Simulating the Index Mortgage

MORTGAGE MATCH RACING

Back-testing inheres that the model values are known (i.e. are a historical fact). This raises the obvious issue that there is only one known past, whereas there are many possible futures. In part, this can be addressed by taking a large sample (as we did in our back-test program), because the long-term past reflects economic cycles likely to repeat over the long-term future. But the problem of future uncertainty can be addressed another way.

Whereas back-testing "proves the past", Monte Carlo simulation generates "possible futures". By this method uncertain variables are repeatedly drawn from a nominated probability distribution. The resulting model is stochastic (gives an ensemble of outcomes with associated probabilities) as opposed to deterministic. Correspondingly, it is appropriate to report results through histograms.

As with our back-test, we analyse mortgages through "match racing" and reporting victory or defeat in terms of Months Saved (i.e. the number of months that the Index Mortgage pays out ahead of or behind its traditional counterpart). Aside from the effects of **Linking**, the mortgages in each racing pair are identical.

By definition, the traditional mortgage is guaranteed to fully amortise over the nominated term. Conversely, the amortisation of the Index Mortgage depends upon the **Indexed Rate**, which rate is a function of the **Total Return** of the **Index** to which the mortgage is Linked. It follows that, if the Indexed Rate is lower than the standard mortgage interest rate (here, the **Prime Borrower Home Loan Rate**), then the Index Mortgage will amortise faster, because a greater proportion of each payment is allocated to principal redemption.

Once again, we assume an initial Link of 15% of the loan amount and we assume away the effect of stock picking by Linking to the All Ordinaries Accumulation Index. Finally, as in the back-testing program, every Index Mortgage is fully costed. That is, all costs and expenses referable to the Index Mortgage are incorporated in the analysis.

SAMPLING METHODS

Three parameters define the outcome of each match race, namely:

(a) The Capital Growth Rate associated to the Index.
(b) The Dividend Yield associated to the Index.
(c) The series of Prime Borrower Home Loan Rates over the period in question.

These concepts are amenable to statistical sampling and we did so according to these paradigms.

Capital Growth Rate – Index Values

We generate the capital growth component of Index Values by way of a traditional Geometric Brownian Motion (i.e. drift plus shock) model, engaging these parameters:

Expected Daily Gain	:	0.0293% (drift)
Daily Price Volatility	:	0.9519% (shock)

Dividend Yield – Index Values

The Index Mortgage attributes a **Total Return** to the mortgage borrower and so we must model the reinvestment of dividends referable to the benchmark basket of stocks. We do so by reference to the historic annual dividend yield of the All Ordinaries Index, which data returns the following parameters and from which we sample per a log-normal distribution:

Mean Annual Dividend Yield	:	4.1371%
Standard Deviation	:	0.8611%

Our model assumes dividends are received and reinvested quarterly in arrears.

Interest Rates

We sample **Prime Borrower Home Lending Rates** according to a GBM model without drift and subject to a floor of 1.5% per annum. The sampled rates produce these ensemble statistics:

Minimum Rate	:	1.500%
Maximum Rate	:	40.6374%
Average Rate	:	4.4290%
Standard Deviation	:	2.0611%

SURVEY SIZE

We ran our model for 5,000 realisations.

