Fannie Mae™

# LFM 5.1 New Acquisition Model Walkthrough

LFM Acquisition Modeling Team

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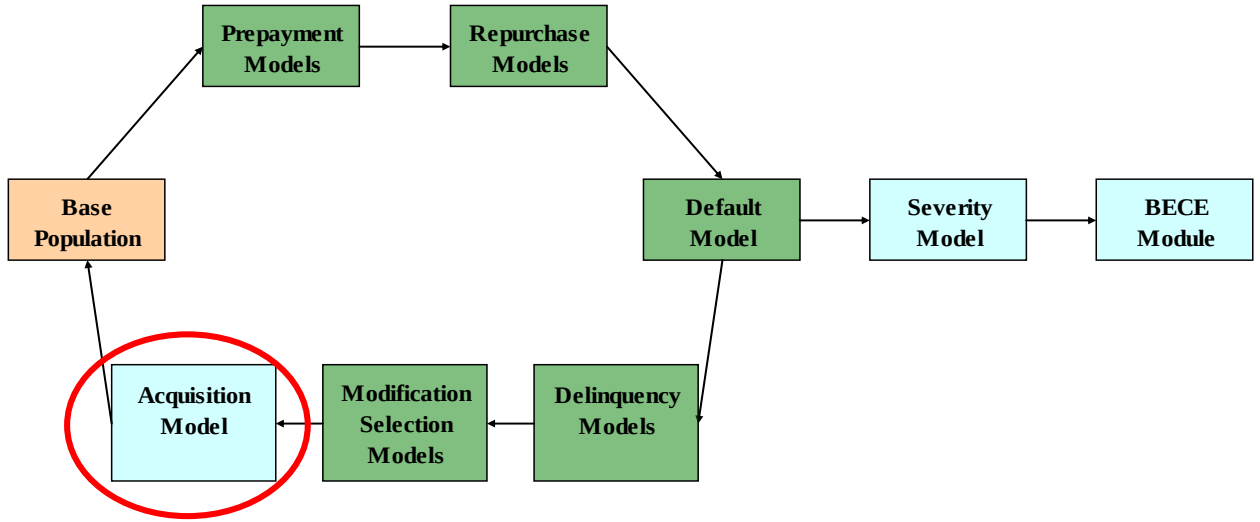
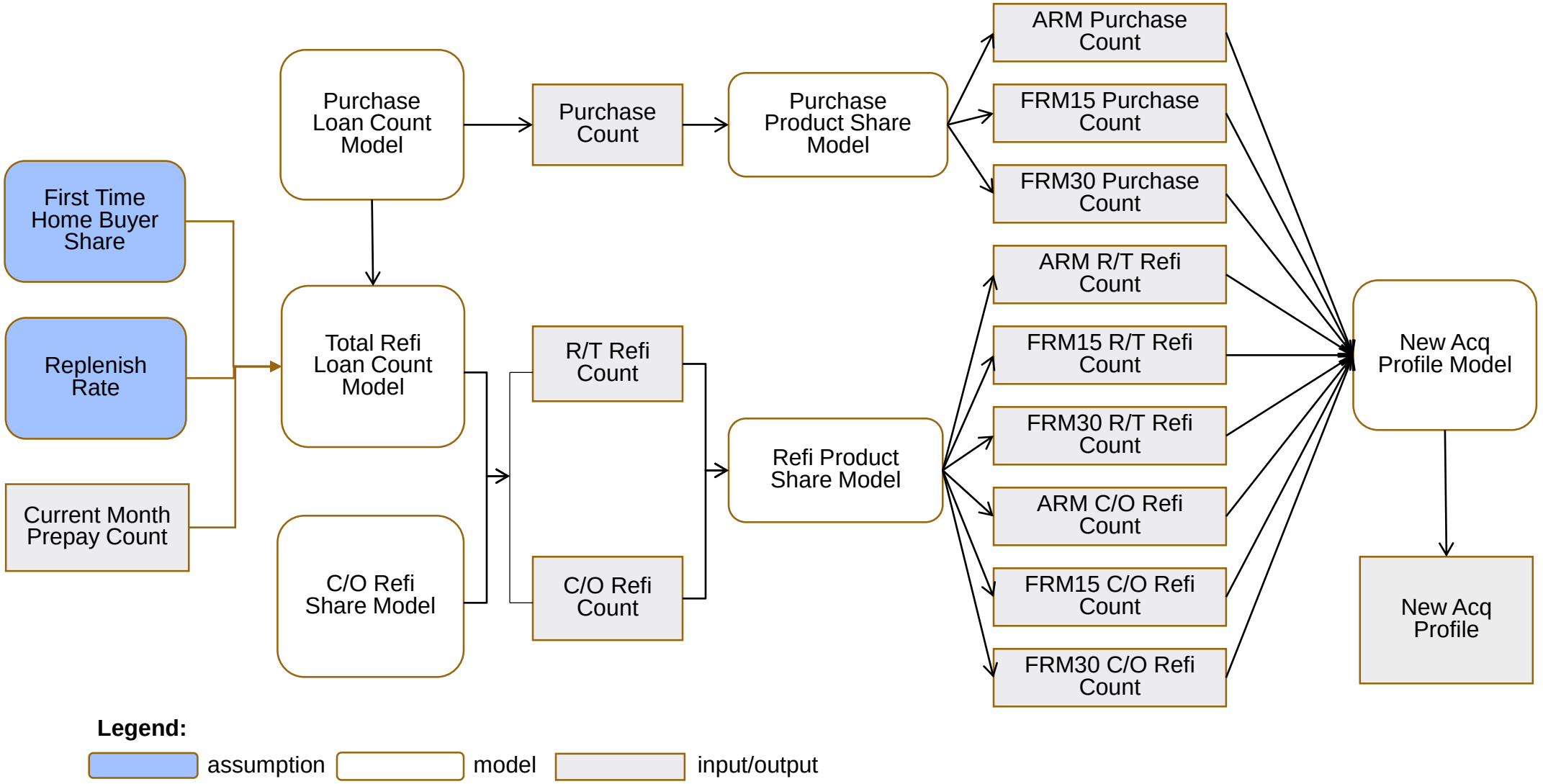
# What's LFM Acquisition Model?

