# Accuracy of Zillow's Home Value Estimates

BY CHARLES CORCORAN, PH.D., CFA, AND FEI LIU

## INTRODUCTION

Zillow is a real estate website that enjoys tremendous name recognition. Buyers use it to search for homes; sellers type in their addresses and get what they believe to be a value of their homes. But is the site accurate and should consumers rely upon it?

## LITERATURE REVIEW

In recent years, home value estimates have been subject to heightened scrutiny, with a housing price bubble followed by a sharp downturn. Interested parties such as appraisers, tax assessors, buyers and sellers seek reliable data from which they can derive an unbiased estimate of value. The real estate industry is based on "information asymmetry," which means that one party (typically the seller) knows more about a product than the other (the buyer). It's an opaque market that encourages obfuscation and leads to flawed pricing. A motivation behind the founding of *Zillow.com* in 2006 was to make real estate more like a stock exchange, a transparent market where all information about every property is readily available and, as a result, pricing is less imperfect.[1]

Zillow provides an estimate of market value for more than 100 million homes based on a proprietary formula. In general, it offers free value estimates, or "Zestimates," using data from appraisal districts and from multiple listing services (MLSs), depending on availability. Zillow uses a "static" formula employing tax information, and applies it uniformly across the country. Their stated mission is "to empower consumers with information and tools to make smart decisions about homes, real estate and mortgages."[2] Zillow is a home and real estate marketplace created to help homeowners, homebuyers, sellers, renters, real estate agents, mortgage professionals, landlords and property managers find and share vital information about homes, real estate, mortgages and home improvement. They assert to be "transforming the way consumers make home-related decisions and connect with professionals."


### About the Authors

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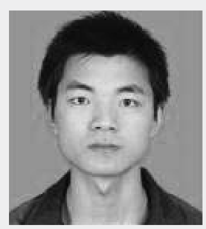

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Zillow partnered with Yahoo! in 2011 to provide the vast majority of Yahoo's real estate listings online, cementing their place as the largest real estate network on the Web according to several online measurement agencies.[3]

The focus of this article is to determine whether Zillow's Zestimates reflect actual sale prices. Realtors generally have been critical of the values produced by Zillow, claiming the data are secondhand, not locally sourced and out of date. Realtors with specific market knowledge are more likely to know specific factors affecting the sale of a home such as the overall condition of the home, room flow, landscaping, views, traffic noise and privacy. These factors have been called *unzillowable*.[4]

Hagerty[5] studied the accuracy of Zillow's estimates and found that they "often are very good, frequently within a few percentage points of the actual price paid. But when Zillow is bad, it can be terrible." O'Brien[6] asserts that "Zillow has Zestimated the value of 57 percent of U.S. housing stock, but only 65 percent of that could be considered 'accurate'—by its definition, within 10 percent of the actual selling price. And even that accuracy isn't equally distributed." The article cites the state of Louisiana as an example, where "the site is just about worthless." The National Community Reinvestment Coalition filed a complaint with the Federal Trade Commission stating that Zillow was "intentionally misleading consumers and real-estate professionals to rely upon the accuracy of its valuation services, despite the full knowledge of the company officials that their valuation Automated Valuation Model (AVM) mechanism is highly inaccurate and misleading."[7]

Zillow often overestimates home values, much as homeowners themselves do. Goodman and Ittner[8] compare owners' estimates of value with subsequent sale prices; their results indicate that homeowners overestimate value by approximately six percent. Riel and Zabel[9] find an 8.4 percent overestimate compared to sale prices. These findings suggest that Zillow estimates are not as accurate as homeowners' estimates. Hollas, Rutherford and Thomson[10] find that Zillow estimates overvalue homes by 10 percent compared to the sale price. Zillow also overestimates values for approximately 80 percent of the houses in their sample by at least one percent. They conclude that homeowners' estimates of value may be more accurate than Zillow's estimates. The coefficients on a Zillow model compared to the coefficients on a sale price model indicate that Zillow prices some housing characteristics differently than the market. Specifically, vacant properties are overvalued. It appears that Zillow does not track the occupancy of a property, yet vacancy is known to affect value. Moreover, Doshan[11] asserts that Zestimates are "gamed." Zillow uses the Zestimate "on or before the sales date." In other words, they use the Zestimate after the listing price becomes public. That makes their Zestimate look more accurate than it really is since the Zestimate can be drastically affected by the listing price.

