Fannie Mae

Fannie Mae Home Price Index (FNM-HPI)

Summary

Fannie Mae's home price index model produces a national historical home price index. Fannie Mae's home price index (FNM-HPI) measures the average historical price changes for single-family residential properties in the United States housing market for each quarter from 1975 Q1 through the most recent quarter. The index is derived from arms-length property transactions in the single-family housing market. Our data sources include transactions with and without conforming mortgages, ensuring our index captures price changes throughout the broad single-family housing market. Condominium data are excluded from our FNM-HPI. Our separate seasonally adjusted and non-seasonally adjusted FNM-HPI series reveal average price appreciation (or depreciation) over time, with or without consideration of seasonal effects[1], respectively.

The FNM-HPI is estimated with arm's length home purchase transaction data from various data sources, supplemented by appraisal data of refinance loans when such data are needed due to thin purchase data[2]. The national HPI is produced by aggregating county-level HPIs to create a national index that is representative of the entire country [3]. The weights for each county are based on the number of single-family housing stock units in each county, so the U.S. HPI represents the general national housing market trend[4]. This approach is consistent with the way many other economic variables are computed, that is, not limited to the business exposure of a particular company or group of companies. The FNM-HPI serves as an indicator of general market home price trends and provides an analytic tool for economic analysis.

This document describes important modeling concepts of the FNM-HPI. The next section includes index methodology. The following two sections provide details on data sources used in FNM-HPI and the approach to geographic aggregation. The final section discusses FNM-HPI availability.

Index Methodology

We employ a variation of a Repeat Transaction Index (RTI) model to estimate the FNM-HPI. The original Repeat Transactions Index (RTI) model was proposed by Bailey et al (1963)[5]. Since then, researchers in industry and academia have proposed various enhancements to the original RTI model. Today, variations of the RTI modeling approach are still used widely in the housing market industry for producing home price indices.

The RTI model approach is an industry standard because it controls for the varying characteristics of homes in the housing market and has minimum data requirements. Because of the heterogeneity of homes in the housing market, a useful measure of home price trend should control for the varying underlying mix of home characteristics reflected in the individual home transaction prices. Without such control, the derived home price trend will be of limited usefulness for economic analysis. The RTI model controls for home characteristics by estimating price trends based on pairs of transactions of the *same* home over time. Another desirable feature of the RTI model is its minimal data requirements. The model only needs a unique home identifier (such as address), geographic variables for aggregation purposes, the dates of home transaction, and the transaction prices.

The original RTI model advocates using purchase transaction data to derive the HPI for the market. This approach works well for large housing markets such as major metropolitan statistical areas (MSAs), states, and the U.S. national. In practice, however, because of concerns about thin purchase transaction data at the local market level, HPI practitioners have frequently used the appraised values of refinance transactions to supplement thin purchase data.

Subsequent research has shown that the appraised values used in refinance loans are often biased when compared to

[1] The seasonal effects are computed based on X-11 methodology and the quarterly data series of non-seasonally adjusted U.S. national HPI.
[2] The threshold for determination of sufficient data to estimate local level HPI based on purchase transactions alone or a combination of purchase transaction and appraisal data is based on a proprietary formula.
[3] If a county does not have sufficient data for estimation of its own HPI, then a state level HPI is used to infill that county's HPI.

[4] Annual estimates of housing stock from the American Community Survey and Moody's Analytics are used for HPI aggregation.
[5] Bailey, M., Muth, R., and Nourse, H. (1963), "A Regression Method for Real Estate Price Index Construction," *Journal of American Statistical Association*, 58, 933-942.

the market values indicated by purchase transactions[6]. Indices that use refinance transaction data thus can potentially exhibit a market trend that is very different from that of the purchase market if any refinance appraisal bias effect is not controlled for. Sometimes the differences between HPIs with and without refinance data can be significant, especially during refinance boom periods.

To avoid any issue with biased refi appraised data values while capturing the benefits of a larger transaction dataset, the FNM-HPI model uses both purchase and refinance transactions data, with a valuation correction performed on the refinance data to adjust the potential systematic valuation bias in appraisal values in refinance data. It makes use of all available transactions data including purchase transactions and refinance transactions data, identifies and corrects the valuation bias in refinance transactions, and ultimately produces a HPI that has lower levels of uncertainty than a HPI estimated by purchase-only transaction data.

Data Sources

Fannie Mae's home price index is calculated using single-family property transaction data on loans purchased by Fannie Mae and Freddie Mac as well as additional home sales transactions based on third-party data providers. Due to the inclusion of third-party home sales data, our HPI incorporates transactions with and without conventional, conforming loans, thus capturing price changes broadly across the single-family housing market. Condominium data are excluded from our FNM-HPI.

We also filter our home transaction data to include arms-length transactions only. Non-standard transactions such as estate sales, sales between family members, and foreclosure sales are excluded. We exclude these transactions because they either do not represent fair market transactions values or they are frequently associated with properties that have undergone significant home condition change (and thus may not have the constant quality across transactions necessary for the reliability of the RTI approach). Our outlier removal process also identifies and removes other transactions of homes that have experienced significant changes in condition or characteristics, such as teardowns and rebuilds.

Geographic Aggregation

Our county-level HPI is the basic building block of the U.S. national HPI. The county-level HPI is estimated based on purchase-only transaction data if sufficient transaction volume exists, otherwise on a combination of purchase and refi transaction data to mitigate the issue of thin data, where the values of the refi transactions are adjusted to minimize the impact of valuation bias (as described above). The national HPI is aggregated from county-level HPIs using single-family housing stock weights.

County was chosen as the basic unit of aggregation for several reasons. For example, it is the most local level for which housing stock data are readily available. Additionally, we use the county-level housing stock weighted aggregation approach to mitigate the potential problem of over-representation of localities with frequent home transactions in the construction of the national HPI. This approach aligns with our intention for the FNM-HPI to represent the average home price trend of the general housing market.

Availability

The FNM-HPI at the U.S. national level is publicly available as a quarterly series starting from Q1 1975 and extending to the most recent quarter. It is available in both non-seasonally adjusted and seasonally adjusted series. The FNM-HPI will be published in the first month of each quarter beginning with Q2 2022, with the final period of each FNM-HPI series covering the prior quarter. Although the FNM-HPI is published in the first month of the quarter, the FNM-HPI is a quarterly series with all transactions in each quarter treated the same.

Fannie Mae's home price estimates are based on preliminary data available as of the date of index estimation and are subject to change as additional data become available in the future. The FNM-HPI is updated on a quarterly basis as new input data arrive and the historical FNM-HPI is recalculated using the incrementally expanded dataset. Due to the repeat transactions methodology used to derive the FNM-HPI, the quarterly re-estimation process may cause revision to the FNM-HPI levels in periods as early as 1975 Q1. Revisions to the FNM-HPI levels tend to be highest in the most recent two quarters due to relatively thin data in recent periods. Revision levels are significantly reduced in periods more than two quarters ago. Revision in periods far in the past are typically very small.

[6] Chinloy, P., Cho, M. & Megbolugbe, I.F. (1997), "Appraisals, Transaction Incentives, and Smoothing", *The Journal of Real Estate Finance and Economics* **14,** 89–111.