- The LFM Acquisition Model forecasts the quantity and characteristics of Fannie Mae monthly loan acquisition for a given economic environment.
- Acquisition Model is book level that can only use aggregate control variables, unlike loan level transition model
- In application, model projected loan count will be randomly sampled from real recent acquisition, and gradually liquidated through prepay or default




- Such inflow of new loans, along with prepay, default liquidation and UPB amortization, determines the size of future book

# How's LFM Acquisition Model Estimated?



# LFM Acquisition Model 5.1 Specification and Intuition

1. PMM count is modeled as a log-linear regression of:

| LFM 5.1 PMM Model Variables | Intuition |
|---|---|
| HP peak-to-current growth (minimum hp growth in last 3 years) | Better HPI, more home purchase |
| HP peak-to-current recovery | Market downturns happen faster than recovery, since fear is stronger than greed |
| FRM30 affordability index (assuming 28% DTI, 80% LTV) | More affordable HPI relative to Income & IR, more purchase |
| Fannie market share | Higher FNMA share, more purchase |
| Seasonality | Warmer months, more purchase |

2. Refi count is modeled as a rule:

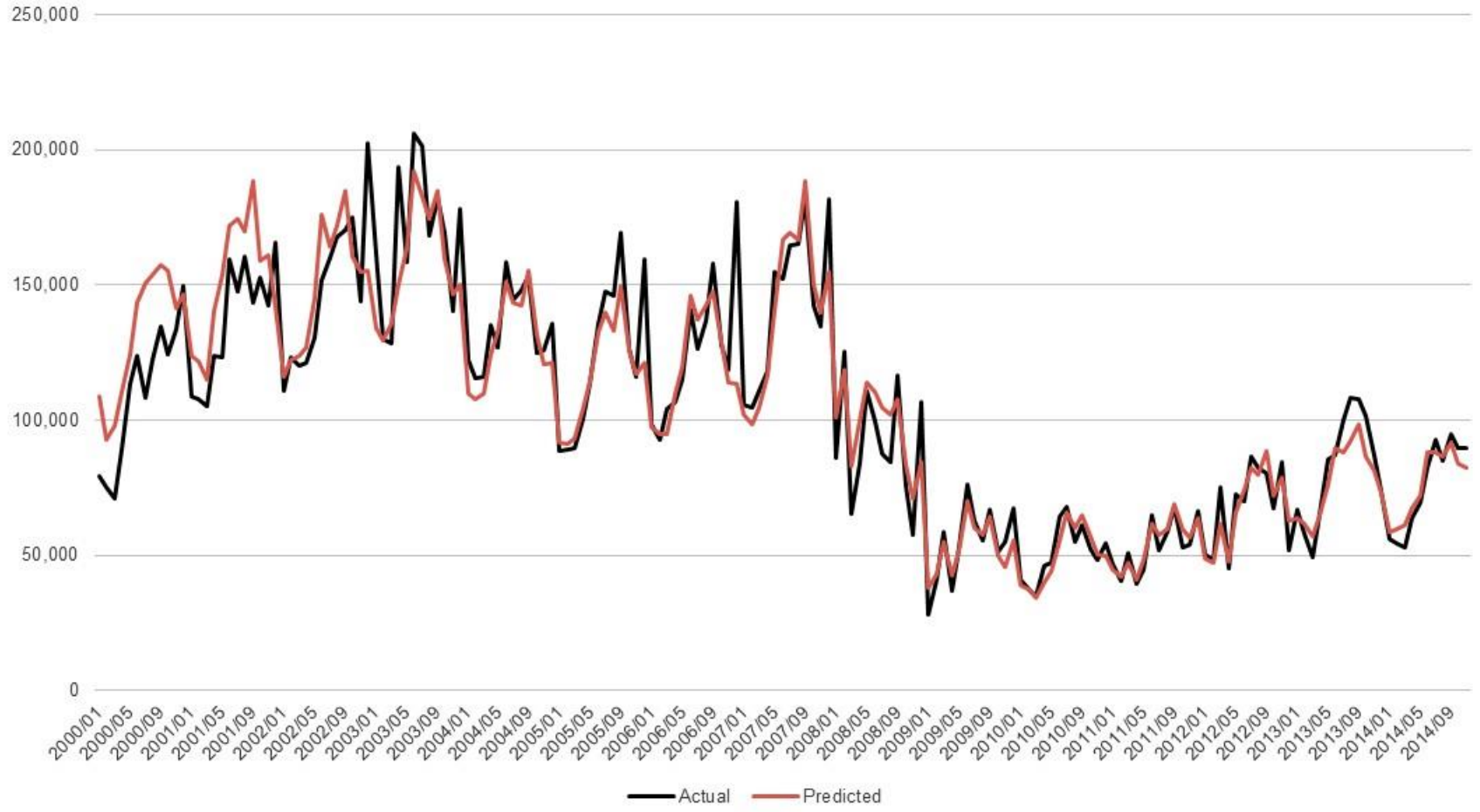
Total Refi = Total Prepay – (PMM volume – First Time Home Buyer)

- Prepay = Refi + Turnover
- PMM = First Time Home Buyer + Non FTHB
- Let “Non FTHB” be a proxy for “Turnover”
- Then Refi is difference between Prepay and PMM, adding FTHB