In response to homeowners' complaints about the quality of the data Zillow extracts from public archives across the United States, in 2011 Zillow added tools that enable homeowners to edit facts and add information about their properties. Zillow also offers listing services for homeowners and real estate agents, which enable these users to edit and add information, both manually and through automated data feeds. These tools are becoming increasingly popular. At present, nearly 20 percent of archived properties have been edited through such tools. By default, Zillow shows the facts that are supplied by the owner or agent, and these facts are supplemented by public data. Zillow also uses the user-contributed facts when computing Zestimates. Zillow's website declares: "we've made it easier for our users to help us improve accuracy by incorporating edited home facts into our Zestimate calculations."[12] Zillow asserts that the improved algorithm models have improved the Zestimate median margin of error to 8.5 percent from 12.7 percent. However, Gelman and Wu[13] find that edited facts improve the completeness of the information that Zillow has in store, but the "accuracy of Zillow's edited facts is not high."

An inherent shortcoming in Zillow's AVM formulation is its reliance on assessed valuation. If a property happens to be in a Proposition Thirteen (California) type of jurisdiction, with limited periodic assessment increases, over time its assessed valuation could be well below market value. Recent sales and reassessments of valuation impact the Zestimate. So Zestimate values can be "off" significantly for a property with no sales history, in a jurisdiction where assessed value is not significantly increased until a sale occurs.

Zillow's no-cost, no-hassle model seems to stand apart from most competitors. Redfin[14] offers a free, no-strings-attached service but its model is rudimentary, considering only comparables in deriving value. *Trulia.com* and *HomeValues.com* require a return contact from a realtor; *RealEstate.com* requires registration, including disclosure of phone number and email address; *RealEstateABC.com* relies on Zillow's Zestimates. FreddieMac offers its Home Value Explorer. This AVM tool generates an estimate of property value quickly, relying on a proprietary algorithm that blends model estimates, a repeat sales model and a hedonic model. This product is licensed and serviced through a distributor network. Each distributor adds services and charges fees.[15] LexisNexis provides a seemingly sophisticated AVM model incorporating price indexing, tax assessment values, and a hedonic model that utilizes comparables sold in the previous year. There is a fee for this service.[16]

## METHODOLOGY

The objective of this research is to compare differences between Zillow's Zestimates and actual sale prices in different markets and at different price ranges for single-family homes. For 2,005 transactions, the following model was developed for measuring mean error:

*(Zestimate value – sale price) / sale price.*

To measure for significant differences between the two markets, and within five price ranges in each market, a one-way analysis of variance (ANOVA) was used. The ANOVA is used to determine whether there are significant differences among the means of three or more independent groups. In this study there are ten groups altogether, five price ranges within two markets—suburban St. Louis, Missouri, and St. Paul, Minnesota. ANOVA compares the variance (or variation) between any two markets' data sets to variation within each particular market sample. If the between variation is much larger than the within variation, as measured by the F-ratio[17], the means of different samples will not be equal. If the between and within variations are approximately the same size, then there will be no significant difference between means. Tukey's test is a post-hoc test, meaning that it is performed after an ANOVA test. The purpose of Tukey's test is to determine which groups in the sample differ. The ANOVA measures only whether groups in the sample differ; it does not measure which groups differ.

This study seeks to measure Zestimate accuracy along two dimensions. First, measuring accuracy between markets. Is the Zestimate value more accurate in markets with better data inputs? And second, between price ranges. Is Zestimate accuracy between the markets affected by property price?

