference between the actual and expected stock level advancements for women. I repeat this procedure 1,000 times. Doing so allows me to calculate a t-statistic for the difference in the number of advancements. As before, a t-statistic greater than 1.96 indicates that the difference is statistically significant at the five percent level.

75. I present the results of this analysis in Table 7. Column 1 shows the total number of observations for men and women in a given Stock Level. For example, I count [redacted] person-year observations in Stock Level 62. Column 2 has the total number of woman-year observations in each Stock Level: there are [redacted] woman-year observations associated with Level 62. Column 3 reports the number of Stock Level advancements (out of the listed Stock Level and into a higher level) for women (for example, 1,395 women advanced out of Level 62 into a higher level). Column 4 shows the actual advancement rate for women (for example, on average, about 25 percent of women advanced out of Level 62 per year).

76. Column 5 contains the predicted advancement rate (out of the listed Stock Level) for women, in the absence of discrimination. If women were treated the same as men, given their characteristics they should have been more likely to progress to the next Stock Level (for example, about 29.2 percent of women should have advanced out of Stock Level 62, as compared to the observed advancement rate of 25 percent).

77. Column 6 reports the expected number of Stock Level advancements among women, had they not faced discrimination in promotions (for example, 1,625 women are expected to have advanced out of Level 62). This is calculated as Column 5 multiplied by Column 2. Column 7 compares the actual and expected numbers of Stock Level advancements among women, and a negative number in this column represents a shortfall in advancements among women. This is calculated as Column 3 minus Column 6. The difference between expected and actual advancement for women out of Stock Level 62 is a shortfall of 230 advancements. Column 8 (the final column) reports the t-statistic for the difference between the actual and the expected numbers of Stock Level advancements for women. The remaining rows in the table can be read in the similar way. There is not a statistically significant shortfall in advancements from Stock Level 59. However, I find a statistically significant shortfall in advancements out of each Stock Level from 60-64. Overall, I find that the total shortfall in Stock Level advancement for women in Stock Level 60-64 is equal to 518.

VIII. COMPENSATION CLASS DAMAGE ESTIMATE

78. Table 8 presents estimates of damages resulting from gender disparity in pay to members of the compensation class. These estimates are based on the total earnings of class members during the class period. In order to calculate total earnings for class members, I have totaled all non-salary earnings that each member of the compensation class actually received between the effective damages start date and May 31, 2016, plus a pro-rata share of each worker's salary, where the pro-ration is based on the proportion of the year that she worked in-class. I have been instructed by Counsel for the Plaintiffs that for class members

who were employed in an in-class position by Microsoft on or after July 18, 2013, the effective damages start date is May 14, 2012 (or hire date, whichever is later), and for class members whose employment in an in-class position with Microsoft terminated prior to July 18, 2013, the effective damages start date is September 16, 2012 (or hire date, whichever is later).

79. In particular, I pro-rate each class member's annual salary to reflect the portion of the year that occurs after her effective start date. I also pro-rate each class member's annual salary according to the proportion of the year that she was not employed in Stock Levels 59-67 in either an IT Operations or Engineering Profession at Microsoft.[56] I also pro-rate each class member's annual salary according to the proportion of the year that she was on unpaid leave. As a result of these calculations, I estimate that members of the compensation class at Microsoft earned approximately $[redacted] during the class period.[57]

80. In order to translate the proportional pay gap (represented by β and calculated from the appropriate estimated log point difference from Table 3) into a total dollar loss in pay, total in-class earnings ($[redacted]) are multiplied by $\frac{\beta}{1-\beta}$. Model 4, which includes controls for human capital characteristics as well as each employee's Discipline yields an estimated a gender pay gap of 6.3% and a damages estimate of approximately $238 million. Model 5, which additionally controls for Standard Title, yields and estimated 2.8% gender

[56] This includes the proportion of the year that she was not employed by Microsoft at all, if applicable.

[57] This calculation includes only compensation paid by Microsoft between September 16, 2012 and May 31, 2016. I understand that the class period has continued beyond May 2016, and these compensation figures should be increased accordingly as more data become available, including the data produced by Microsoft on October 24, 2017.

pay gap and a damages estimate of approximately $100 million. This is a conservative measure of damages, and does not include a separate analysis of the damages due to women's shortfall in advancement.

IX. CONCLUSIONS

81. Members of the compensation class at Microsoft (that is, female Technical Employees in Stock Levels 59-67) receive lower compensation on average, than otherwise-similar men, and this difference in pay is statistically significant. This difference persists even if I control for each worker's Standard Title.

82. I also find that female Technical Employees in Stock Levels 60-64 at Microsoft have a lower probability of advancement through Stock Levels and Career Stages than otherwise-similar men, and this difference in advancement rates is statistically significant. I estimate that female Technical Employees in Stock Levels 60-64 were denied 518 Stock Level advancements.

Henry Farber
December 5, 2017

TABLE 1
Gender Counts by Stock Level

Level	Employee Years	Count of Women	Percent Women	Count of Men	Percent Men	
59	[redacted]	3,317	19.6%	13,627	80.4%	In-Class Stock Levels
60		5,156	21.0%	19,353	79.0%	
61		7,452	20.9%	28,233	79.1%	
62		8,040	19.8%	32,615	80.2%	
63		6,094	16.3%	31,301	83.7%	
64		3,813	13.7%	23,990	86.3%	
65		1,795	11.4%	13,946	88.6%	
66		920	10.0%	8,298	90.0%	
67		363	6.7%	5,043	93.3%	
68		151	7.2%	1,938	92.8%	Out-Of-Class Stock Levels
69		65	6.3%	970	93.7%	
70		41	7.2%	532	92.8%	
80		11	6.7%	152	93.3%	
81		0	0.0%	23	100.0%	
82		0	0.0%	8	100.0%	
83		0	0.0%	4	100.0%	
0		326	25.3%	964	74.7%	
Overall		37,544	17.2%	180,997	82.8%	

Note: Stock level 0 is not directly comparable to other Stock Levels. Microsoft assigns employees to Stock Level 0 while they are awaiting assignment to a standard level.

This is all workers employed in Engineering or IT Professions in the listed Stock Levels whose annual salary is greater than $1. Annual Salary is coded as "1" during periods in which an employee in engaged in a Joint Venture with another company, and the other company, rather than Microsoft, processes that employee's payroll.

TABLE 2
Difference between Women's and Men's Total Compensation by Year

Year	Difference in Mean Total Compensation	T-Statistic on Difference in Total Compensation	Percent Difference in Mean Total Compensation	T-Statistic on Percent Difference in Mean Total Compensation	Employee Years
	[1]	[2]	[3]	[4]	[5]
2011	[redacted]	-19.52	-9.4%	-22.36	[redacted]
2012		-20.60	-8.4%	-22.23	
2013		-20.48	-8.4%	-21.54	
2014		-19.48	-8.1%	-20.93	
2015		-20.46	-8.3%	-21.05	
2016		-19.80	-8.3%	-20.19	
Overall		-25.13	-8.6%	-50.83	

This sample includes workers in Engineering or IT Operations Professions in Stock Levels 59-67 who are not employed in any professions other than Engineering or IT Operations at any point in the salary year, and who begin the year in Stock Levels 59-67. Additionally, this sample is limited to employee-years with non-missing values for tenure and age. I have also dropped employee-years in which annual salary is 1, or in which Career Stage is one of the following: ATR-C; ATR-D; ATR-E; IC-0; or MA.

