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# The Risk of Using the Wrong Risk Metric in HMDA Analyses

Likelihood Ratios v. More Sophisticated Statistical Measures



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# Wrong Risk Metric in HMDA Analyses

With the recent release of lending institutions' HMDA data, community groups, regulators, and the institutions themselves are engaging in lively debates regarding the methods by which the data should be analyzed. The focus has been primarily on the new pricing data included in the annual submission to regulators. Several articles have been written, primarily by community groups, condemning differences noted by their analyses. The differences are often shown as a rate that expresses the likelihood a minority will receive a reportable rate spread loan versus that of a White borrower. Thus, if a lender makes a reportable rate spread loan to 10% of all minority borrowers but to only 2% of all White borrowers, then minority borrowers are five times as likely to receive a reportable rate spread loan. This rate is commonly referred to as the "likelihood ratio". However, as is explained in this article, using a likelihood ratio alone to monitor fair lending risk is insufficient. In fact, using the ratio alone can prove detrimental. It can mask significant differences in the data and divert attention by pointing to insignificant issues.

## Weakness Of The Likelihood Ratio

While the logic used in calculating the likelihood ratio may make headlines in the court of public opinion, it does not pass muster in a court of law. The fundamental flaw is that the likelihood ratio does not take into account two critical pieces of information – the total number of observations and the variability of the data.

The number of observations must be taken into account when reviewing a difference between two groups. For example, using the earlier illustration, it is not known whether the 10% of all minorities is simply one individual out of ten or 1,000 individuals out of 10,000. It is also not known whether the 2% for whites is 2 out of 10 or 2,000 out of 10,000.

The variability of the data is also not considered properly. Variability accounts for the uniformity, or lack thereof, of the data. If the data includes a great amount of variability in the selected factor, the raw difference must be large in order for it to be truly significant. However, if the data includes a minimal amount of variability, the raw difference does not need to be large at all for it to be significant.

## Significance Can Only Be Determined When All Information Is Considered

A difference can only be determined truly significant when the raw difference, the number of observations and the variability are considered. Regulators have long used statistics as a way to account for all three points, as can be easily demonstrated by the regulatory risk factor reports used by all the agencies. A simple statistical test is employed that produces a t-statistic, which allows for the determination of a specific significance level. The significance level is roughly equivalent to the certainty with which a person can definitively say the difference mirrors reality. At a 95% significance level, it is probable a court of law would deem the difference to be real and not due to chance. When using a likelihood ratio, the calculation shows the relative difference between two groups and does not employ a consistent standard. As such, an arbitrary level – 1.25 or 2.00 or 3.5 – must be chosen with no basis of true significance.

Also, because the likelihood ratio uses the percentage of White borrowers as its reference rather than accepted statistical tests, a traditional subprime lender may not be as susceptible to adverse conclusions. If a traditional subprime lender makes a reportable rate spread loan to 42% of White borrowers and to 99% of minorities, the ratio would still only be 2.38. The ratio for a traditional subprime lender would still be far below the ratio of 5.00 for a traditional prime lender with 2% of White borrowers and 10% of minorities receiving a reportable rate spread. In reality, the difference of 57% (99% - 42%) for a subprime lender may be far more egregious than the 8% difference (10% - 2%) for a prime lender with a similar number of observations.

To illustrate the enumerated points, several examples are listed for a traditional prime lender as well as a traditional subprime lender. The examples show how each metric can give differing outcomes in the same situation.

**Figure 1: Different Outcomes Produced Using Likelihood Ratio v. Statistical "Certainty"**

| | Traditional Prime Lender | | | Traditional Subprime Lender | | |
|---|---|---|---|---|---|---|
| | **Example 1** | | | **Example 1** | | |
| | Total Funded Loans | Reportable Rate Spread Loans | % Above Threshold | Total Funded Loans | Reportable Rate Spread Loans | % Above Threshold |
| Minority borrowers | 5,000 | 300 | 6.00% | 5,000 | 2,500 | 50.00% |
| White borrowers | 10,000 | 200 | 2.00% | 10,000 | 4,600 | 46.00% |
| | | **Raw Difference** | **4.00%** | | **Raw Difference** | **4.00%** |
| | | **Likelihood Ratio*** | **3.00** | | **Likelihood Ratio*** | **1.09** |
| | | **Statistical "Certainty"** | **100.0000%** | | **Statistical "Certainty"** | **100.0000%** |
| | **Example 2** | | | **Example 2** | | |
| | Total Funded Loans | Reportable Rate Spread Loans | % Above Threshold | Total Funded Loans | Reportable Rate Spread Loans | % Above Threshold |
| Minority borrowers | 5,000 | 125 | 2.50% | 5,000 | 2,325 | 46.50% |
| White borrowers | 10,000 | 200 | 2.00% | 10,000 | 4,600 | 46.00% |
| | | **Raw Difference** | **0.50%** | | **Raw Difference** | **0.50%** |
| | | **Likelihood Ratio*** | **1.25** | | **Likelihood Ratio*** | **1.01** |
| | | **Statistical "Certainty"** | **98.8424%** | | **Statistical "Certainty"** | **52.1857%** |
| | **Example 3** | | | **Example 3** | | |
| | Total Funded Loans | Reportable Rate Spread Loans | % Above Threshold | Total Funded Loans | Reportable Rate Spread Loans | % Above Threshold |
| Minority borrowers | 500 | 13 | 2.60% | 500 | 233 | 46.60% |
| White borrowers | 1,000 | 30 | 2.00% | 1,000 | 460 | 46.00% |
| | | **Raw Difference** | **0.60%** | | **Raw Difference** | **0.60%** |
| | | **Likelihood Ratio*** | **1.30** | | **Likelihood Ratio*** | **1.01** |
| | | **Statistical "Certainty"** | **66.1458%** | | **Statistical "Certainty"** | **21.1973%** |

