

OVERVIEW OF FORECASTING METHODOLOGY

iEMERGENT

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INTRODUCTION

iEmergent is a forecasting and advisory firm dedicated to the home lending industry. We provide forward-looking data that drills down to the neighborhood level, quantifying future mortgage opportunity in markets of all shapes and sizes.

Founded in 2000, we bring a forward-looking approach to navigating change. As the lending industry, technology, and economic conditions evolve, we continue to shift our structure, products, and approach to meet lender needs. We strive to always be ahead of the changes they face.

This overview provides insight into our forecasting approach, the fundamental concepts of our purchase forecast model, our process for validation, and our results.

OUR FORECASTING APPROACH

iEmergent forecasts mortgage opportunity for markets at various levels of geography across the 50 United States and the District of Columbia. In simple terms, a market's mortgage opportunity is the number of originated loans and dollar volume that are projected over a specific period of time within that geography.

The purpose of our forecasts is to help organizations make better business decisions that lead to a successful, sustainable future. By knowing what's next in a market, lenders are able to anticipate change and capture opportunity—as efficiently as possible. Amid economic uncertainty, shifting homebuyer behavior, and regulatory changes, leaders need more than expertise and experience to maintain and improve performance. They need evidence.

Our insight helps them:

- Expand and grow responsibly,
- Target new and diverse segments,
- Improve sales strategies at all levels,
- Optimize resources, brand, and locations,
- Recruit, hire, train, and retain better sales resources, and
- Minimize risk and better meet CRA, Fair Lending or other regulations.

Most importantly, our data helps lenders think about where to go and how to get there.

FUNDAMENTALS OF THE MODEL

The iEmergent forecasting method is a hybrid of traditional demand forecast models, and it has evolved significantly since 2004, when we issued our first forecast. From the beginning, our model did not attempt to explain why each mortgage market behaves as it does; instead, we focused on market outcomes to identify how many and what type of loans will be originated over the next one to five years. The following two concepts are the fundamentals of our forecasts:

Purchase Mortgage Generation Rates (PMGR)

The behavior of mortgage markets is complex—in fact, there are hundreds of indicators, trends, patterns, and events that impact how and why markets behave as they do.

After analyzing millions of loan application records over decades, iEmergent recognized specific patterns of behavior that captured the complexity of these multiple factors. What emerged was the **Purchase Mortgage Generation Rate (PMGR)**, or the rate at which an individual market produces purchase mortgages. Not only is the PMGR of each market unique, but it is predictable by our model. Thus, it is the primary driver of our forecasts. The PMGR inherently captures the impact of broad-scale economics, decades of history from the HMDA Loan Application Record, homebuyer and housing behavior patterns, and other prominent indicators, as shown in Figure 1.

Through the PMGR, we are able to simplify the projection of loans and dollars through a single indicator.

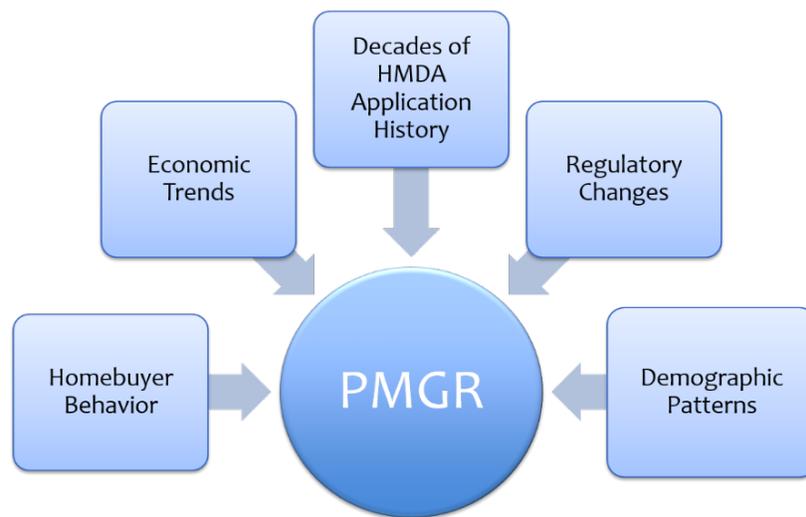


Figure 1: Inputs to PMGR

Homebuyer Pool

Many traditional mortgage industry volume forecasts are calculated using top-down, optimal-utility methodologies. Assumptions are made based on broad supply-side market behaviors that follow the Say’s Law of Markets: “Aggregate supply creates its own aggregate demand.”