Annual Salary is coded as "1" during periods in which an employee in engaged in a Joint Venture with another company, and the other company, rather than Microsoft, processes that employee's payroll.

Negative values in Columns [1] or [3] represent lower average compensation for Female Technical Employees.

TABLE 3
Analysis of Gender Difference in Total Compensation

	Log Point Difference	T-statistic on Log Point Difference	P-Value	Percent Difference	Adjusted R^2	Employee Years
Model 1	-0.089	-25.42	< 0.005	-8.6%	0.009	[redacted]
Model 2	-0.077	-25.62	< 0.005	-7.4%	0.340	
Model 3	-0.077	-29.69	< 0.005	-7.4%	0.510	
Model 4	-0.065	-26.33	< 0.005	-6.3%	0.551	
Model 5	-0.028	-21.73	< 0.005	-2.8%	0.785	

Model 1: Gender is the only explanatory variable
Model 2: Adds controls for "compensation year", employee age (and its square), employee tenure at Microsoft (and its square), state in which the employee works, city in which the employee works, and PayScaleType
Model 3: Adds controls for employees' performance ratings
Model 4: Adds controls for Discipline
Model 5: Adds controls for Standard Title

TABLE 4
Analysis of Gender Difference in Peformance Metrics

	Coefficient on Female	T-statistic	Employee Years
Contribution Ranking	-0.038	-2.14	[redacted]
Commitment Rating	-0.045	-2.45	
Performance Rating	-0.010	-0.84	
Reward Outcome	0.000	-0.01	

This table reports the results of order-probit analyses of employee performance ratings. Each row of this table concerns a distinct performance metric used by Microsoft. The only explanatory variable in each analysis is gender.

<u>Relevant Time Period for Each Metric:</u>

Contribution Ranking:	2011
Commitment Rating:	2011
Performance Rating:	2012-2014
Reward Outcome:	2015-2016

TABLE 5
Stock Level Advancement,
Men vs. Women, 2011 - 2015

Stock Level	Women	Men
59	45.7%	45.3%
60	43.5%	44.4%
61	33.5%	36.5%
62	25.0%	30.5%
63	21.6%	25.0%
64	17.2%	19.4%

A Stock Level advancement is defined as a change from a lower Stock Level into a higher Stock Level, comparing Stock Level on September 1 of year *t* with Stock Level on September 1 of year *t-1*.

TABLE 6E

Stock Level and Career Stage Advancement Differences for Men and Women, 2011-2015

	Average Advancement Rate [1]	Difference (Marginal Effect) [2]	Z-statistic [3]	Employee Years [4]
[A] Stock Level Advancement	0.317	-0.021	-9.224	[redacted]
[B] Career Stage Advancement prior to 2014	0.146	-0.027	-10.051	
[C] Career Stage Advancement post 2014	0.288	-0.034	-3.069	

Based on a probit analysis of an advancement measure on tenure, tenure squared, age, age squared, year, performance metrics, location, Discipline, and prior Stock Level in Row [A] or Career Stage in Rows [B] and [C].

Errata: The previous version of this table included employees in Stock Level 65 in error. This analysis includes only workers in Stock Levels 59-64.

TABLE 7E
Stock Level Advancement Shortfall, 2011-2015

Stock Level	Number of Observations	Number of Woman-Years	Number of Advancements, Women	Advancement Rate, Women	Expected Advancement Rate, Women	Number of Expected Advancements, Women	Shortfall of Advancements, Women	T-Statistic
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
59	11,731	[redacted]	1,009	0.457	0.456	1,006	3	0.50
60	17,330	[redacted]	1,555	0.435	0.445	1,593	-38	-3.52
61	25,963	[redacted]	1,793	0.335	0.352	1,885	-92	-6.46
62	29,204	[redacted]	1,395	0.250	0.292	1,625	-230	-17.59
63	25,861	[redacted]	870	0.216	0.243	976	-106	-11.69
64	18,777	[redacted]	418	0.172	0.193	470	-52	-8.55

Total Shortfall, Stock Levels 60-64: **-518**

Note:
A Stock Level advancement is defined as a chance from a lower Stock Level into a higher Stock Level, comparing Stock Level on September 1 of year *t* with Stock Level on Semptember 1 of year *t*- 1.

Based on a probit analysis of the Stock Level advancement indicator variable on tenure, tenure squared, age, age squared, year, performance metrics, location, Discipline, and prior Stock Level. This model is estimated for men only and the probability of Stock Level Advancement is predicted for both men and women.

Errata: The previous version of this table included employees in Stock Level 65 in error. This analysis includes only workers in Stock Levels 59-64.

Reported Calculations and Results:

Column:	**Reports:**
[4] = [3] / [2]	Advancement Rate, Women
[5]: Result from Probit Model	Expected Advancement Rate, Women
[6] = [5] x [2]	Number of Expected Advancements, Women
[7] = [3] - [6]	Shortfall of Advancements, Women

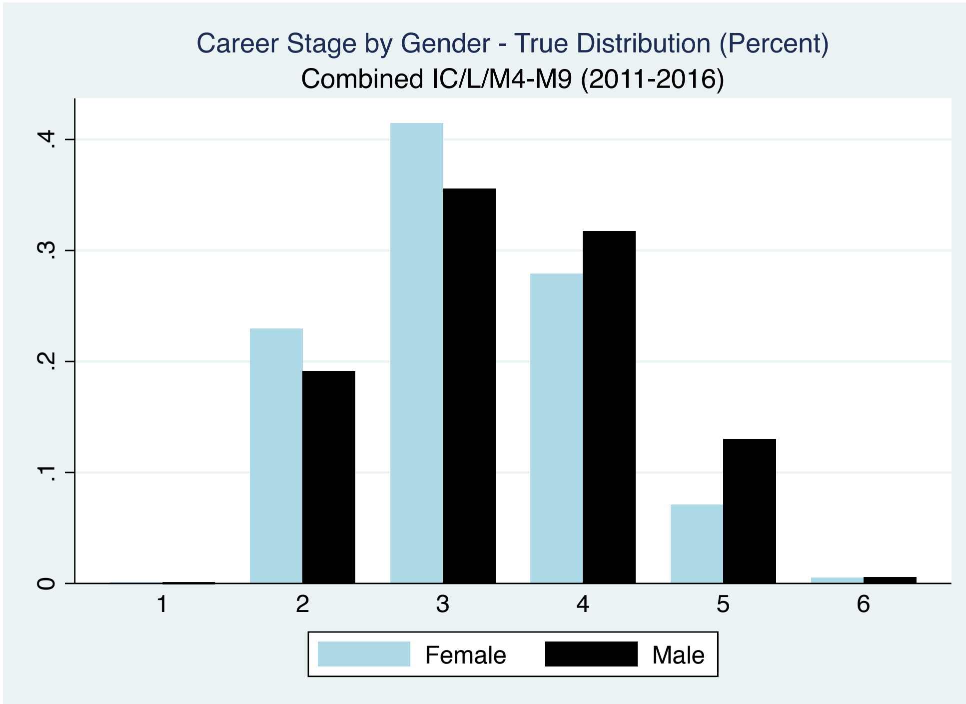
TABLE 8
Damages Analysis

	Total Comp Gap (pct)	T-statistic	Adjusted R^2	Employee Years	Damages
Model 1	-8.6%	-26.59	0.009	[redacted]	[redacted]
Model 2	-7.4%	-26.63	0.340		
Model 3	-7.4%	-30.86	0.510		
Model 4	-6.3%	-27.21	0.551		
Model 5	-2.8%	-22.04	0.785		

