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March 4, 2013

Ben S. Bernanke, Chairman
Janet L. Lellen, Vice Chair
Elizabeth A. Duke, Member
Daniel K. Tarullo, Member
Sarah Bloom Raskin, Member
Jeremy C. Stein, Member
Jerome H. Powell, Member
Board of Governors of the Federal Reserve System
20th Street and Constitution Avenue, NW
Washington, DC 20551

An April 23, 2013 response to this letter is discussed on the Federal Reserve Letter subpage of the Lending Disparities page of jpscanlan.com.

Re: Misunderstanding of Statistics in the Enforcement of Fair Lending Laws

Dear Chairman Bernanke, Vice Chair Lellen, and Members of the Board of Governors:

On occasion I write to institutions whose missions involve the interpretation of data on demographic differences in the law and the social and medical sciences advising them of problems in their interpretations arising from the failure to recognize the ways that standard measures of differences between rates at which advantaged and disadvantaged groups experience favorable or adverse outcomes tend to be affected by the overall prevalence of an outcome. Other recipients of letters raising some aspect of the matter addressed here include [Robert Wood Johnson Foundation](#)¹ (Apr. 8, 2009), [National Quality Forum](#) (Oct. 22, 2009), [Institute of Medicine](#) (June 1, 2010), [The Commonwealth Fund](#) (June 1, 2010), [United States Department of Education](#) (Apr. 18, 2012), [United States Department of Justice](#) (Apr. 23, 2012) (DOJ Justice Measurement Letter), and [Harvard University](#) (Oct. 9, 2012) (Harvard University Measurement Letter).

This letter principally concerns a perverse feature of the enforcement of fair lending laws by the Federal Reserve System (Fed) and other federal agencies arising from the failure of such agencies to recognize the pattern whereby the rarer an outcome the greater tends to be the relative difference in experiencing it and the smaller tends to be the relative difference in

¹ To facilitate consideration of the issues raised in letters such as this I make available electronic copies of the letters on the Institutional Correspondence subpage of the Measuring Health Disparities page of jpscanlan.com. Underlinings in this letter reflect links to the underlined material in such a copy of the letter. If the letter is corrected after it is first posted on the website, such fact will be noted on the final page.

avoiding it. Such failure has led to an enforcement regime in which federal regulators encourage lenders to take actions that make it more likely that the federal government will sue them.

The matter is addressed more fully in the body of this letter. An Appendix to the letter addresses three related matters. Section A of the Appendix discusses patterns by which absolute (percentage point) differences between outcome rates tend to be affected by the prevalence of an outcome and the Fed's occasional reliance on absolute differences to appraise the size of a lending disparity without appreciation of these patterns or the way that absolute differences between rates would tend to yield conclusion about the comparative size of disparities that are different from those yielded by relative differences in favorable or adverse outcomes. Section B of the Appendix addresses the problematic nature of standard efforts to appraise the size of a disparity for purposes of determining whether the disparity results from lender bias. Section C of the Appendix provides a guide to the issues addressed on the [Lending Disparities](#) page of [jpscanlan.com](#) and its ten subpages.

Since at least 1994, out of concern about racial differences in adverse lending outcomes, federal agencies have been encouraging lenders to relax lending criteria and otherwise to reduce the frequency of adverse lending outcomes. Such approach accords with longstanding practice in the employment context where lowering test cutoffs has been universally regarded as reducing the disparate impact of employment test because lowering cutoffs tends to reduce relative differences in pass rates. But whereas lowering cutoffs tends to reduce relative differences in pass rates, lowering cutoffs tends to increase relative differences in failure rates. Similarly, reducing the frequency of adverse lending outcomes, while tending to reduce relative differences in the corresponding favorable outcomes, will tend to increase relative differences in the adverse outcomes. But, apparently unaware that reducing the frequency of adverse lending outcomes tends to increase relative differences in experiencing those outcomes, agencies enforcing fair lending laws have been monitoring fair lending compliance in terms of relative differences in adverse outcomes. Thus, the Fed has participated in an enforcement regime in which the federal government encourages lenders to engage in conduct that makes it more likely that the federal government will find them guilty of violating fair lending laws.

The pattern whereby the rarer an outcome the greater tends to be the relative difference in experiencing it and the smaller tends to be the relative difference in avoiding it² is inherent in the shapes of other than highly irregular risk distributions and can be found in virtually any data that

² For clarification I note that I employ the phrasing in the text because I have used it for some time and because it is the usage on which various scholars have commented. Technically more precise phrasings would be, instead of “the rarer an outcome,” “the more an outcome is restricted toward either end of the overall distribution” or “the more an outcome is restricted to those most susceptible to it.” I also note that while I commonly discuss the pattern in terms of normal distributions, the pattern would also exist in the case of uniform (rectangular-shaped) distributions.

allow one to examine various points on a continuum of factors associated with experiencing some outcome. One of the more obvious examples of this pattern, and one that I use in the three 2012 articles on fair lending enforcement discussed below, is found in normally distributed test score data. In accordance with the discussion in the preceding paragraph, such data show how lowering a test cutoff will increase relative differences in failure rates while reducing relative differences in pass rates. Graphical illustrations of the described pattern may be found in Figure 1 of the [DOJ Measurement Letter](#) (at 4) and Figure 1 of the [Harvard University Measurement Letter](#) (at 6). Such data also underlie many of the tables and figures in the October 2012 Applied Statistics Workshop at Harvard's Institute for Quantitative Social Science ("[The Mismeasure of Group Differences in the Law and the Social and Medical Sciences](#)"). A graphical illustration based on the shapes of the distributions themselves may be found in Figure 1 of my "[Divining Difference](#)" (*Chance*, Spring 1994).