In contrast, iEmergent applies a “demand-driven” approach that captures the changing household-buyer patterns that define housing patterns over time. Here’s why:

Houses can’t buy themselves. Low interest rates can’t shop for homes to buy. Available credit won’t spontaneously buy homes. Low housing prices don’t buy homes. Secondary markets by themselves don’t incent people to buy homes. Big inventories can’t write a check for the mortgage. Households buy homes. And if households don’t buy homes, then mortgages aren’t originated.ⁱ

Households that could potentially finance a home in a given year constitute the homebuyer pool, or the **number of households that are ready, willing and able to buy a home**. The homebuyer pool is the foundation of homeownership demand and is the second pillar of the iEmergent method.

There will be an estimated 123.9 million households in 2018. Each year, iEmergent partitions those households into three groups: homeowners with a mortgage, homeowners without a mortgage, and non-homeowners. Using probability theory, adjustments are made to each of these three groups as new households are formed, and households convert from one group to another (e.g., non-homeowners become homeowners, and homeowners without a mortgage convert to homeowners with a mortgage). Over the past decade, the total share of the non-homeowner group has risen the most rapidly, as U.S. homeownership remains at an all-time low.

Most important to our forecast methodology, however, is determining the size of the coming year’s homebuyer pools. Despite 123.9 million households in 2018, not all of them are ready, willing, and able to purchase a home in the next twelve months. Therefore, we account for that portion of the pool by creating a fourth partition that removes those households that are least likely to originate a mortgage. Households that have recently purchased or refinanced a home are taken out of the pool, as are those households who are unemployed, are struggling with balance sheet/credit issues, or starting foreclosure, as detailed in Figure 2.

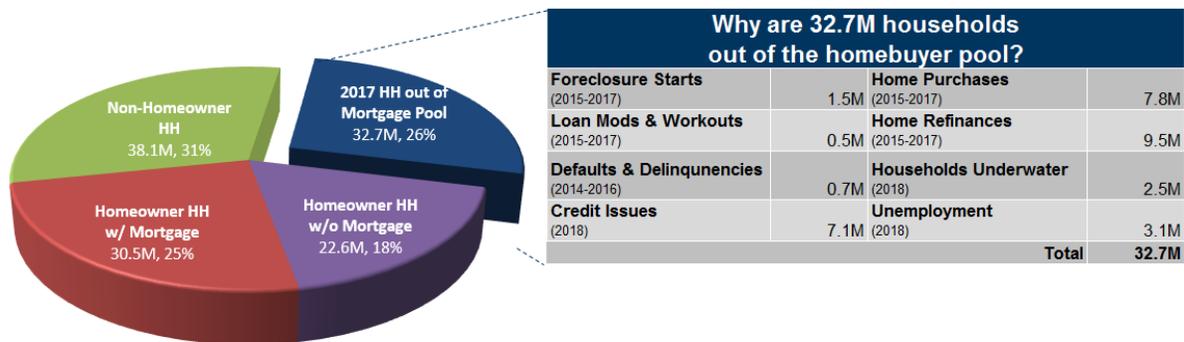


Figure 2: Composition of the 2017 Household Pool

So, despite 123.9 million households projected in 2018, only 91.2 million (73%) are part of the homebuyer pool. Housing markets are complex ecosystems, and homeownership behaviors are constantly evolving, ebbing, and flowing. The supply-demand dichotomy will eventually establish new equilibriums – at different points in time for different communities. The iEmergent forecasting methodology is built on the reality that homeownership demand is a critical driver of mortgage opportunity.

Homebuyer Pool + PMGR

The relationship between the Homebuyer Pools and the PMGRs determines the final outcome of our forecasts: the number of purchase mortgage loans and dollars that will be originated in markets of all sizes and shapes over the next one-to-five years.

VALIDATION AND ACCURACY

We calculate the accuracy of our forecast results by comparing it to the data that is released through HMDA, which we consider to be the “gold standard” and the closest approximation of actual that is available.

Included in the narrative below are the testing results on our all occupancy purchase forecast model, as it is the cornerstone of our methodology and the foundation upon which we build our segment forecasts. Separate validation studies are being conducted for our market segment forecasts on loan type, borrower race/ethnicity, loan size (conforming vs. jumbo), and borrower income level (low, moderate, middle, and upper).