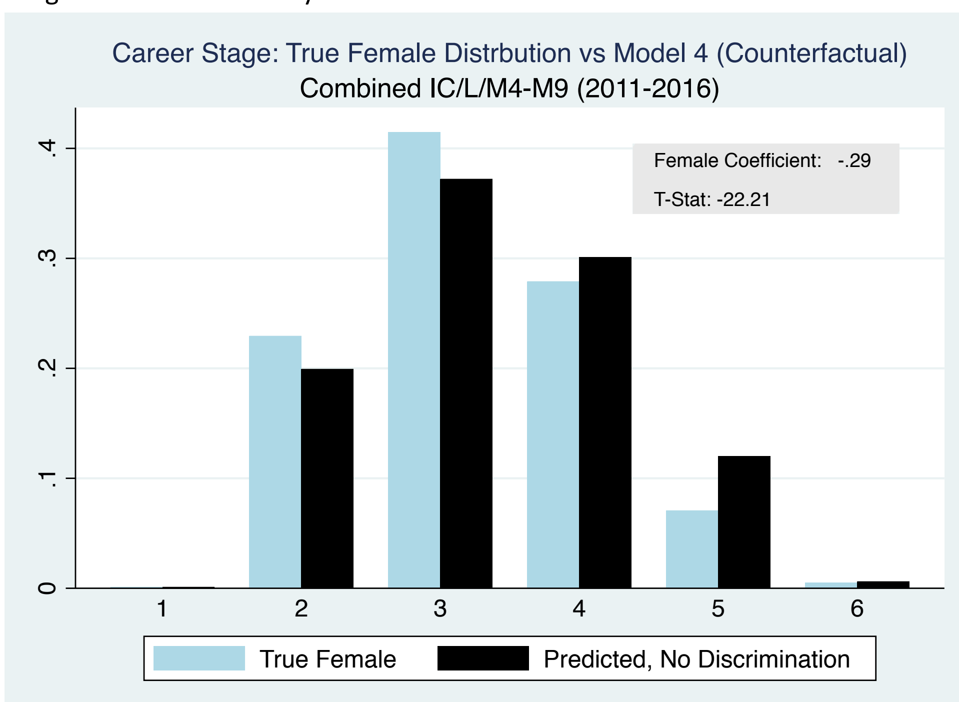
Model 1: Gender is the only explanatory variable
Model 2: Adds controls for "compensation year", employee age (and its square), employee tenure at Microsoft (and its square), state in which the employee works, city in which the employee works, and PayScaleType
Model 3: Adds controls for employees' performance ratings
Model 4: Adds controls for Discipline
Model 5: Adds controls for Standard Title

The total in-class compensation is: [redacted]

FIGURE 1E



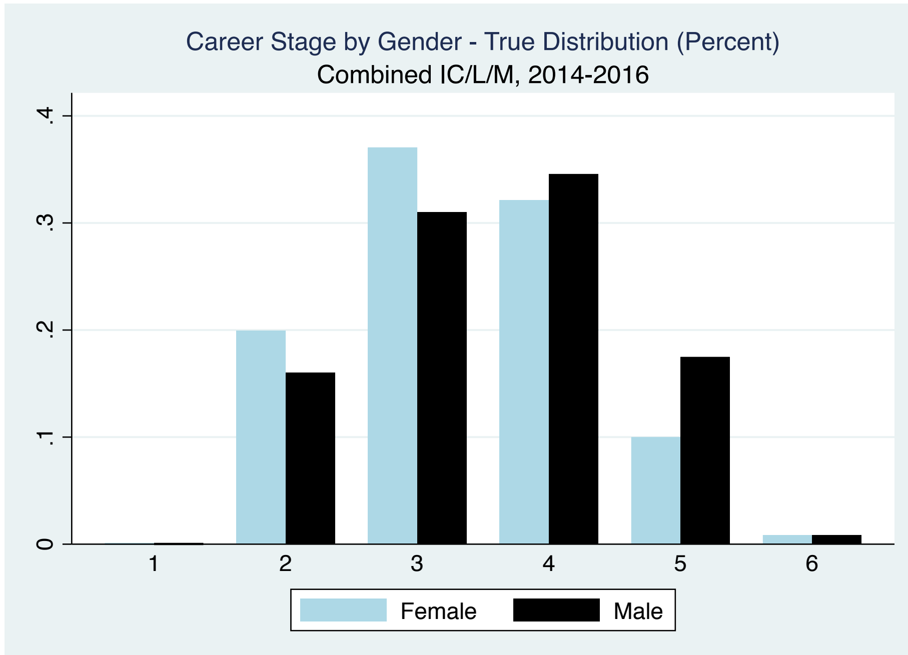
Note: The height of each bar represents the proportion of individuals in each career stage. I exclude M career stages 1-3 from this analysis.



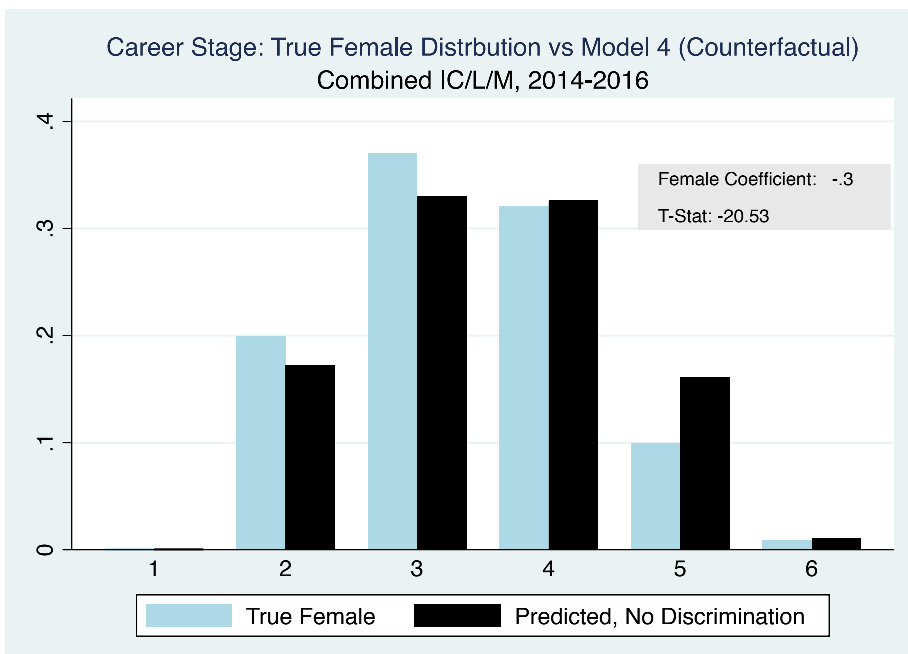
Note: The **Predicted, No Discrimination** distribution is calculated based on an ordered probit analysis that includes each employee's age, tenure, location, performance ratings, and Discipline, as well as the compensation year and an indicator for female. The coefficients of this analysis are used to predict the female distribution assuming each female was male (the female indicator set to zero) but otherwise had her observed characteristics.