A similar example may be found in published income data, which show how lowering poverty will tend to increase relative differences in poverty rates while reducing relative differences in rates of avoiding poverty. See the table and figures of my "[Can We Actually Measure Health Disparities](#)" (*Chance*, Spring 2006). Examples found in other types of data, including data from published life tables and the National Health and Nutrition Survey, are made available by means of the [Collected Illustrations](#) subpage of the [Scanlan's Rule](#) page (SR) of [jpscanlan.com](#).

But probably the most pertinent example for instant purposes is found in credit score data like that underlying Figure 1 below.³ These data are discussed more fully in the [Credit Score Illustration](#) subpage of SR, Table 1 of which provides the actual values underlying the illustrations.⁴ The figure shows the pattern whereby the lower the credit score, the greater the relative difference in failing to achieve the score and the smaller the relative difference in achieving the score.⁵ The figure thus illustrates the way that, for example, a lender's lowering of

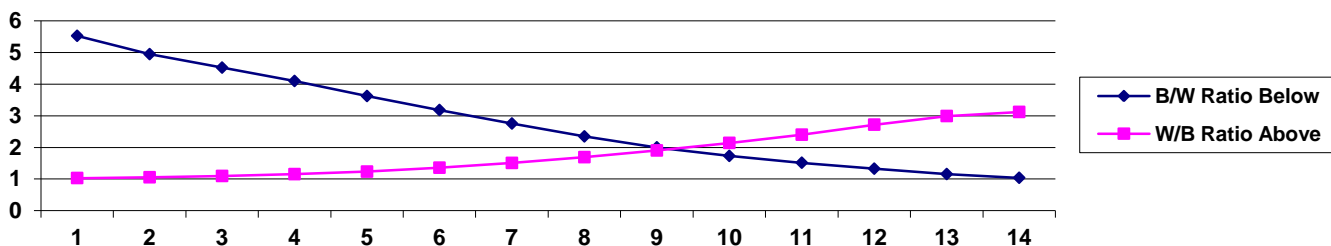
³ The data are drawn from an expert report in a putative class action against Wells Fargo Bank. See Table 4 (at 35) of [Class Certification Report of Howell E. Jackson](#), *In re Wells Fargo Mortgage Litigation*, No. 8-CV-01930-MMC (JL) (M.D. Cal.) (Nov. 23, 2010).

⁴ In conference presentations since 2006 I have presented the values associated with near universal experiencing of the adverse outcome (either a high adverse outcome rate for the advantaged group or a cut point associated with a high adverse outcome rate for the advantaged group) on both the left side and the right side of the x-axis of figures used to illustrate patterns by which measures change as prevalence changes. Figures in the Department of Justice and Harvard letters present such values on the left side. Figure 1 of this letter presents such value on the right side, as I have for some time done with the figures referenced on Credit Score Illustration subpage of SR. As shown in Table 1 of that subpage, credit scores corresponding to the numbers on the x-axis range, in increments of 20, from 540 at point 1 to 800 at point 14. Regarding the use of the larger rate as the numerator in both ratios (in contrast to the common usage of the rate of the disadvantaged group in both numerators), see Section A of the [Semantic Issues](#) subpage of SR.

⁵ These data pertain solely to persons who received loans. Thus, some inferences based on these data would be subject to the considerations discussed in the [Partial Picture Issues](#) subpage of the [Lending Disparities](#) page and my "[Illusions of Job Segregation](#)" (*Public Interest*, Fall 1988). Further, the data reflect distributions that are truncated portions of larger distributions and that hence will exhibit some patterns that are different those found in normal distributions, especially as to odds ratios, as discussed on the [Credit Score Illustrations](#) and [Truncation Issues](#) subpages of SR and as illustrated in a number of the figures in the 2008 International Conference on Health Policy

the credit score required for a borrower to secure some favorable lending outcome, while tending to reduce relative differences in rates of securing the outcome, will tend to increase the relative differences in the adverse outcome on which regulators rely to appraise compliance with fair lending laws.