We validated the results against the actual HMDA data for counties and the nation. Figure 3 below captures the volume accuracy percentage ((actual dollars - forecast dollars)/actual dollars) for recent forecast years at the 18-month and 12-month time horizons for markets at various levels of and sizes of geographyⁱⁱ.

2017 Summary: HMDA Actuals			Accuracy per Year (Variout Time Horizons)										
Forecast Level of Detail: County (Purchase Dollars)	2017 Actual Purchase Dollars	Market % of all US Purchase Dollars	2010	2011	2012	2013	2014	2015		2016		2017	
			12-Mo.					18-Mo.	12-Mo.	18-Mo.	12-Mo.	18-Mo.	12-Mo.
1. All Counties (3,142)	\$1,073.4 B	100%	92%	87%	88%	85%	92%	82%	90%	83%	96%	95%	100%
2. Top 1,000 Counties	\$1,025.4 B	96%	92%	88%	88%	86%	93%	82%	90%	83%	96%	96%	100%
3. Top 500 Counties	\$935.2 B	87%	93%	88%	89%	86%	94%	84%	91%	84%	97%	97%	101%
4. Top 50 Counties	\$408.5 B	38%	94%	89%	89%	96%	98%	94%	96%	107%	106%	101%	100%

Figure 3: Volume accuracy percentages for various levels of geography and time horizons.

In our validation studies, we also examine the Absolute Error (AE) for each market. Figure 4 below summarizes the census-tract level AE for 2017 purchase loans, comparing iEmergent’s 2017 forecast, released in October 2017, to the 2017 HMDA actuals, released early in May of 2018.

Calculating the AE for each tract puts the accuracy of the forecast in the context of how it is used. In over 67% of the 72,851 nationwide census tracts, the iEmergent forecast error was fewer than 10 loans.

At an AE of 15 loans, iEmergent’s census tract-level accuracy grew to 79.2% of all tracts.

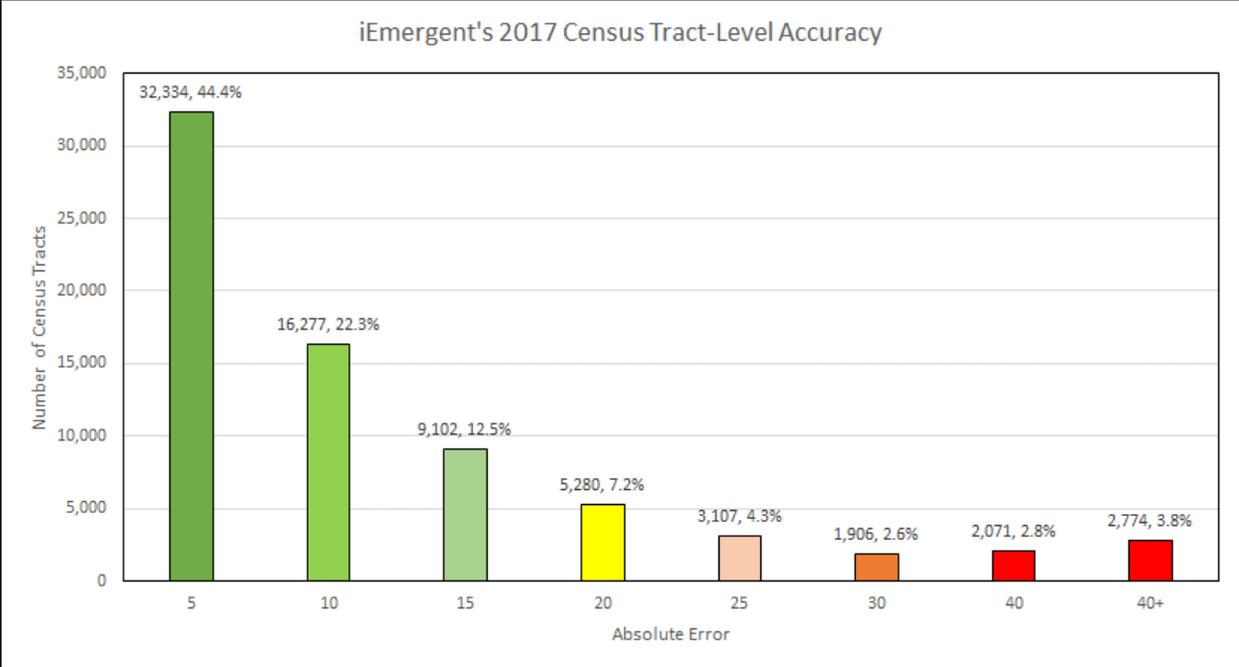


Figure 4: Calculated absolute error for 2017 purchase loans by tract.