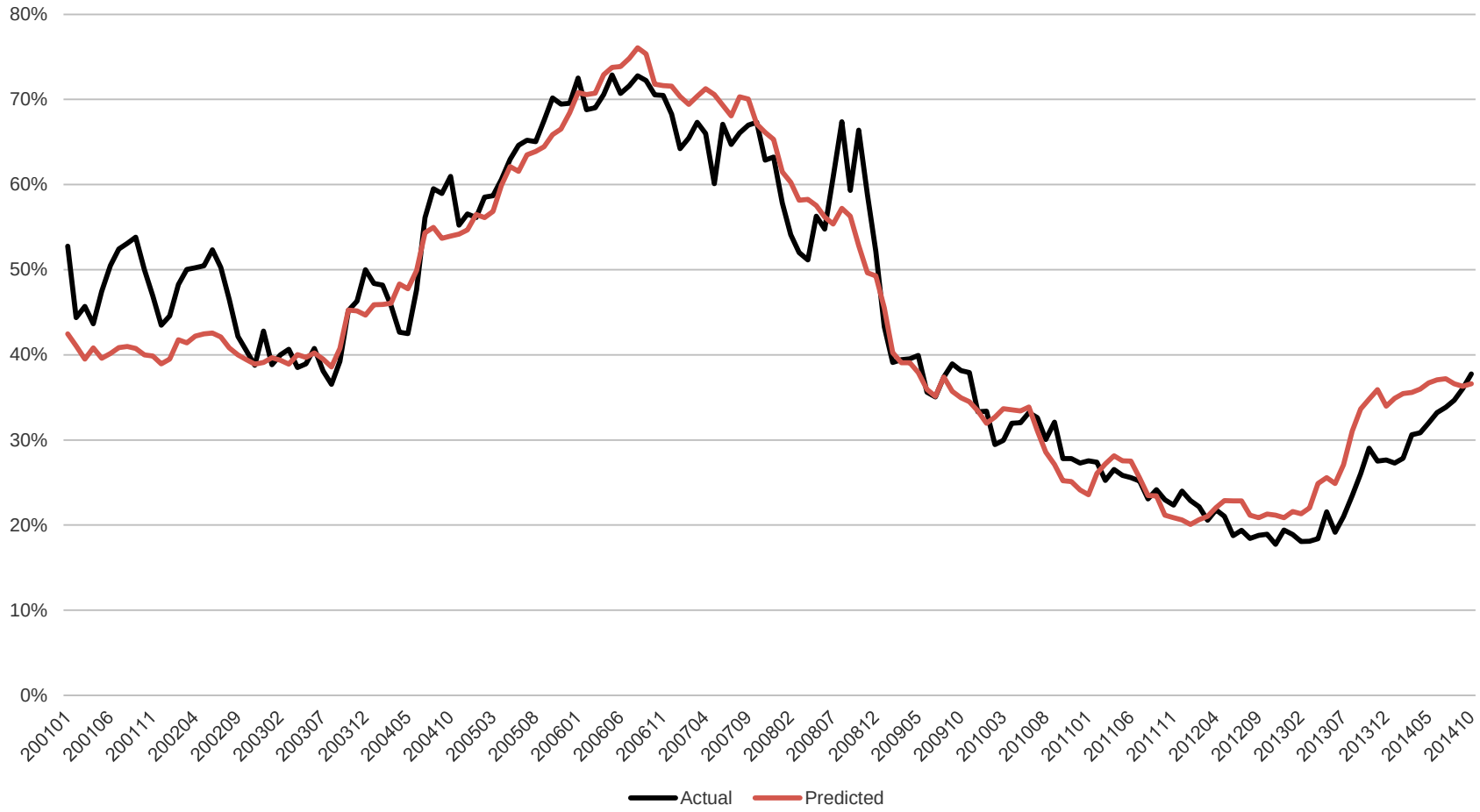
| Model | Functional Form | Explanatory Variables | Intuition |
|---|---|---|---|
| **3. Cashout Refi Share** | log of odds-ratio linear regression | Rate Incentive | Higher rate incentive, higher R/T share. Book level rate incentive is modeled through FRM30 IR growth rate. |
| | | HPI Trend Gap | Cashout requires equity, so higher MLTV lower Cashout share. Without book level MLTV, use proxy of HPI difference from long-term HPI linear trend. |
| **4. & 5. ARM Product Share** | log of odds-ratio linear regression | FRM30 affordability index | ARM payments start out lower than FRM. When HPI increase causes lower FRM product affordability, more people would choose ARM. |
| | | FRM30_ARM51 Spread | Bigger difference, more enticing ARM product will be. |
| | | HP trough-to-current growth (maximum hp growth in last 3 years) | Higher HPI growth, lower future MLTV when ARM reset rates, so borrower can have option to re-sell or refinance. |
| **6. & 7. FRM15 Product Share** | log of odds-ratio linear regression | FRM30 affordability index | Higher FRM30 affordability, higher FRM30 share. |
| | | FRM15 affordability index | Higher FRM15 affordability, higher FRM15 share. |
| | | FRM30_FRM15 Spread | Bigger difference, higher FRM15 share. |
| **8. PMM Loan Size** | DTI linear regression | FRM30 affordability index | Affordable monthly payment is jointly determined by income, interest rate, and HPI. Loan size can be backed out from affordable monthly payment using mortgage function. |
| **9. Refi Loan Size** | Lookup table | Ratio over <10yrs prepaid FRM30 loan size in the same month | Link inflow loan size with outflow to bring more alignment |