Figure 1. Ratios of (a) Black Rate of Falling Below Score to White Rate of Falling Below Score and (b) White Rate of Falling Above Score to Black Rate of Falling above Score



A recent demonstration of the pattern in economists' terms may be found in a paper by Peter J. Lambert and Subbu Sabramanian, "[Disparities in Socio-Economic Outcomes: Some Positive Propositions and their Normative Implications](#)" (Society for the Study of Economic Inequality Working Paper Series, ECINEQ WP 2012 – 281, Nov. 2012). The existence of such pattern is hardly open to question. Indeed, squarely confronted with the issue, far more of the Fed's statisticians and economists would maintain that the pattern is self-evident than would maintain that it does not exist.

Despite the fact that the described patterns is evident in so many types of data, ever since the Fed and other agencies involved with the enforcement of fair lending laws issued the March 1994 Policy Statement of the Interagency Task Force on Fair Lending, those agencies have been encouraging lenders to relax criteria and otherwise to reduce the frequency of adverse lending outcomes, while continuing to monitor the fairness of lender practices on the basis of relative differences in adverse outcomes.⁶ Thus, by responding to encouragements to adopt policies that

Statistics [presentation](#). But these considerations do not lessen the utility of the data for illustrating the patterns described in the text above and in Appendix A.

⁶ The 1994 [Interagency Policy Statement](#) (at 8), in addition to encouraging lenders to think critically about standard lending criteria, and especially about unusually stringent lending criteria, that have an adverse impact on minorities, cited a minimum loan amount as a policy with a possible disparate impact. The [Appendix](#) to the August 2009 Interagency Fair Lending Examination Procedures (at 27) cites a minimum income requirement as a policy with a possible adverse impact on minorities. Lowering these minimums, as with lowering a test cutoff, would typically be regarded as a less discriminatory alternative. But both would tend to increase relative differences in failing to meet the minimum.

reduce the frequency of adverse lending outcomes, lenders increased the chance that they would be sued because of the size of relative differences in adverse outcomes.

The Department of Housing and Urban Development's February 8, 2013 issuance of a final rule on the discriminatory effects standard in the enforcement of the Fair Housing Act (24 CFR 100.500), including its explicit statement that a covered entity may be held liable for failure to implement a less discriminatory alternative to a practice causing a disparate impact (24 CFR 100.500(c)(3)), merely formalizes the standards long being imposed by agencies monitoring fair lending laws. See [Appendix](#) to the August 2009 Interagency Fair Lending Examination Procedures (at 27). Neither the rule nor the accompanying explanatory materials discuss either how to measure a disparate impact or how to determine whether an alternative is less discriminatory. It is fair to assume, however, that, as in the past, measurement will be in terms of relative differences in adverse outcomes.

The following three articles published over the last year discuss these issues in the context of recent fair lending settlements involving Bank of American's Countrywide Financial unit and Wells Fargo Bank, in both of which cases the complaints fault the lender for failing to reduce the frequency of the adverse outcomes at issues: "[Misunderstanding of Statistics Leads to Misguided Law Enforcement Policies](#)" (*Amstat News*, Dec. 2012); "[Disparate Impact': Regulators Need a Lesson in Statistics](#)" (*American Banker*, June 5, 2012); "[The Lending Industry's Conundrum](#)," (*National Law Journal*, Apr. 2, 2012).⁷

As explained in Section C of the Appendix, the [Lending Disparities](#) page of [jpscanlan.com](#), along with its subpages, addresses the above and related issues in greater depth, and lists articles describing the above-discussed statistical pattern in the lending context as early as 1992.⁸ Other closely related materials on [jpscanlan.com](#) include the [Discipline Disparities](#) page, the [Disparate Impact](#) page and its subpages (especially the [Less Discriminatory Alternative - Substantive](#) and

⁷ Another of my recent articles on fair lending, "[Statistical Quirks Confound Lending Bias Claims](#)" (*American Banker*, Aug. 14, 2012), touches upon the main issue in the three articles discussed in the text, but principally addresses whether efforts to adjust for borrower characteristics in fair lending analyses adequately do so, which is also the subject of the [Underadjustment Issues](#) subpage of the [Lending Disparities](#) page of [jpscanlan.com](#). I note that, while the title of the article uses the word "quirks," the forces underlying the points in the article are fundamental rather than idiosyncratic and are the same forces underlying the pattern shown in Figure 1.

⁸ Early articles on this issue include "[Bias Data Can Make the Good Look Bad](#)" (*American Banker*, Apr. 27, 1992) (which discusses that minorities may have their best chance of securing mortgages at lenders with the largest racial differences in rejection rates because those lenders will tend to have comparatively low rejection rates for minorities as well as whites), "[Getting it Straight When Statistics Can Lie](#)" (*Legal Times*, June 23, 1993) (which, in addition to discussing various contexts in which putatively less discriminatory alternatives to practices causing large relative differences in adverse outcome rates would generally increase those differences, discusses the Controller of the Currency policy in which lenders who reject minority mortgage applications twice as often as white applications would receive intense scrutiny), and "[When Statistics Lie](#)" (*Legal Times*, Jan. 1 1996) (which discusses a putative class action against NationsBank based on a study ranking lenders according to the size of relative differences in mortgage rejection rates). These articles may be read to suggest that relative differences in favorable outcomes provide a sound basis for appraising the size of a disparity. Subsequent work recognizes that the matter is more complex. See the [Employment Tests](#) subpage of SR and Section B of the Appendix.