I exclude M career stages 1-3 from this analysis.

FIGURE 2

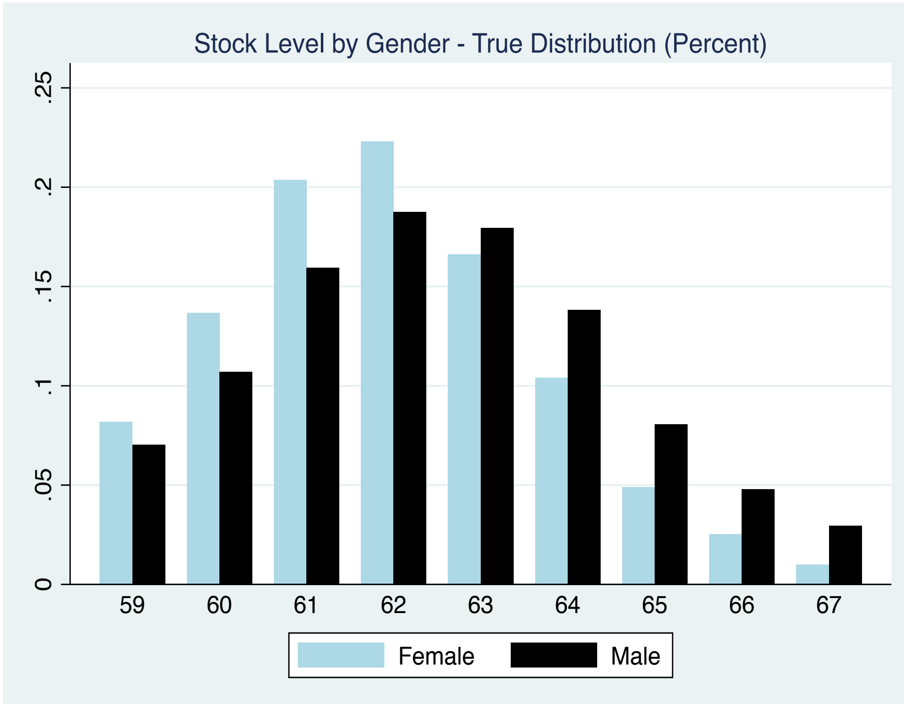


Note: The height of each bar represents the proportion of individuals in each Career Stage.

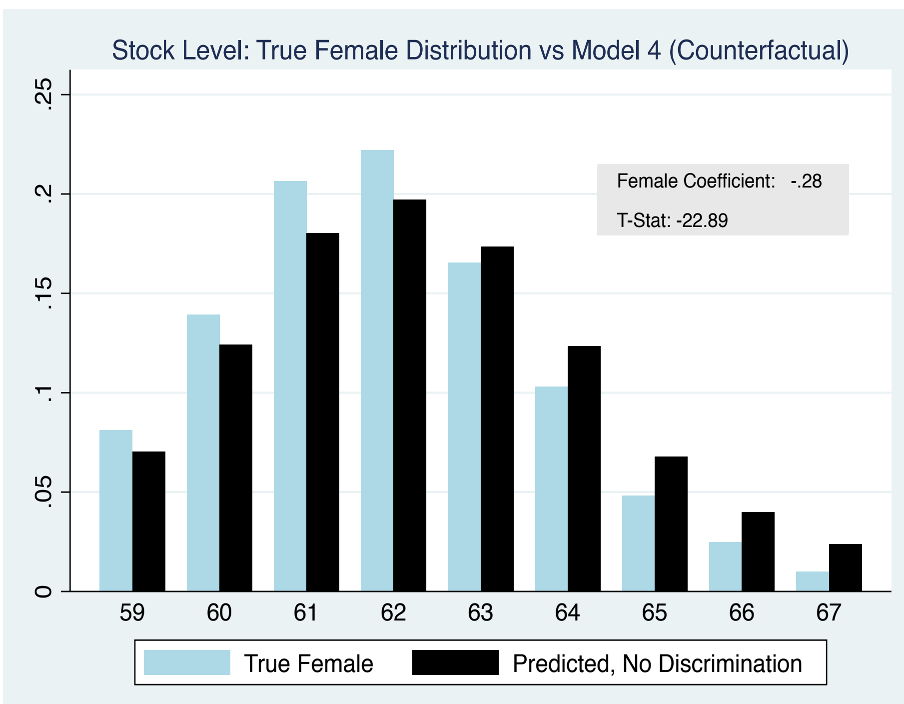


Note: The **Predicted, No Discrimination** distribution is calculated based on an ordered probit analysis that includes each employee's age, tenure, location, performance ratings, and Discipline, as well as the compensation year and an indicator for female. The coefficients of this analysis are used to predict the female distribution assuming each female was male (the female indicator set to zero) but otherwise had her observed characteristics.

FIGURE 3E



Note: The height of each bar represents the proportion of individuals in each Stock Level.



Note: The **Predicted, No Discrimination** distribution is calculated based on an ordered probit analysis that includes each employee's age, tenure, location, performance ratings, and Discipline, as well as the compensation year and an indicator for female. The coefficients of this analysis are used to predict the female distribution assuming each female was male (the female indicator set to zero) but otherwise had her observed characteristics.

APPENDIX A

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Education

Rensselaer Polytechnic Institute, BS (Economics), 1972
Cornell University, MS (Industrial and Labor Relations), 1974
Princeton University, Ph.D. (Economics), 1977

Current Employment

Princeton University
- Professor of Economics, 1991-1995.
- Hughes-Rogers Professor of Economics, 1995-present.
- Director, Industrial Relations Section, 2013-2017.

Major Fields of Interest

Labor Economics	Econometrics	Law and Economics
Industrial Organization	Political Economy	

Other Current Appointments

Faculty Associate, Industrial Relations Section, Princeton University, 1991-present.
Research Associate, National Bureau of Economic Research, 1982-.
Research Fellow, Institute for the Study of Labor (IZA), Bonn, 2006-.
Affiliated Faculty, Kahneman-Treisman Center for Behavioral Science and Public Policy, Princeton University, 2016-.
Faculty Associate, Program in Political Economy, Princeton University, 1993-.
Faculty Associate, Program in Applications of Computing, Princeton University, 1996-.
Faculty Associate, Center for the Study of Social Organization, Princeton University, 2008-.
Editorial Board, Journal of Labor Abstracts, 1996-.
Associate Editor, Journal of Empirical Legal Studies, 2004-.
Labour Statistics Advisory Committee, Statistics Canada, 2003-.
Executive and Supervisory Committee (ESC) of CERGE-EI, Prague, 2005-2009, 2011-.
International Affiliate, Canadian Labour Market and Skills Researcher Network, 2011-.

Honorific Fellowships, Prizes, and Professional Offices

Society of Labor Economists, President 2016-17.
Fellow, Econometric Society, elected 1988.
Fellow, Society of Labor Economists, elected 2004.
Fellow, Labor and Employment Relations Association, named 2009.

Honorific Fellowships, Prizes, and Professional Offices (cont'd)

Edwin E. Ghiselli Award for Research Design, American Psychological Association, Division 14, 1984. (with Max H. Bazerman)

Richard E. Quandt Teaching Prize, Department of Economics, Princeton University, June 2000 and June 2011.