* Assumes a ratio of 1.5 or greater to be significant

| Key | |
|---|---|
| | Significant difference between Minority borrowers and White borrowers |
| | No significant difference between Minority borrowers and White borrowers |

As can be seen in the examples, the use of the likelihood ratio versus the computed statistical “certainty” gives differing answers in certain instances. If a likelihood ratio of 1.5 is chosen by a traditional prime lender as the threshold, only Example One would alert management to a significant difference; however, the use of statistics shows both Example One and Example Two to have a significant difference. In Example Three, where the likelihood ratio is actually higher than Example Two, the statistical “certainty” is below the high risk level.

Should a traditional subprime lender choose the same likelihood ratio of 1.5 as the significance threshold, none of the three examples would show a significant difference between Minority borrowers and White borrowers; however, using the standard statistical test shows a significant difference in Example One.

It is interesting to note that each example for a traditional lender and its corresponding example for a traditional subprime lender have the same raw difference yet the likelihood ratio and statistical "certainty" value are not the same. Only when the raw difference, the number of observations and the total variability are all considered can an accurate conclusion be made. As such, reliance should only be placed on the statistically-driven significance test.

## HMDA Data Alone Does Not Provide Sufficient Information

Of course, another concern exists; namely, the illustrations shown above refer to HMDA data only and do not compare to the full data gathered to make a decision. As such, the noted differences should only be used to focus future analyses. However, it is important to note, and is shown by the six examples, that as the size of the two groups decreases, the ability to detect significant differences also decreases, even when using statistical tests. For this reason, a population of data is always preferred to a sample. However, a sufficient number of observations that is indicative of the decision must be used to make an accurate conclusion.

Determining where to focus limited resources is a critical risk management responsibility. Using the appropriate metric is an important first step. Using accepted statistical tests provides a reliable and consistent measurement tool that accounts for all essential factors. Once a risk has been identified using the limited HMDA data, additional information used in the decision-making process can be added and further analyses completed to determine if corrective action is needed.

Referring specifically to the new rate spread information, the regulators, in a release published March 31, 2005, have noted that more information than HMDA data is needed.

> Supervisory and enforcement agencies investigating disparities typically collect additional information about price determinants from lenders' loan files or other sources. Without information about relevant price determinants, one cannot draw definitive conclusions about whether particular lenders discriminate unlawfully or take unfair advantage of consumers. HMDA data … exclude many other potential determinants, such as borrower credit history, borrower debt-to-income ratio, and the ratio of the loan amount to the value of the property securing the loan (loan-to-value ratio). *Therefore, price disparities by race, ethnicity, or sex disclosed in HMDA data will not alone prove unlawful discrimination.* (*Emphasis Added*)[*]

To account for these relevant determinants, regression analysis is the best tool to employ and can be used to further identify and explain any noted differences as part of a larger fair lending monitoring program. Only when all the relevant information is considered, including a possible file review, can a difference be conclusively proven.

## Risk of Reputation Damage

Despite the weaknesses of the likelihood ratio and its relative inferiority to accepted statistical tests, it will continue to be used by community groups to allege discrimination

[*] The Federal Reserve Board of Governors. (March 31, 2005). Frequently Asked Questions About The New HMDA Data. [Online], Available: http://www.federalreserve.gov/boarddocs/press/bcreg/2005/20050331/attachment.pdf

by lenders. As such, it is wise to know the results of such a metric and how it could impact the reputation of a lender. More importantly, it is critical for an institution to clearly articulate the shortcomings of the likelihood ratio and then explain the use of more reliable measures. Only the institution has the complete information to determine if discrimination has occurred; therefore, it is prudent to proactively monitor lending practices in order to quickly and effectively rebut the accusations of a hostile third-party. Without a prepared and complete response, an institution has done little to avoid being judged harshly by the court of public opinion.

## A Lender's Precarious Position

Today's lenders are in a precarious position where they must please both government regulators using one metric and protect their reputation from damage through the use of a different metric. The first metric is absolute, reliable, and consistent and provides results whereby an institution can remain in compliance. The second metric is relative and cannot guarantee compliance but only provide irrelevant evidence for damaging allegations of discrimination. Furthermore, both metrics fail to account for critical information beyond that included in the HMDA data. Only when a lender has identified potential risks through the use of both metrics can it properly allocate its limited resources to respond to all critics. Through the use of regression analysis, as part of a larger monitoring program, a lender can simultaneously account for all factors used in the lending decision and identify any differences between groups. The result of such a robust analysis will well equip any lender to respond to government regulators and community groups alike.

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ADI Consulting (ADI) provides a variety of services to lenders of all sizes across the country. Through its focused process of assess, design, and implement, ADI is able to identify risks that threaten a lending institution and in turn create a customized solution to mitigate the threat. Coupled with its knowledge of the industry and many years of experience, this process has allowed ADI to assist mortgage lenders through every step of the lending procedure, from pre-application to post-funding.