[Fisher v. Transco Services](#) subpages, which discuss that in every setting where a disparate impact is measured in terms of the relative difference in an adverse outcome the practice that would generally be regarded as an obviously less discriminatory alternative would tend to increase the relative difference in the adverse outcome).

These materials should persuade the Fed that there is something deeply incongruous in the federal government's enforcement of fair lending laws. Once aware of these issues, responsible government agencies are compelled to address them.

There are special reasons for the Fed to address the described issues in a sound manner. While few people are familiar with the statistical pattern described above, understanding the illustrations in the three 2012 articles requires a mathematical background generally acquired in elementary school. Yet on a daily basis the Fed conducts statistical analyses of such complexity that even highly educated people must largely accept the soundness of such analyses on the basis of trust in the Fed's expertise. Any failure of the Fed to master the basic statistical principles described in the paragraphs above (as well as in Section A and B of the Appendix) would reasonably lead observers to be less trusting of the Fed's expertise in more complex matters.

Further, the failure to understand the ways standard measures of differences between outcome rates are affected by the prevalence of an outcome has long undermined a vast array of efforts to interpret data on group differences in the law and the social and medical sciences. For example, as also discussed in the 2012 *Amstat News* article, actions of the Departments of Justice and Education regarding racial and other differences in public school discipline rates, like the fair lending enforcement policies described above, involve civil rights enforcement policies that both are based on a statistical perception that is the exact opposite of reality and entail encouraging entities to engage in conduct that makes them more likely to be sued. Based on the mistaken perception that more lenient discipline standards will tend to reduce racial disparities in discipline rates both agencies have been encouraging public schools to relax discipline standards. But, as in the lending context, fairness continues to be monitored on the basis of the relative differences in adverse outcomes that the relaxing of discipline standards is likely to increase. See my "[Racial Differences in School Discipline Rates](#)" (*Recorder*, June 22, 2012) and the [Discipline Disparities](#) page and its subpages for fuller discussion of this issue.

Many other examples may be found in "[The Perils of Provocative Statistics](#)" (*Public Interest* 1991), "[Race and Mortality](#)" (*Society*, Jan./Feb. 2000, reprinted in *Current*, Feb., 2000),⁹ and "[Can We Actually Measure Health Disparities](#)" (*Chance*, Spring 2006), as well as the measurements letters sent to the Department of Justice and Harvard University and the [Measuring Health Disparities](#), [Scanlan's Rule](#), [Mortality and Survival](#), [Educational Disparities](#),

⁹ Though "Race and Mortality" focused on issues concerning the interpretation of health and healthcare disparities, the "Social Sciences and the Law" section of the article discussed the anomaly in fair lending enforcement that is the subject of this letter. An updating of that article titled "Race and Mortality Revisited," to appear in *Society* later this year, will address whether fair lending enforcement has a sounder statistical foundation in 2013 than it had in 2000.

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and [Feminization of Poverty](#) pages of [jpscanlan.com](#). As discussed at pages 21-24 and 28-43 of the [Harvard University Measurement Letter](#) and the February 5, 2013 [Comment on Epstein BMJ 2012](#), even though in 2005 the National Center for Health Statistics formally recognized that one would commonly reach different conclusions as to whether health and healthcare disparities were increasing or decreasing depending on whether one examined relative differences in favorable or adverse outcomes, vast resources continue to be expended on health and healthcare disparities research undertaken without an understanding of the ways measures employed to analyze disparities are affected by the prevalence of an outcome. Such research is thus of limited value even when it is not patently incorrect or misleading. As discussed in the last two mentioned items, among the varied anomalies concerning appraisals of health and healthcare disparities undertaken without consideration of the ways measures tend to be affected by the prevalence of an outcome, (a) the Agency for Healthcare Research and Quality funds research where the researchers employ measures that tend to reach opposite conclusions from those the agency would reach, with neither the researchers' nor the agency's being aware of such fact and (b) an effort by Massachusetts to address healthcare disparities in its Medicaid pay-for-performance program is more likely to increase than reduce such disparities.

Given the stature of the Fed, its directly addressing the described measurement issues could do much to provide law enforcement and research involving demographic differences in a wide range of outcomes the sound statistical foundation that these activities have so far failed to reflect.

Sincerely,

/s/ **James P. Scanlan**

James P. Scanlan

Attachment

Appendix to Letter to Federal Reserve Board

The main body of the March 4, 2013 letter to Chairman Ben S. Bernanke and the Members of the Board of the Federal Reserve System (Fed) discusses the fact that, out of concern about large relative differences between whites and minorities in adverse lending outcomes, federal regulators have encouraged lenders to reduce adverse lending outcomes, but, unaware that reducing adverse lending outcomes tends to increase relative differences in adverse outcome rates, those agencies continue to monitor fair lending compliance on the basis of relative differences in adverse outcomes. Thus, lenders most responsive to federal encouragements make themselves the most likely targets for litigation.