Prize from American Law and Economics Association for best paper in the *American Law and Economics Review* in 2013. Awarded in 2014 for "Why do Plaintiffs Lose Appeals? Biased Trial Courts, Litigious Losers, or Low Trial Win Rates?"

Past Positions

Professor (1986-1991), Associate Professor (1981-1986), Assistant Professor (1977-1981), Department of Economics, Massachusetts Institute of Technology.

Institute for Advanced Study, School of Social Science. Member, September 2006 - August 2007. Visitor, September 2010 - August 2011.

Russell Sage Foundation, Visiting Scholar, September 2002 - July 2003.

Fellow, Center for Advanced Study in the Behavioral Sciences, 1983-1984 and 1989-1990.

Harvard University, Visiting Professor of Economics, Fall 2014.

Director, Industrial Relations Section, Princeton University, July 1993-December 1993, July 1995-June 1998, July 2003 – June 2004.

Associate Editor, Industrial and Labor Relations Review, 1999–2004.

Associate Editor, Quarterly Journal of Economics, 1984-1989.

Editorial Board, American Economic Review, 1988–1991.

Social Science Research Council Advisory Group on a 1986 Quality of Employment Survey, 1985-86.

Visiting Fellow, University of Warwick, Summer 1982.

Member, Visiting Committee, Department of Economics, Princeton University, 1979-1990.

Member, Nominating Committee, Industrial Relations Research Association, 1990.

Co-Director, Summer Institute on Negotiation and Dispute Resolution, Center for Advanced Study in the Behavioral Sciences, Summer 1992.

John M. Olin Fellow, Cornell Law School, February 1994 and October 1994.

Member, Peer Review Panel, National Science Foundation Economics Program, Spring 1992, Spring 1994-Spring 1995.

Editorial Board, Industrial and Labor Relations Review, 1994-1999.

Member, Peer Review Panel, National Science Foundation Behavioral Sciences Infrastructure Competition, Spring 1999.

Member, Committee on the Status of Women in the Economics Profession, 1996-2000

Technical Review Committee, National Longitudinal Surveys, 1996-2004.

Social Science External Advisory Council, Cornell University, 2006-2008.

Member, Committee on Honors and Awards, American Economics Association, 2013-2014.

Past Positions (cont'd)

Visiting Scholar, Center for Economic Performance, London School of Economics, March 2015.

Visiting Scholar, Centre de Rescherche en Économie et Statistique (CREST), Paris, May 2015

Membership in Professional Societies

American Economic Association	Econometric Society (Fellow)
American Law and Economics Association	Labor and Employment Relations Association (Fellow)
American Statistical Association	Society of Labor Economists (Fellow)

Fellowships, Grants, Contracts, and Awards

National Science Foundation, Grant No. SES-7924880 to Massachusetts Institute of Technology, "Economics of Labor Unions," 1/80-6/82.

U.S. Department of Labor, Minimum Wage Study Commission, Contract No. J9E-00113 to Massachusetts Institute of Technology, "Union Wages and the Minimum Wage," 9/80-2/81.

Alfred P. Sloan Research Fellowship, Alfred P. Sloan Foundation, 9/81-8/85.

National Science Foundation, Grant No. SES-8207703 to Massachusetts Institute of Technology, "An Analysis of the Unionization Process in the United States," 7/82-6/83.

7National Science Foundation, Grant No. SES-8408623 to National Bureau of Economic Research, "Threat Effects and the Extent of Unionization in the United States," 7/84-12/86.

National Science Foundation, Grant No. SES-8605530 to National Bureau of Economic Research, "The Political Economy of Labor Unions," 8/86-12/88.

National Science Foundation, Grant No. SES-8912664 to National Bureau of Economic Research, "Empirical Analysis of Inter-Firm Worker Mobility," 7/89-6/92.

U.S. Department of Labor, Grant No. E-9-J-9-0050 to National Bureau of Economic Research, "Evaluating Competing Theories of Interfirm Worker Mobility," 9/89-1/92.

U. S. Department of Labor, Office of the Assistant Secretary for Policy, Contract No. B9461588, "Incidence and Consequences of Job Loss," 12/95-4/46.

U. S. Department of Labor, Office of the Assistant Secretary for Policy, Contract No. B9462164, "Alternative Employment Arrangements as a Response to Job Loss," 7/96-12/96.

U. S. Department of Labor, Office of the Assistant Secretary for Policy, Contract No. B9492501, "Job Loss and Long-Term Employment in the U.S." 6/99-11/99.

American Law and Economics Association, Best Paper Award, 2013,*American Law and Economics Review*

Alfred P. Sloan Foundation, Grant for "An Audit Study of the Determinants of Reemployment with Special Focus on Older Workers," Co-PI, 11/2012-12/2015.

Published Papers

"The Composition of Strike Activity in the Construction Industry," *Industrial and Labor Relations Review*, April 1976: pp. 388-404. (with D.B. Lipsky)

"The Determinants of Union Wage Demands: Some Preliminary Empirical Evidence," *Proceedings of the Thirtieth Annual Winter Meeting of the Industrial Relations Research Association*, 1977.

"Bargaining Theory, Wage Outcomes, and the Occurrence of Strikes: An Econometric Analysis," *American Economic Review*, June 1978: pp. 262-271.

"Individual Preferences and Union Wage Determination: The Case of the United Mine Workers," *Journal of Political Economy*, October 1978: pp. 923-942.

"The United Mine Workers and the Demand for Coal: An Econometric Analysis of Union Behavior," *Research in Labor Economics*, Vol. 2, 1978.

"Interest Arbitration, Outcomes, and the Incentive to Bargain," *Industrial and Labor Relations Review*, October 1979: pp. 55-63. (with Harry C.Katz)

"Unionism, Labor Turnover, and Wages of Young men," *Research in Labor Economics*, Vol. 3, 1980: pp. 33-35.

"Why Workers Want Unions: The Role of Relative Wages and Job Characteristics," *Journal of Political Economy*, April 1980: pp. 349-369. (with Daniel H. Saks)

"An Analysis of Final-Offer Arbitration," *Journal of Conflict Resolution*, December 1980: Vol. 24, No. 4, pp. 683-705.

"Does Final-Offer Arbitration Encourage Bargaining?" *Proceedings of the Thirty-third Annual Meeting of the Industrial Relations Research Association*, 1980: pp. 219-226.

"The Role of Arbitration in Dispute Settlement," *Monthly Labor Review*, May 1981.

"Union Wages and the Minimum Wage," *Report of the Minimum Wage Study Commission*, Vol. VI, 1981.

"Splitting-the-Difference in Interest Arbitration," *Industrial and Labor Relations Review*, October 1981, pp. 70-77.

"Job Queues and the Union Status of Workers," *Industrial and Labor Relations Review*, April 1982: pp. 354-367. (with John M. Abowd)

"Worker Preferences for Union Representation," *Research in Labor Economics*, Supplement 2, 1983: pp. 171-205.

"The Determination of the Union Status of Workers," *Econometrica*, September 1983: pp. 1417-1437.

"Right to Work Laws and the Extent of Unionization," *Journal of Labor Economics*, July 1984: pp. 319-352.