# LFM Acquisition Model 5.1 In-Sample Fit

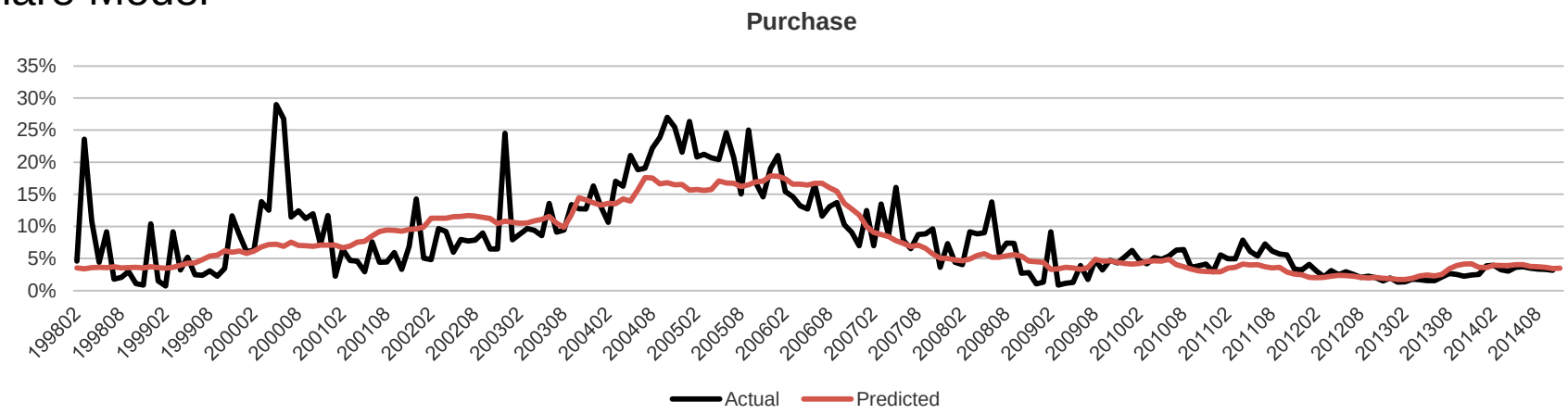
- PMM Count Model

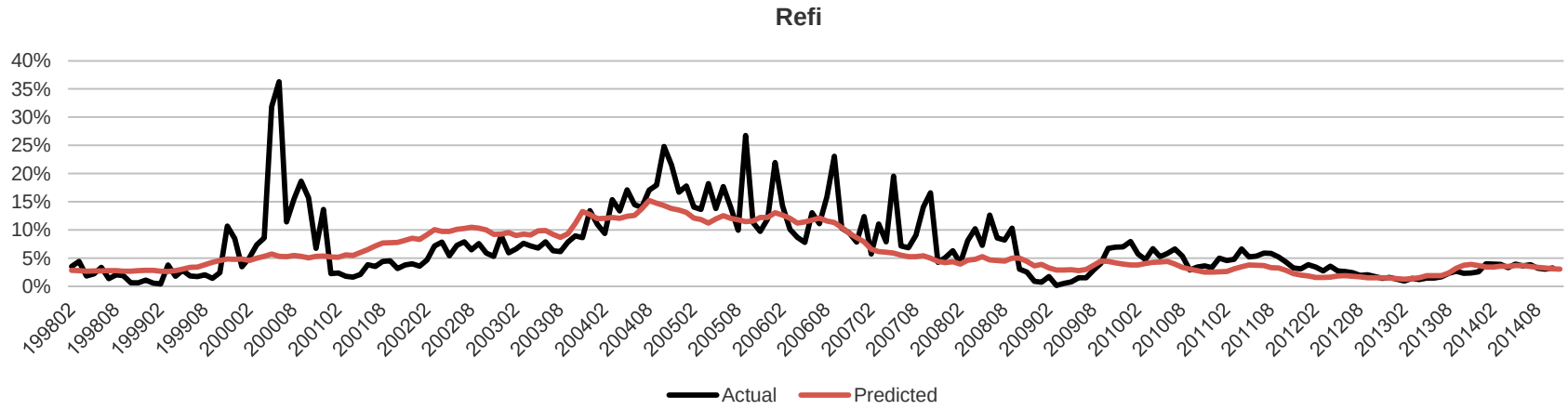


- Cashout Share Model

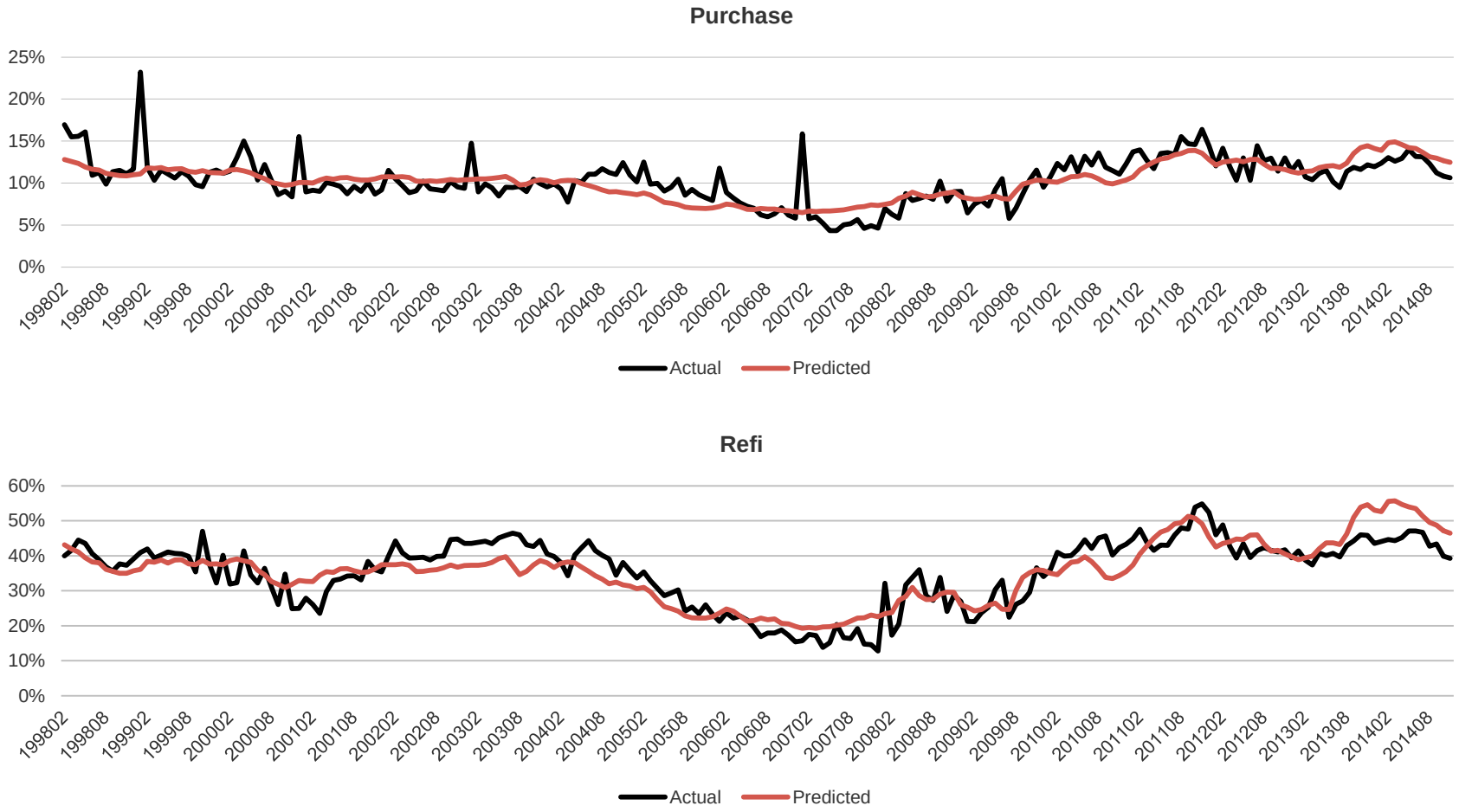


- ARM Share Model



- FRM15 Share Model



# What's LFM Acquisition Model 5.1 Improvement?

- Replace ARMA models with clearly defined economic drivers
  - LFM 5.0 autoregressive residuals boost in-sample fit, without economic meaning
  - LFM 5.1 builds transparent connection between economic environment and forecasted activity, with fewer variables

| LFM 5.0 PMM Model Variables | LFM 5.1 PMM Model Variables |
|---|---|