This appendix treats three related issues. Section A discusses patterns by which absolute (percentage point) differences between outcome rates tend to be affected by the prevalence of an outcome and the Fed's occasional reliance on absolute differences to appraise the size of a lending disparity without appreciation of these patterns or the way that absolute differences between rates would tend to yield conclusion about the comparative size of disparities that are different from those yielded by relative differences in favorable or adverse outcomes. Section B discusses the problematic nature of standard efforts to appraise the size of a disparity for purposes of determining whether the disparity results from lender bias. Section C provides a guide to the issues addressed on the [Lending Disparities](#) page of [jpscanlan.com](#) and its ten subpages.

A. Absolute Differences Between Rates as a Measure of Lending Disparities

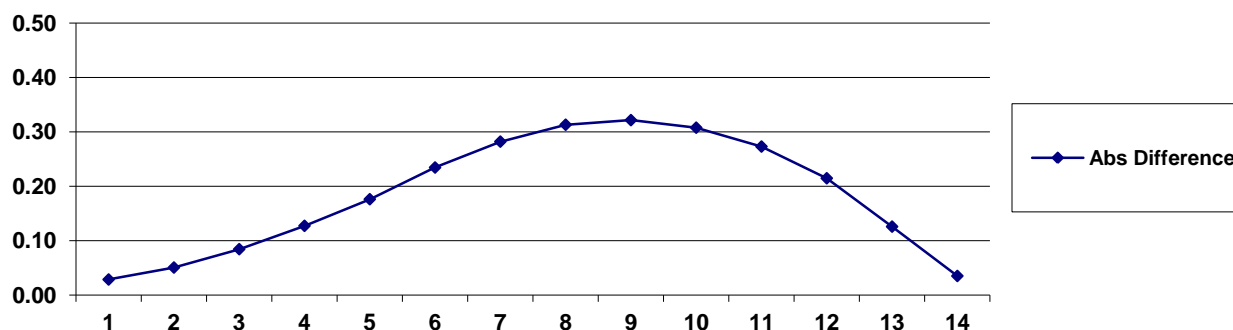
While most analyses of differences in lending outcomes have relied on relative differences in adverse outcomes, a number studies by arms of the Fed have measured lending disparities in terms of absolute differences between rates. For that reason, I discuss below the patterns by which absolute differences between rates tend to be affected by the prevalence of an outcome and the implications of the failure to understand those patterns in efforts to appraising the size of lending disparities.

Appraisals of the size of the difference between the circumstances of two group reflected by a pair of outcome rates in terms of absolute differences are unaffected by whether one examines the favorable or the adverse outcome. But in order for a measure to effectively quantify said differences in circumstances on the basis of outcome rates the measure must remain unchanged when there occurs a change in the overall prevalence of the outcome akin to that effected by the lowering of a test cutoff. And, like the two relative differences, absolute differences tend to be affected by the overall prevalence of an outcome, though in a more complicated way than the two relative differences. Roughly, as uncommon outcomes (less than 50% for both groups being compared) become more common, absolute differences between rates tend to increase; as common outcomes (greater than 50% for both groups being compared) become even more common, absolute differences tend to decrease. In cases where the outcome is either common or uncommon, the pattern of direction of changes in absolute differences as the prevalence of an outcome changes will tend to track the direction of changes of the smaller relative difference. Where the rate of either outcome is less than 50% for one group and more than 50% for the other

group, the prevalence-related pattern is difficult to predict, as discussed in the introductory section of the [Scanlan's Rule](#) page. Similarly, such patterns may be difficult to predict when a group's outcome rate crosses either of the points defined by a rate of 50% for the advantaged or disadvantaged group.

An illustration of these patterns based on test score data according to the same specifications used in the three 2012 lending disparities articles cited above may be found in Figure 2 of the [Harvard University Measurement Letter](#) (at 19). But, as with the relative differences, and notwithstanding the considerations in note 5 of the body of the letter to the Board, for instant purposes credit score data provide the most useful illustration of the patterns. Such data underlie the percentage point differences between white and black rates of achieving (failing to achieve) the credit scores corresponding to the points on the x-axis of Appendix Figure 1

Appendix Figure 1. Absolute Difference Between Black and White Rates of Falling above Each Score



The figure shows (as is made clearer in the Table 1 of the [Credit Score Illustration](#) subpage of the [Scanlan's Rule](#) page (SR) of [jpscanlan.com](#)) that, when a cutoff is set at the very high credit score reflected by point 14 (800), the absolute difference is only 3 percentage points. As the cutoff is reduced, the absolute difference increases to a maximum 32 percentage points at point 9 (700), then decreases to 3 percentage points again at point 1 (540).