"Analyzing the Decision Processes of Third Parties," *Sloan Management Review*, Fall 1985: pp. 39-48. (with Max H. Bazerman)

Published Papers (cont'd)

"Arbitrator Decision Making: When are Final Offers Important?" *Industrial and Labor Relations Review*, October 1985: pp. 76-89. (with Max H. Bazerman)

"The Extent of Unionization in the United States: Historical Trends and Prospects for the Future," Presented to M.I.T./Union Conference, June 1983. in *Challenges and Choices Facing American Labor*, Thomas Kochan, ed. M.I.T. Press, 1985.

"The Analysis of Union Behavior." In Ashenfelter and Layard, eds. *The Handbook of Labor Economics*, North Holland Publishing Company, 1986.

"The General Basis of Arbitrator Behavior: An Empirical Analysis of Conventional and Final-Offer Arbitration," *Econometrica*, November 1986: pp. 1503-1528. (with Max H. Bazerman)

"Why is there Disagreement in Bargaining?" *American Economic Review*, May 1987: pp. 347-352. (with Max H. Bazerman)

"Job Duration, Seniority, and Earnings," *American Economic Review* June 1987: pp. 278-297. (with Katharine G. Abraham)

"The Recent Decline of Unionization in the United States," *Science* 13 November 1987, pp. 915-920.

"The Evolution of Public Sector Bargaining Laws." in *When Public Sector Employees Unionize*, Richard B. Freeman and Casey Ichniowski, eds., University of Chicago Press, 1988, pp. 129-166.

"Returns to Seniority in Union and Nonunion Jobs: a New Look at the Evidence," *Industrial and Labor Relations Review* 42 October 1988: pp. 3-19. (with Katharine G. Abraham)

"Divergent Expectations as a Cause of Disagreement in Bargaining: Evidence from a Comparison of Arbitration Schemes," *Quarterly Journal of Economics* 104 February 1989: pp. 99-120. (with Max H. Bazerman)

"Trends in Worker Demand for Union Representation," *American Economic Review*, 79(2), May 1989: pp.166-171.

"The Decline of Unionization in the United States: What Can be Learned from Recent Experience?," *Journal of Labor Economics* 8(1) January 1990: pp. S75-S105.

"The Role of Arbitration Costs and Risk Aversion In Dispute Outcomes," *Industrial Relations* 29(3), Fall 1990: pp. 361-384. (with Margaret A. Neale and Max H. Bazerman)

"Medical Malpractice: An Empirical Examination of the Litigation Process," *Rand Journal of Economics* 22(2), Summer 1991: pp. 199-217. (with Michelle J. White)

"Is Arbitration Addictive? Evidence from the Laboratory and the Field," *Proceedings of the Forty-fourth Annual Meeting of the Industrial Relations Research Association*, 1992, pp. 402-410. (with Janet Currie)

"An Experimental Comparison of Dispute Rates in Alternative Arbitration Systems," *Econometrica* 60(6), November 1992: pp. 1407-1433. (With Orley Ashenfelter, Janet Currie, and Matthew Spiegel)

Published Papers (cont'd)

"Union Membership in the United States: The Decline Continues," in *Employee Representation: Alternatives and Future Directions*, Bruce Kaufman and Morris Kleiner, editors. Industrial Relations Research Association, 1993. (with Alan B. Krueger)

"The Incidence and Costs of Job Loss: 1982-1991," *Brookings Papers on Economic Activity: Microeconomics*, 1993: pp. 73-132.

"A Comparison of Formal and Informal Dispute Resolution in Medical Malpractice," *Journal of Legal Studies*, June 1994: pp. 777-806. (with Michelle J. White)

"The Analysis of Inter-Firm Worker Mobility," *Journal of Labor Economics*, October 1994: pp. 554-593.

"Forming Beliefs about Adjudicated Outcomes: Risk Attitudes, Uncertainty, and Reservation Values," *International Review of Law and Economics*, 1995 : pp. 289-303. (with Linda Babcock, Cynthia Fobian, and Eldar Shafir)

"Polities and Peace," *International Security*, Fall 1995: pp. 123-146. (with Joanne Gowa). Reprinted in Debating the Democratic Peace, Michael E. Brown, Sean M. Lynn-Jones, and Steven E. Miller, eds. MIT Press, 1996.

"Learning and Wage Dynamics," *Quarterly Journal of Economics* 111 November 1996: 1007-1047. (With Robert Gibbons)

"Common Interests or Common Polities? Reinterpreting the Democratic Peace," *Journal of Politics* 59 May 1997: 393-417. (with Joanne Gowa)

"The Litigious Plaintiff Hypothesis: Case Selection and Resolution," *Rand Journal of Economics* 28 1997 : S92-S112. (with Theodore Eisenberg)

"The Changing Face of Job Loss in the United States, 1981-1995," *Brookings Papers on Economic Activity: Microeconomics*, 1997: 55-128.

"Trends in Long-Term Employment in the United States: 1979-1996," in *Third Public GAAC Symposium: Labor Markets in the USA and Germany*, German-American Academic Council Foundation, Bonn and Washington, 1998.

"Has the Rate of Job Loss Increased in the Nineties?" *Proceedings of the Fiftieth Annual Winter Meeting of the Industrial Relations Research Association*, Volume 1, 1998: 88-97.

"Are Lifetime Jobs Disappearing? Job Duration in the United States: 1973-1993," in *Labor Statistics Measurement Issues*, John Haltiwanger, Marilyn Manser, and Robert Topel, eds., University of Chicago Press, 1998. pp. 157-203.

"Mobility and Stability: The Dynamics of Job Change in Labor Markets." In Ashenfelter and Card, eds. *The Handbook of Labor Economics*, vol 3B, pp. 2439-2484, North Holland Publishing Company, 1999.

"Changing Stock Market Response to Announcements of Job Loss: Evidence from 1970-1997," *Proceedings of the Fifty-First Annual Winter Meeting of the Industrial Relations Research Association*, Volume 1, 1999. pp. 26-34. (with Kevin Hallock).

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"Alternative Employment Arrangements as a Response to Job Loss," *Journal of Labor Economics*, October 1999. pp. S142-S169.

"Capital Markets and Job Loss: Evidence from North America," *Wirtschafts Politische Blatter*, 1999. pp. 573-577. (with Kevin Hallock).

"Recent Trends in Employer-Sponsered Health Insurance Coverage: Are Bad Jobs Getting Worse?" *Journal of Health Economics*, January 2000. pp. 93-119. (with Helen Levy).

"Trends in Long-Term Employment in the United States: 1979-1996," in Estreicher, ed. *Global Competition and the American Employment Landscape As We Enter the 21st Century: Proceedings of New York University 52d Annual Conference on Labor*, pp. 63-98, Kluwer Law International, 2000.

"Union Success in Representation Elections: Why Does Unit Size Matter?" ' *Industrial and Labor Relations Review*, January 2001. pp. 329.348.

"Accounting for the Decline of Unions in the Private Sector, 1973-1998," *Journal of Labor Research*, Summer 2001. pp. 459-485. Reprinted in *The Future of Private Sector Uniionism in the United States* James T. Bennett and Bruce E. Kaufman, eds. Armonk, NY. M. E. Sharpe. (with Bruce Western)

"Ronald Reagan and the Politics of Declining Union Organization," *British Journal of Industrial Relations*, September 2002. pp. 385-401. (with Bruce Western)

"The Government As Litigant: Further Tests of the Case Selection Model," *American Law and Economics Review*, 2003. (with Theodore Eisenberg)

"Can Increased Organizing Reverse the Decline of Unions in the U.S.? Lessons from the Last Quarter Century," in *Changing Role of Unions: New Forms of Representation.* P. Wunnava, ed. M.E. Sharpe, 2004. pp. 323-361. (with Bruce Western)

"Job Loss in the United States, 1981-2001," *Research in Labor Economics* 23 (2004), pp. 69-117.