For comparison purposes, a Zillow one-star market (suburban St. Louis) and a Zillow four-star market (suburban St. Paul), segregated into five price ranges, are analyzed. These are both large suburban markets in the Midwest, for which the quality of valuation information differs considerably, according to Zillow's four-star rating scheme. Four-star markets supposedly provide the most accurate, "best" Zestimates, followed by three-star markets, noted as "good," "fair" two-star markets and, finally, one-star markets where estimates cannot be computed accurately or are simply the tax assessor's value. Zestimate accuracy is computed by comparing a property's final sale price to the Zestimate on or before the sale date. Ratings are based on accumulated data over the previous three months. Zillow promotes the star-rating scheme from an implied presumption that a four-star rating must be good, as it exceeds the other three-star categories and is termed "best." A Tukey post-hoc test was conducted on multiple price range comparisons between the two markets.

Of the 2,005 properties analyzed, 849 were in the St. Paul market and 1,156 were in the St. Louis market. Five price ranges were employed: (1) < \$103,000; (2) \$103,000–\$203,000; (3) >\$203,000–\$253,000; (4) >\$253,000–\$353,000; and (5) > \$353,000. The \$203,000 price benchmark was based on the median existing single-family home price for the second quarter of 2013.[18]

## FINDINGS

In aggregate, for both markets and for all prices ranges, the mean error is 24.8 percent. Mean error rates in the four-star (St. Paul) market compared with the one-star (St. Louis) market are significantly different, with a mean error rate of 17.15 percent in the four-star market and 30.48 percent in the one-star market. The significance level is 0.000 (p = .000), which is below 0.05. Note the large F-ratio. See Figure 1 and bottom of Figure 2.

*Figure 1*
One-Way ANOVA

| Difference | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 85.976 | 9 | 9.553 | 138.143 | .000 |
| Within Groups | 137.958 | 1995 | .069 | | |
| Total | 233.934 | 2004 | | | |

Significance at .05 level
Source: SPSS statistical package

Even though Zestimate values are significantly closer to sale prices in the four-star market compared with the one-star market, the differences are most prevalent among properties with sale prices under \$203,000, the benchmark price level used in this study. For homes under \$103,000, four-star market data may not have significantly better information value than the one-star market, given mean error rates of 52.43 percent and 64.23 percent, respectively. Further, overestimates are far more common on the lower-priced homes. Zestimates exceed actual market values in 63.44 percent of all transactions, but for properties with sale prices under \$103,000, 93.08 percent (121/130) of properties in the four-star market and 95.14 percent (333/350) of properties in the one-star market are associated with overestimated Zillow values.

For homes priced between $103,000 and $203,000, the four-star market does provide an outcome significantly different from the one-star market, with mean error rates of 10.77 percent and 19.68 percent, respectively.

Within higher price ranges, above $203,000, differences between the two markets are not significant, with mean error rates ranging from 9.53 percent to 14.63 percent. See Figure 2.

*Figure 2*

Tukey Post-Hoc Test for Multiple Comparisons

| Price (x1000) | Differences between markets (mean values) SP - SL | Significance | Mean percent difference within markets, (sample size) (Zest.-sale price)/sale price | |
|---|---|---|---|---|
| | | | SP | SL |
| <103 | -.11793235* | .001 | 0.52434 (130) | 0.64227 (350) |
| 103-203 | -.08910191* | .000 | 0.10771 (434) | 0.19682 (344) |
| <203-253 | .02845627 | .997 | 0.09531 (133) | 0.12376 (138) |
| <253-353 | .008355306 | 1.000 | 0.11541 (99) | 0.12376 (208) |
| <353 | .02245725 | 1.000 | 0.12386 (53) | 0.14632 (116) |
| All | | | 0.17147 (849) | 0.30475 (1,156) |

*denotes significance at the .05 level.
SP=St. Paul, SL= St. Louis
Source: SPSS statistical package

## CONCLUSION

The four-star market had a significantly lower mean error rate than the one-star market, 17.15 percent versus 30.48 percent. High mean error rates are concentrated among lower-priced homes. At prices above the median home price of $203,000, differences between the four-star and one-star markets are not significant.