At a national level, the county-level forecast model we used from 2010-2012 yielded more accurate results than the tract-based model we adopted in 2013. With the exception of a few very small counties, census tracts are smaller in size and prone to much greater volatility. Yet, the value of census tract-level forecasts to lenders is unmistakable, so we continue to refine the census tract-level model.

SUMMARY

Over the past decade, iEmergent has been committed to producing and offering accurate forecasts of mortgage opportunity to organizations of all sizes, and types, with the primary purpose of helping them make decisions that improve their **long-term** performance and profitability. The forecasting approach, models, and methods we use were carefully chosen according to how well they help serve that purpose. Experience has taught us that the best models and methods are built on strong and proven fundamentals but are constantly being tested and modified to ensure ongoing efficacy.

APPENDIX: INPUTS

At the core of our forecasting approach are more than a decade of detailed housing, household and mortgage finance behavior data for each of the 72,851 census tracts in the United States. Both directly and indirectly included in our models are the following sources:

Economic, Demographic & Housing Data

- *HMDA Loan Application Record 2001-2017*: The Home Mortgage Disclosure Act of 1975 requires many depository and non-depository lenders to collect and publicly disclose information about housing-related loans and applications for such loans, including several applicant/borrower characteristics. The data is submitted by each lender through the Loan Application Record (LAR), and this data is made available to the public nine to ten months following the end of the year. The LAR data is a critical piece of our forecast methodology and serves as the dataset to which we compare our forecasts and estimates to validate our models.
- *Decennial Census 2000, 2010*: The census of population and housing, taken by the Census Bureau in years ending in 0 (zero). Article I of the Constitution requires that a census be taken every ten years for the purpose of reapportioning the U.S. House of Representatives.
- *American Community Survey (ACS)*: The American Community Survey (ACS) is a relatively new survey conducted by the U.S. Census Bureau. It uses a series of monthly samples to produce annually updated estimates for the same small areas (census tracts and block groups) formerly surveyed via the decennial census long-form sample. Initially, five years of samples were required to produce these small-area data. Once the Census Bureau, released its first 5-year estimates in December 2010; new small-area statistics now are produced annually. The Census Bureau also will produce 3-year and 1-year data products for larger geographic areas. The ACS includes people living in both housing units (HUs) and group quarters (GQs). The ACS is conducted throughout the United States.
- *EASI US 2017/2022 Demographic Update*: Easy Analytics Software, Inc. (EASI) is a premiere provider of forecasts related to population, household, and housing unit demographicsⁱⁱⁱ. EASI demographers and economists utilize multiple datasets, including the ACS, the Census, Bureau of Labor Statistics, Metrostudy, HUD and postal carrier route data.
- *Bureau of Labor Statistics*: The BLS provides summary and detailed information about unemployment, wages, benefits, and occupations that is critical to defining the household pool for each year and establishing demand.
- *Veteran Population Projection Model (VetPop Model)*: The VetPop2016 provides the latest official Veteran population projection from the Department of Veterans Affairs (VA). VetPop2016 is an actuarial projection model developed by the Office of the Actuary (OACT) for Veteran population projection from Fiscal Year FY2014 to FY2043. Using the best available

Veteran data by the end of FY2013, VetPop2014 provides living Veteran counts by key demographic characteristics such as age, gender, period of service, and race/ethnicity at various geographic levels.

- *Expert Judgment*
 - iEmergent
 - MBA, Fannie Mae, Freddie Mac
 - FHFA, HUD

ⁱ Hedlund, Dennis. *Everybody Out of the Pool (Mortgage Banking, December 2011)*, 46.

ⁱⁱ Weighted mean absolute forecast accuracy (WAFA) is the unity opposite of the calculated weighted absolute percent error (1-WAPE%=WAFA). Weighted absolute percent error represents the composite average absolute % error rate calculated across the markets being considered, where the contribution of each market's error to the WAPE is weighted by the annual loan volumes generated by each market. The annual % error in each market is treated as absolute, without regard to whether the forecast error was (+/-) higher or lower than the actual.

ⁱⁱⁱ In an independent study performed by a team of demographers which compared projections versus actual for a multitude of data points, EASI's estimates and projections were the most accurate of the firms reviewed.