"Is Tomorrow Another Day? The Labor Supply of New York City Cab Drivers," *Journal of Political Economy* 113 (February 2005), pp. 46-82.

"Nonunion Wage Rates and the Threat of Unionization," *Industrial and Labor Relations Review* 58 (April 2005), pp. 335-352.

"What do we know about Job Loss in the United States? Evidence from the Displaced Workers Survey, 1981-2004," *Economic Perspectives*, Federal Reserve Bank of Chicago (Second Quarter, 2005), pp. 13-28.

"Union Membership in the United States: The Divergence between the Public and Private Sectors," in *Collective Bargaining in Education: Negotiating Change in Today's Schools*, Jane Hannaway and Andrew J. Rotherham, eds. Harvard Education Press, 2006, pp. 27-51.

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"Is the 'Company Man' an Anachronism? Trends in Long Term Employment in the U.S." in *The Price of Indenpendence*, Sheldon Danziger and Cecilia Rouse, eds. Russell Sage, 2007, pp. 56-83.

"Reference Dependent Preferences and Labor Supply: The Case of New York City Taxi Drivers," *American Economic Review*, June 2008: pp. 1069-1082.

"Short(er) Shrift — The Decline in Worker-Firm Attachment in the United States," in *Laid Off, Laid Low: Political and Economic Consequences of Employment Insecurity,* Katharine S. Newman, ed. New York, Columbia University Press, 2008. pp. 10-37.

"The Changing Relationship Between Job Loss Announcements and Stock Prices, 1970-99," *Labour Economics*, January 2009: 1-11. (with Kevin Hallock).

"Job Loss and the Decline in Job Security in the United States," in Katharine G. Abraham, James R. Spletzer, and Michael Harper, eds. *Labor in the New Economy.* U. of Chicago Press, 2010.

"Labor Market Monopsony," *Journal of Labor Economics*, April 2010: 203-210. (with Orley Ashenfelter and Michael R. Ransom)

"The Incidence and Cost of Job Loss in the Great Recession: How Bad Has it Been?" *Economists' Voice*, January 2012.

"Unemployment in the Great Recession: Did the Housing Market Crisis Prevent the Unemployed from Moving to Take Jobs?" *American Economic Review*, Papers and Proceedings, May 2012: pp. 520-525.

"Why do Plaintiffs Lose Appeals? Biased Trial Courts, Litigious Losers, or Low Trial Win Rates?" *American Law and Economics Review*, February 2013: pp. 73-109. (with Theodore Eisenberg)

"Job Loss: Historial Perspective from the Displaced Workers Survey." in *Unexpected Lifecycle Events and Economic Security: the Roles of Job Loss, Disability, and Changing Family Structure*, Kenneth A. Couch, Mary C. Daly, and Julie Zissimopoulos, eds., Stanford University Press, 2013, pp. 11-33.

"The Effect of Extended Unemployment Insurance Benefits: Evidence from the 2012-2013 Phase-Out," *American Economic Review*, 105(5) May 2015, pp. 171-176. (with Jesse Rothstein and Robert G. Valleta)

"Union Organizing Decisions in a Deteriorating Environment: The Composition of Representation Elections and the Decline in Turnout," *Industrial and Labor Relations Review*, 68(5) October 2015, pp.1126-1156.

"Do Extended Unemployment Benefits Lengthen Unemployment Spells? Evidence from Recent Cycles in the U.S. Labor Market," *Journal of Human Resources*, 50(4) October 2015: pp. 873-909. (with Robert G. Valletta).

"Why You Can't Find a Taxi in the Rain and Other Labor Supply Lessons from Cab Drivers," *Quarterly Journal of Economics*, 130(4) November 2015: pp. 1975-2026.

Published Papers (cont'd)

"Determinants of Callbacks to Job Applications: An Audit Study," *American Economic Review*, 106(5) May 2016, pp. 314-318. (with Dan Silverman and Till von Wachter)

"Employment, Hours, and Earnings Consequences of Job Loss: U.S. Evidence from the Displaced Workers Survey," *Journal of Labor Economics*, 35(S1) July 2017, pp. S235-S272.

"Factors Determining Callbacks to Job Applications by the Unemployed: An Audit Study," *RSF: The Russell Sage Foundation Journal of the Social Sciences*, 2017. (with Dan Silverman and Till von Wachter)

Published Reviews, Comments, and Short Surveys

Review of *The Future Impact of Automation on Workers* by Wassily Leontief and Faye Duchin. in *Science*, May 23, 1986: pp. 1022-1023.

Review of *What Do Unions Do?* by Richard B. Freeman and James L. Medoff in *Journal of Economic Literature*, December 1986: pp. 1842-1844.

Comments on Dissertation Roundtable Session, *Proceedings of the Thirty-ninth Annual Meeting of the Industrial Relations Research Association*, 1986: pp. 229-231.

Comment on "Semi-parametric Estimation on Employment Duration Models" by Joel L. Horowitz and George R. Neumann in *Econometric Reviews*, 1987: pp. 41-54. (with David E. Card).

Comment on "The Impact of Firm Acquisitions on Labor" by Charles Brown and James L. Medoff in *Corporate Takeovers: Causes and Consequences*, Alan J. Auerbach, ed., University of Chicago Press, 1988.

Comment on "FAT: The Displacement of Nonproduction Workers and the Efficiency of U.S. Manufacturing Industries," by Richard E. Caves and Matthew B. Kreps. *Brookings Papers on Economic Activity: Microeconomics*, 1993: pp. 278-282.

Comment on "Participation and Productivity: A Comparison of Worker Cooperatives and Conventional Firms in the Plywood Industry," by Ben Craig and John Pencavel. *Brookings Papers on Economic Activity: Microeconomics*, 1995: pp. 161-166.

Comment on "Lost Jobs," by Robert E. Hall, *Brookings Papers on Economic Activity*, 1995: pp. 257-262.

Response to "Democracy and Peace," by Charles S. Gochman, *International Security*, Winter 1996/97: pp. 186-187. (with Joanne Gowa).

Response to "A Tale of Two Democratic Peace Critiques," by William R. Thompson and Richard Tucker, *Journal of Conflict Resolution*, June 1997: pp. 455-456. (with Joanne Gowa).

Comment on "International Trade and Job Displacement in U.S. Manufacturing, 1979-1991," by Lori G. Kletzer, in Susan M. Collins ed. *Imports, Exports, and the American Worker*, Washington, DC. The Brookings Institution Press, 1998. pp. 457-459.

Published Reviews, Comments, and Short Surveys (cont'd)

Review of *What Workers Want* by Richard B. Freeman and Joel Rogers in *Journal of Economic Literature*, 2000.

"Trade Unions, Empirical Analysis of." *International Encyclopedia of Social and Behavioral Sciences,* Elsevier Science, 2001.

"Dispute Resolution." *International Encyclopedia of Social and Behavioral Sciences,* Elsevier Science, 2001.