There are several implications of reliance on absolute differences rather than relative differences in the adverse outcome in the appraisal of lending disparities. First, in the rate ranges commonly at issue in lending disparities analyses, reducing adverse outcome will tend to reduce absolute differences between rates. Thus, whereas implementing practices that would commonly be deemed less discriminatory alternatives to challenged lending practices will tend to increase the relative differences in adverse outcomes most regulators examine, such implementation will tend to reduce absolute differences between rates. It warrants note, however, that there may be circumstances where reducing the frequency of an adverse outcome will tend to increase absolute differences. For example, suppose that a lender accorded certain advantages to borrowers at or above a certain credit score (which, of course, could be regarded as involving either a benefit for those achieving the score or a penalty for those failing to achieve it). For reasons discussed in the body of the letter to the Board, regardless of the rate ranges at issue, lowering the credit score cutoff for receiving that benefit will tend to increase relative differences in failing to receive the benefit while reducing relative differences in receipt of the benefit. As

reflected in Figure 1, and shown more precisely in Table 1 of the [Credit Score Illustrations](#) subpage of SR, lowering the cutoff from 680 (point 8) to 660 (point 7) will reduce the absolute difference between rates. But lowering the cutoff from 740 (point 11) to 720 (point 10) will increase the absolute difference.

Second, as discussed on the [Disparities – High Income](#) subpage of the [Lending Disparities](#) page, observers often make points based on the fact that relative differences in adverse lending outcomes tend to be larger among like higher-income groups than lower-income groups. Presumably, that will also be the case for groups with higher credit ratings, as discussed in [“Statistical Quirk Confound Lending Bias Claims”](#) (*American Banker*, August 14, 2012) and the [United States v. Wells Fargo](#) subpage of the [Lending Disparities](#) page. But things like mortgage application rejection rates are commonly in ranges where absolute differences between rates tend to be larger among lower-income groups than higher-income groups (hence supporting opposite inferences from those that have been drawn based on relative differences in adverse outcomes). For reasons discussed in the last paragraph, however, there could be circumstances where the rate ranges at issue for the particular outcome examined are such that absolute differences would tend to be greater among higher-income groups than lower-income groups.

Third, given the rate ranges commonly at issue lending disparities analyses, rankings of lenders according to the size of absolute differences will tend to contrast sharply with rankings based on relative differences in adverse outcomes (as in the study underlying the *Lathern v. NationsBank* case discussed in my [“When Statistics Lie”](#) (*Legal Times*, Jan. 1 1996) and in the [Lathern v. NationsBank](#) subpage of the [Lending Disparities](#) page.¹

In works by arms of the Fed that have relied on absolute differences as a measure of disparity, the authors have shown no understanding of these issues and, indeed, so far as I have been able to determine, have failed even to recognize situations where different measure yield different conclusions. In the October 9, 1992, [Interagency Policy Statement on Fair Mortgage Lending Practices](#), in discussing the 1992 Boston Fed’s fair lending study ([Mortgage Lending in Boston: Interpreting HMDA Data](#)), the statement relied on relative differences in adverse outcomes in noting that black and Hispanic applicants were denied loans two to three times as often as whites. Presumably, it also relied on relative differences in adverse outcomes when observing that “[t]he disparity in denial rates in the Boston metropolitan area was among the highest in the country.” But when the statement mentioned that “[d]isparities appeared to be most common among applicants who have some imperfections or flaws in credit qualifications,” it apparently relied on the percentage point differences noted in the study at page 40. Relative differences in denial rates were probably higher among applicants without such blemishes. The study itself mentions both relative and absolute differences without an understanding of the implications of the choice of measure.

¹ One will observe less consistency with the patterns described on the [Scanlan’s Rule](#) with respect to a data across lenders than one will observe in other circumstances regarding differences in lending outcomes because of the importance of variations among lender practices (as measured in accordance with the methods discussed in Section B *infra*, and shown in the tables on the Disparities – High Income subpage). See Section A.9 of the Scanlan’s Rule page.

The same failure of understanding exists in the more recent studies that have relied either principally or wholly on absolute differences to appraise disparities. See Marvin M. Smith and Christy Chung Hevener, "[Subprime Lending Over Time: The Role of Race](#)" (Federal Reserve Bank of Philadelphia, Oct. 2010) and Robert B. Avery, Kenneth P. Brevoort, Glenn B. Canner, "[The 2006 HMDA Data](#)" (Federal Reserve Bulletin, Dec. 2007).

If I have overlooked some instance in these or other Fed studies where the authors have discussed the choice of measure, it seems safe to assume that such discussion fails to recognize the ways the various measures tend to be affected by the prevalence of an outcome.

B. The Measurement of Bias in Lending Decision

While discussion in the body of the letter to the Board principally addresses perceptions about adverse impact of lending policies, appraisals of lending disparities often involve the question of whether such disparities result from conscious or unconscious bias and hence raise the issue of how to measure that bias. The issue is of particular importance when efforts to adjust for difference in credit-related characteristics of minority and white applicants leave some unexplained disparity, and the question a fact finder must confront is whether, given the possibility or likelihood that there exists some unaccounted for difference in characteristics, the size of the residual disparity is such that there is reason to believe that a substantial part of the disparity was caused by lender bias. See [Disparate Treatment](#) subpage of the [Discipline Disparities](#) page.