| HP Growth between lag36 and lag12 months | HP peak-to-current growth |
| HP Growth between lag60 and lag36 months | HP peak-to-current recovery |
| HP Growth between lag84 and lag60 months | FRM30 affordability index (assuming 28% DTI) |
| Refi Rate change between lag12 and lag6 months | Fannie market share |
| Refi Rate change between lag6 and lag3 months | Seasonality |
| T-Bill change between lag12 and lag6 months | |
| Quarter dummy | |
| Years since 1991 | |
| 3 Autoregressive lagged residual terms | |

- Enhance Loan Size Methodology
  - LFM 5.0 unrealistically models loan size of future acquisition linearly with HPI
  - LFM 5.1 link future Refi acquisition UPB to prepayment profile
- Extend estimation period through 2014Q3
- Add dials to allow alignment with ESR and SF view for outlook change
  - LFM 5.0 requires OTA for alignment
  - LFM 5.1 introduces three configurable dials

# LFM Acquisition Model 5.1 Dials (Assumptions)

1. PMM Model Intercept Dial

Ln(PMM)= (Intercept + **Adjustment**) + $\alpha$ x PTC + $\beta$ × FRM30 Affordability +$\theta$ ×Seasonality + $\delta$ × Market Share

2. Refi Model Replenish Rate Dial

Total Refi = $\gamma$ × Total Prepay – (PMM volume – **FTHB**)

3. Refi Model 1st Time Borrower Dial: ST decays to LT (past 10yr historical average) in 5 years