While differences between the two markets are significant for homes selling for less than $103,000, the mean error rates are so great that they are of little value in either the four-star or one-star markets. A four-star's mean error of 52.43 percent indicates little more credibility than a one-star's 64.23 percent. While differences at all price levels in both markets are usually overestimates, at this lowest price level they are almost always overestimates.

Differences between the two markets are also significant in the $103,000–$203,000 price range. But with a mean error in the four-star market of 10.77 percent, this is close to the 10 percent error level noted by O'Brien as an acceptable threshold. So for properties in this price range, a four-star rating may be meaningful.

For the three price ranges beginning with the national median of $203,000 and above, differences between the four-star and one-star markets are not significant. With the exception of the $203,000–$253,000 price range, this does not imply improved outcomes in the four-star market for the top two price ranges. Differences in both markets, while not statistically significant, are quite large, with mean error rates ranging from 11.54 percent to 14.63 percent.

Within the middle price range, $203,000–$253,000, the smallest differences are found within both markets. In the four-star market, the mean error rate is 9.53 percent, while in the one-star market it is 12.38 percent. This difference is, again, statistically insignificant.

Zillow's value as a pricing tool is questionable. With the possible exception of the $203,000–$253,000 price range, the four-star designation is of little value. Even the best results in the four-star market produce mean error rates approaching 10 percent. In both markets and for all other price levels, mean error rates are above the 10 percent level. Accuracy of 10 percent still implies an error of more than $20,000 for an average price property. While Zillow may be a useful tool, providing an ever-changing snapshot of home prices, don't bet the ranch on it. ■

## ENDNOTES

1. For details about Zillow's estimation methods and models, see *http://www.zillow.com/zestimate/#what*.
2. *http://www.zillow.com/corp/About.htm*.
3. *http://websearch.about.com/od/Alternative-Search-Engines/p/Zillow-Com-Real-Estate-Search-Made-Simple.htm*.
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5. Hagerty, James R., "How Good Are Zillow's Estimates?" *The Wall Street Journal*, Feb. 14, 2007, sec. D.
6. O'Brien, Jeffrey, "What's Your House Really Worth?", *Fortune*, Feb. 15, 2007.

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8. Goodman, John L., Jr., and John B. Ittner, "The Accuracy of Home Owners' Estimates of House Value," *Journal of Housing Economics*, Vol. 2, Issue 4, December 1992, pp. 339–357.

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10. Hollas, Daniel, Ronald Rutherford and Thomas Thomson, *Appraisal Journal*, Winter 2010, Vol. 78, Issue 1, pp. 26–32.

11. Doshan, Brett, *http://www.HomeVisor.com*, Oct. 19, 2012.

12. *http://www.zillow.com/zestimate/#update*, April 4, 2014.

13. Gelman, Irit and Ningning Wu, Proceedings of the 44th Hawaii International Conference on System Sciences, p. 9, Jan. 5, 2011.

14. *https://www.redfin.com/what-is-my-home-worth?estPropertyId=51230374&src=landing-page,* April 5, 2014.

15. *http://www.freddiemac.com/hve/distributors.html*, April 5, 2014.

16. *http://www.lexisnexis.com/legalnewsroom/lexis-hub/b/legaltoolbox/archive/2011/09/23/automated-valuation-models-from-lexisnexis.aspx.*

17. The F ratio is the ratio of the variance between groups to the variance within groups, i.e., the ratio of the explained variance to the unexplained variance.

18. Op. cit. at 12.

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the four-star market as compared with the one-star market, with a mean difference between Zestimates and sales prices of 17.15 percent and 30.48 percent, respectively. However, with the possible exception of the middle market price range, $203,000–$253,000, differences between Zestimates and sale prices are so great as to render doubt about the usefulness of Zestimates, regardless of the market's star rating. Differences usually are overestimates, with subsequent sale prices below Zestimate values.