The illustration below is akin to that in Section B of the [DOJ Measurement Letter](#) and Section D of the [Harvard University Measurement Letter](#), which letters are mentioned in the body of the letter to the Board. It was originally used to refute claims commonly made with respect to the measurement of health and healthcare disparities to the effect that measures that yield opposite conclusions as to directions of change over time may both be in some way valid and that choice of measure involves a value judgment. See the [Relative Versus Absolute](#) subpage of the [Measuring Health Disparities](#) page of [jpscanlan.com](#) and Table 2 (slide 14) of the Third North American Congress of Epidemiology [presentation](#). But the information in the table also illustrates the shortcomings of each of the standard measures of bias.

Appendix Table 1 below is a slightly modified version of Table 3 of the Harvard letter. The table could be somewhat better adapted to the lending context by using lower adverse outcome rates, such as may be found toward the bottom of [Table 1](#) of the British Society for Population Studies 2006 [presentation](#), thereby making the rate ranges closer to those likely to be at issue in the lending context. But the values in the table are satisfactory for instant purposes. The table shows hypothetical favorable outcome rates of an advantaged group (AG) and a disadvantaged group (DG) applying for some loan product at four lenders, along with the ratios of approval rates and ratios of rejection rates, as well as the absolute difference between rates and an odds ratio. In a situation where it is assumed that for each lender the qualifications of the applicants from the advantaged group do not differ from the qualifications of the disadvantaged group and all differences in rates result from lender bias, the question posed is how might the employers be ranked, from highest to lowest, according to level of bias. The numbers in parentheses for each measure reflect the ranking pursuant to that measure. I note in advance that

I could make the same point more simply with two rows of data. But I use four rows to illustrate the ways the absolute differences and odds ratios alter their directions of change as overall prevalence changes.

Appendix Table 1. Hypothetical Patterns of Approval Rates of Advantaged and Disadvantaged Borrowers at Four Lender and Measure of Differences between Rates of Approval or Rejection

Lender	AG Approval Rate	DG Approval Rate	AG/DG Approval Ratio	DG/AG Rej Ratio	Abs Df	Odds Ratio
A	20.1%	9.0%	2.22 (1)	1.14 (4)	0.11 (4)	2.53 (1)
B	40.1%	22.7%	1.77 (2)	1.29 (3)	0.17 (2)	2.29 (3)
C	59.9%	40.5%	1.48 (3)	1.48 (2)	0.19 (1)	2.19 (4)
D	90.0%	78.2%	1.15 (4)	2.17 (1)	0.12 (3)	2.50 (2)

There are four principal ways observers might rank the degree of bias of these lenders. Those who rely on relative differences in favorable outcomes, such as would commonly occur in an employment discrimination case involving hiring or promotion, would rank them A,B,C,D. Those who rely on relative differences in adverse outcomes, as would commonly occur in a lending discrimination case and as might also be done in an employment discrimination case where the favorable outcome is retention and the adverse outcome is termination, would rank them D,C,B,A, the opposite of the first approach.

Those who rank them on according to the absolute difference between rates would rank them C,B,D,A. And those who rely on the odds ratio, such as those who would attempt to evaluate the situation by means of logistic regression might do, would rank them A,D,B,C, the opposite of the ranking based on absolute differences.

There are, however, no sound arguments as to why one approach is superior to another. It would be absurd to assert that one lender is more biased than another as to approval while another is more biased as to rejection.² It would be similarly absurd to say that contrasting interpretations as to the degree of bias based on either of the two relative differences and the absolute difference (or odds ratio) would both be sound or that determining which employers are the most biased involves a value judgment. Rather there can only be one correct interpretation as to the comparative bias of the lenders reflected in the data.

The same reasoning would hold if, instead of representing the situations of four lenders, the rows of data represented one lender at four points in time and the question to be answered was whether lender bias increased or decreased from each point in time to the next. The reasoning would hold as well if it was not known whether any of the lenders was biased and the question to be answered involved the degree of difference in the qualifications of applicants of the

² For reasons explained in the body of the letter to the Board, the lender that is most responsive to encouragements to find less discriminatory alternatives to practices with a disparate impact will tend to show the largest relative differences in adverse outcomes. Thus, reliance on relative differences in adverse outcome creates the additional anomaly that lenders most responsive to regulator encouragements often will be perceived as those most likely to have engaged in disparate treatment as well as disparate impact. See my "[Bias Data Can Make the Good Look Bad](#)" (*American Banker*, Apr. 27, 1992). This Appendix, however, deals with the more fundamental issue concerning the problematic nature of all standard measures of differences between outcome rates.

advantaged and disadvantaged groups that would be necessary to explain each difference in outcome rates as a result of something other than bias.