Comment on "The U.S. Health Care System and Labor Markets," by Brigitte C. Madrian, in Jane Sneddon Little, ed. *The Challenge of Reforming the U.S. Health Care System*, Boston. The Federal Reserve Bank of Boston, 2007. pp. 165-172.

Unpublished Papers

"Product Demand and Union Wage Behavior: The Case of Bituminous Coal." Presented at the Atlantic City Meeting of the Econometric Society, September 1976.

"Relative Wages, Union Membership, and Job Queues: Econometric Evidence Based on Panel Data," July 1978, (with John M. Abowd). (Revision of paper presented to the Econometric Society, New York, December 1977).

"An Analysis and Evaluation of Final Offer Arbitration," Working Paper No. 242, Department of Economics, M.I.T., May 1979.

"Mechanisms for Settling Public Sector Labor Disputes: A Comparative Evaluation of Conventional Arbitration and Final-Offer Arbitration," August 1979.

"Are Quits and Firings Actually Different Events: A Competing Risk Model of Job Duration," July 1980. Presented at the Denver Meeting of the Econometric Society, September 1980.

"An Analysis of Hicks' Theory of Industrial Disputes," July 1980. Presented at the Denver Meeting of the American Economic Association, September 1980.

"Divergent Expectations, Threats Strategies, and Bargaining under Arbitration," June 1981. Presented at the San Diego Meeting of the Econometric Society, June 1981.

"The Determination of Negotiated Wage Changes: A Reference Wage Approach," Sep 1981.

"The Demand for Union Representation," Working Paper No. 295, Department of Economics, M.I.T., February 1982.

"The Union Status of Jobs: Some Preliminary Results," December 1982. Presented at Conference on Labor Economics, Hoover Institution, January 1983.

"The Political Economy of Labor Unions," October 1983.

"Product Market Competition, Union Organizing Activity, and Employer Resistance," Working Paper No. 551, Department of Economics, MIT, April 1990. (With John Abowd)

"Evaluating Competing Theories of Worker Mobility," Final Report submitted to U.S. Department of Labor, Bureau of Labor Statistics, March 1992.

Unpublished Papers (cont'd)

"The Relationship Between Quality of Care and Liability in Medical Malpractice," mimeo, June 1992. (with Michelle J. White)

"The Role of the Panel Study of Income Dynamics in the Analysis of Labor Force Dynamics," mimeo, October 1994. (prepared at the request of the Board of Overseers of the Panel Study of Income Dynamics)

"The Changing Face of Job Loss in the United States, 1981-1993," Working Paper No. 360, Industrial Relations Section, Princeton University, March 1996.

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"Round Up the Usual Suspects: The Decline of Unions in the Private Sector, 1973–1998." Working Paper No. 437, Industrial Relations Section, Princeton University, April 2000.

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"Job Loss in the United States, 1981-1999," Working Paper No. 453, Industrial Relations Section, Princeton University, June 2001.

"What's a Dropout to Do? Coping with the Deterioration of the Low-Skilled Labor Market," Working Paper No. 467, Industrial Relations Section, Princeton University, July 2002. (with Leah Platt)

"Labor Market Adjustment to Globalization: Long-Term Employment in the U.S. and Japan," Working Paper No. 519, Industrial Relations Section, Princeton University, September 2007.

"Increasing Voter Turnout: Is Democracy Day the Answer?" Working Paper No. 546, Industrial Relations Section, Princeton University, February 2009.

"Rational Choice and Voter Turnout: Evidence from Union Representation Elections," Working Paper No. 552, Industrial Relations Section, Princeton University, October 2009.

Sworn Testimony
In the Past Four Years
10/27/2017
Henry S. Farber

1. Deposition testimony, Maderazo et al., v. VHS San Antonio Partners et al., February 18, 2016.

2. Deposition testimony, Little et al., v. Washington Metropolitan Area Transit Authority, February 4, 2016.

3. Hearing testimony, before the National Labor Relations Board in the matter of The Trustees of Columbia University in the City of New York, employer, and Graduate Workers of Columbia-GWC, UAW, petitioner. Case 02-RC-143012, April 27, 2015.

4. Class Certification Hearing, Chen Oster et al., v. Goldman, Sachs & Co. and The Goldman Sachs Group, Inc., October 23, 2014

5. Deposition testimony, Chen Oster et al., v. Goldman, Sachs & Co. and The Goldman Sachs Group, Inc., November 19, 2013.

APPENDIX B

Documents Relied Upon

Case Documents
Second Amended Class Complaint, April 6, 2016. Case No. 15 cv 1483 (JLR)
Declaration of Joseph Whittinghill, May 9, 2016
Declaration of Larissa Johnson, May 2, 2016
Deposition of John Adrian Ritchie, June 29 and 30, 2016

Correspondence
Letter from Jessica Perry, August 25, 2016
Letter from Lauri Damrell, January 20, 2017

Bates-Numbered Documents
MSFT_MOUSSOURIS_00001615
MSFT_MOUSSOURIS_00001997
MSFT_MOUSSOURIS_00002378.pptx
MSFT_MOUSSOURIS_00004281
MSFT_ MOUSSOURIS_00006414
MSFT_MOUSSOURIS_00050736
MSFT_MOUSSOURIS_00058126.ppt
MSFT_MOUSSOURIS_00688508
MSFT_ MOUSSOURIS _00642050
Software Engineering -competencies MSFT_MOUSSOURIS_00006414.pdf
Software Engineering MSFT_MOUSSOURIS_00642050.pdf
Staffing Orientation Slides MSFT_MOUSSOURIS_00741588.pptm

Publicly Available Documents
http://www.shareholder.com/visitors/activeedgardoc.cfm?f=rtf&companyid=MSFT&id=12205633
https://news.microsoft.com/facts-about-microsoft/#ImportantDates

Data
MSFT_MOUSSOURIS_00121406.xlsx
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MSFT_MOUSSOURIS_00121416.xlsx
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MSFT_MOUSSOURIS_00646652.xlsx
MSFT_MOUSSOURIS_00646654.xlsx

Since filing my report on October 27, 2017, I have discovered several errors in my report. These errata are summarized in the following table, and a corrected report is attached.

Location	Original Text	New Text
¶ 60	…The top panel compares the distribution of men and women within the "IC" Career Stages….	…The top panel compares the distribution of men and women's Career Stages ….
¶ 60	The coefficient on the female indicator variable in the ordered probit analysis is negative (-0.16) …	The coefficient on the female indicator variable in the ordered probit analysis is negative (-0.29) …
¶ 71	…the probability of moving up a Career Stage prior to compensation year 2014 is 2.6 percentage points lower…	…the probability of moving up a Career Stage prior to compensation year 2014 is 2.7 percentage points lower…
¶ 71	…following compensation year 2014, women are about 3.5 percentage points less likely…	…following compensation year 2014, women are about 3.4 percentage points less likely…
¶ 80	…total in-class earnings are multiplied by $\frac{\beta 1-\beta}{}$.	…total in-class earnings are multiplied by $\frac{\beta}{1-\beta}$.
Figure 1	See Figure 1E, attached	
Figure 3 Note	The height of each bar represents the proportion of individuals in each Career Stage.	The height of each bar represents the proportion of individuals in each Stock Level.
Table 6	See Table 6E, attached	
Table 7	See Table 7E, attached	

Henry Farber
December 5, 2017