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### Renewables, Tax Credits and Ad Valorem Taxes: Are Policies Aligned?

*P. Barton DeLacy, CRE, FRICS, MAI*

As the renewable energy industry matures, growing controversy swirls around its funding and, ironically, its sustainability. Left unchecked, local assessors can undermine the operating efficiencies of wind and solar farms with assessments based on replacement cost rather than market value.

In this article, the author explores the implications of how wind and solar farms are project financed and poses two questions that bear directly on their ad valorem assessment:

1. Given that, but for production or investment tax credits, most projects would not be built—do these credits accrue to market value, or are they a form of inverse economic obsolescence?
2. The relative productivity of a wind or solar farm is a function of its nameplate capacity. A "Net Capacity Factor" measures its efficiency. Might the latter serve as a measure of functional obsolescence?

These issues now are being raised in *Lost Creek Wind LLC v. DeKalb County Assessor* before the State Tax Commission and Circuit Court of Missouri.

## VIEWPOINT

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### The Death of Corporate Reputation

*Bowen H. McCoy, CRE*

For more than a century law firms, investment banks, accounting firms, credit rating agencies and companies seeking regular access to U. S. capital markets made large investments in their reputations. They generally treated their customers well and occasionally even endured losses to maintain their reputations as faithful brokers, dealers, issuers and gatekeepers. Many would conclude that this has changed. In this "Viewpoint," the first of more to come, the author expresses his concern that today's leading capital market participants no longer treat customers as valued counterparties whose trust must be earned and nurtured, but as distant counterparties to whom no duties are required. The rough and tumble norms of the marketplace have replaced the long standing fiduciary model in U. S. finance. The result has been unrelenting financial scandal.

## RESOURCE REVIEWS

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### The Metropolitan Revolution: How Cities and Metros are Fixing our Broken Politics and Fragile Economy

*Reviewed by Owen M. Beitsch, Ph.D., CRE*

In *The Metropolitan Revolution: How Cities and Metros are Fixing our Broken Politics and Fragile Economy*, Bruce Katz and Jennifer Bradley, both of the Brookings Institution, offer a blueprint for action which can rebuild economies and is determinedly self-reliant. They speak of a revolution in thought and actions stemming from "cities and metropolitan areas [as] the engines of economic prosperity and social transformation in the United States." If they are correct in their outlook, they are capturing the essence of a sustainable movement because cities matter, and the strategic solutions breed largely from locally renewable resources.

Covering a range of community-building activities, Katz and Bradley make the case that local developers and their local governments can achieve an extraordinary range of major improvements by linking with grass root activists, civic institutions, local foundations, and local banks historically bypassed in favor of federal resources. Reviewer **Owen Beitsch, CRE,** gives the book a "thumbs up" saying "the kernels in this book…shine."

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### The End of the Suburbs: Where the American Dream Is Moving

*Reviewed By Roy J. Schneiderman, CRE, FRICS*

Not often does a book reviewed in *Real Estate Issues* get a "thumbs down," but reviewer **Roy J. Schneiderman, CRE, FRICS**, recommends "giving a pass" to this one. "*The End of the Suburbs* presents a fairly superficial treatment of the issues, where all roads lead to "the end of the suburbs"—or at least some of the suburbs," says Schneiderman. "No doubt this book will be very well-received by people who already agree with the title thesis. But it will do nothing to influence those who disagree, and little to inform those who are trying to form an opinion."

## CONTRIBUTORS

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Banghart frequently speaks on issues related to partnership taxation and the legal and tax implications of various incentive programs. He served as executive editor (1999–2000) and associate editor (1998–1999) of the *Capital Defense Journal*. He is a member of the Massachusetts Bar Association and the Virginia Bar Association (Young Lawyers Division, Executive Council, 2003–2004).

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