As shown in [Table 1](#) of the 2006 British Society for Population Studies [paper](#), the patterns shown in Appendix Table 1 simply reflect the situations at different cut points where the means of two normal test score distributions differ by half a standard deviation. Thus, the strength of the forces causing the rates to differ is the same in each row and any measure that suggests that such strength differs from row to row is an unsound measure.³

As implied in the example, in any setting where one must estimate on the basis of a pair of outcome rates the strength of the forces causing those rates to differ (whether those forces involve differences in treatment or differences qualifications), the only sound method of doing so is to derive from the rates the difference between means of the hypothesized normal underlying distributions (or of such other than normal distributions as might be justified in a particular circumstance). See the [Solutions](#) subpage of [Measuring Health Disparities](#) page of [jpscanlan.com](#).

C. Description of the Lending Disparities Page and its Subpages

The Lending Disparities page and its subpages address a number of issues addressed in the body of the letter to the Board or this Appendix in greater depth as well as some issues not addressed in the letter and Appendix.

The main [Lending Disparities](#), in addition to broadly summarizing the subject and providing links to relevant articles, addresses eight key points at varying length.

Point 1 (Implications of Relaxing Lending Criteria) briefly addresses matters concerning relaxing lending criteria that are now more fully covered in the body of the letter to the Board.

Point 2 (Underadjustment Issues) briefly addresses matters that are now more fully covered on the [Underadjustment Issues](#) subpage.

Point 3 (Implications of Large Relative Differences in Rejection Rates among High-Income Groups) briefly addresses matters now more fully addressed on the [Disparities – High Income](#) subpage.

Point 4 (Higher Default Rates among Minorities as Putative Evidence of the Absence of Discrimination) addresses the misperception that higher default rates among minority borrowers is evidence of the absence of discrimination

³ For discussion of why the rate ratio is an illogical as well as unsound measure of association, see [Subgroup Effects](#), [Illogical Premises](#), and [Illogical Premises II](#) subpage of the [Scanlan's Rule](#) page and the [Four-Fifths Rule](#) subpage of the [Disparate Impact](#) page. See also the February 25, 2013 [Comment on Hingorani BMJ 2013](#).

Point 5 (Recent Studies of Racial Differences in Foreclosure Rates) discusses the way that recent studies of racial differences in foreclosure rates have failed to recognize that general reductions in foreclosure rates will tend to increase relative differences in foreclosure rates.

Point 6 (Measuring Disparities with Odds Ratios) addresses implications of reliance on odds ratios rather than relative differences.

Point 7 (HAMP and Racial Disparities) discusses the way that the Home Affordable Mortgage Program, by reducing foreclosure rates, will tend to increase relative differences in foreclosure rates.

Point 8 ([Partial Picture Issues](#)) briefly addresses issues now more fully addressed on the [Partial Picture Issues](#) subpage.

The Lending Disparities page currently has ten subpages, including a page that discusses the letter to the Board and that will discuss such actions as the Fed may take or fail to take in response to it. From time to time other subpages may be added. The ten existing subpages are described briefly below:

The [Disparities – High Income](#) subpage addresses the erroneous perception that the fact that relative differences in adverse outcomes tend to be greater among higher-income than lower-income groups suggests that differences in income do not explain rejection rate disparities.

The [Underadjustment Issues](#) subpage addresses the fact that efforts to adjust for racial differences in characteristics related to securing some outcome are invariably inadequate.

The [Absolute Differences – Lending](#) subpage discusses issues concerning the measurement of lending disparities by means of absolute differences between rates as has been done in a number of studies by arms of the Federal Reserve System (a matter now treated in Section A of this Appendix).

The [Lathern v. NationsBank](#) subpage discusses a putative class action brought against NationsBank Mortgage Corp. in Washington, DC on the basis of a study showing that NationsBank had comparatively large relative differences in mortgage rejection rates.

The [United States v. Countrywide](#) subpage addresses several issues especially pertinent to the Department of Justice's lending discrimination case against Countrywide Financial Corp. that was the subject of a \$335 million settlement announced in December 2011.

The [United States v. Wells Fargo](#) subpage addresses several issues especially pertinent to the Department of Justice's lending discrimination case against Wells Fargo Bank that was the subject of a \$175 million settlement announced in July 2012.

The [Partial Picture Issues](#) subpage addresses a fundamental problem with analyses underlying claim of discrimination in assignment to subprime status and discrimination in loan pricing at issue in cases like *United States v. Countrywide* and *United States v. Wells Fargo* that was not

present in analyses of rejection rate disparities – *i.e.*, that the analyses of the claims fail to examine the entire universe of persons seeking the desired outcome.

The [File Comparison Issues](#) subpage discusses the problematic nature of efforts to identify discrimination by means of comparisons of files of rejected and approved applicants.

The [Holder/Perez Letter](#) subpage discusses an April 24, 2012 letter to the Department of Justice alerting the agency, among other things, that statistical perceptions underlying its fair lending enforcement policies are incorrect.

The [Federal Reserve Letter](#) subpage discusses the letter to the Board of which this Appendix is a part.