RESULTS

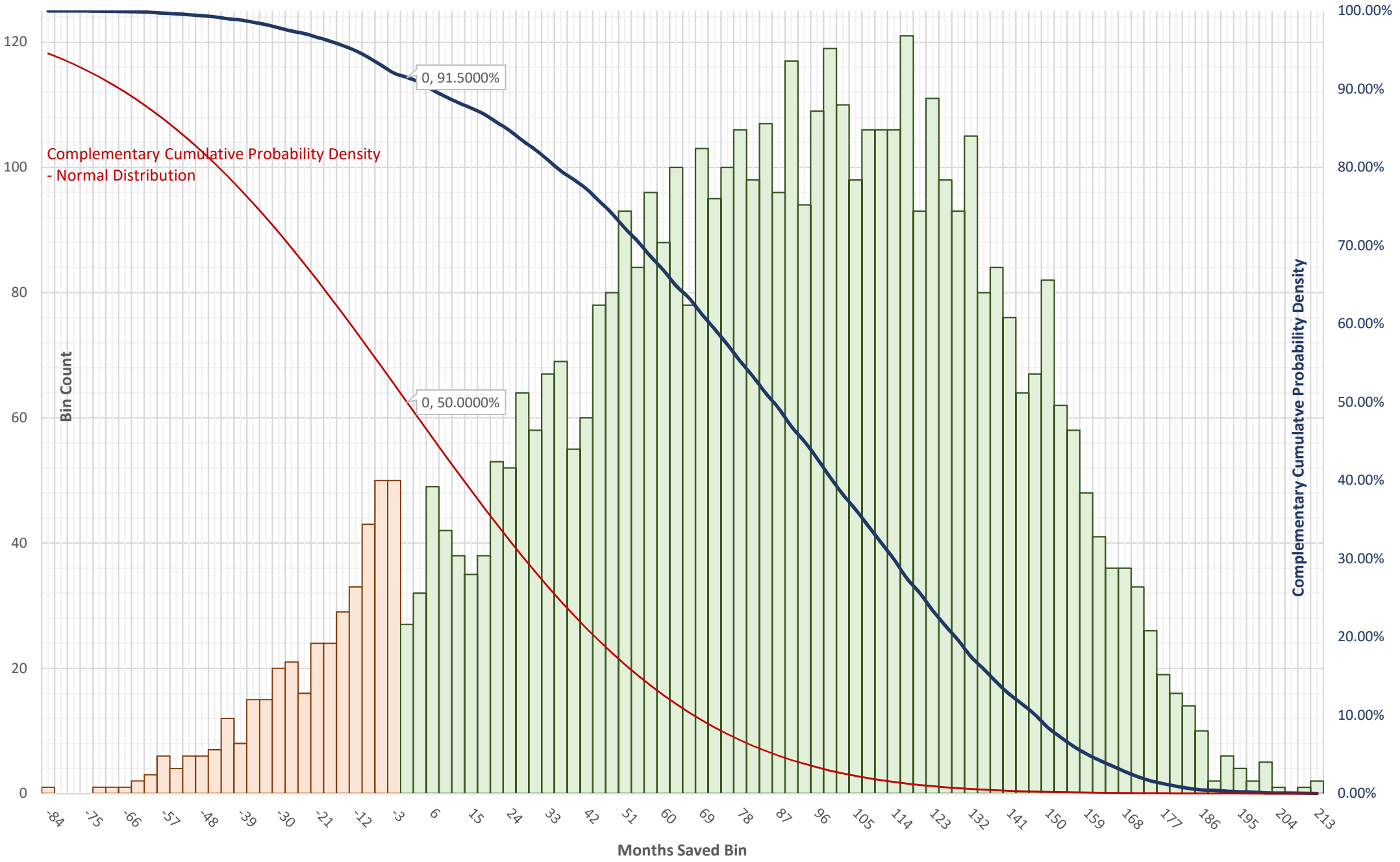
Statistic	Result	% of Sample
Simulation Realisations	5,000	100.00%
Ties	14	0.2800%
Index Mortgage Wins	4,588	91.7600%
Index Mortgage Loses	398	7.9600%

REPORTING

We chart these results by way of the following histogram.

CONCLUSIONS

- Back-testing demonstrated a high likelihood (greater than 97%) that any given Index Mortgage would prove a better choice than its equivalent traditional counterpart.
- We said that result could be confidently extrapolated, for three reasons. First, the sample size was significant. Secondly, the results extended over several economic cycles. Thirdly, there was no reason to believe that the factors which drive the Index Mortgage will be significantly different over the long-term future than over the long-term past.
- To this we add the confirmatory result of 5,000 Monte Carlo simulations to conclude that any given Index Mortgage is highly likely to outperform its equivalent traditional counterpart over the medium to long term.


Complementary Cumulative Probability Density
- Normal Distribution
0, 91.5000%
0, 50.0000%
Bin Count
Complementary Cumulative Probability Density
Months Saved Bin
120
100
80
60
40
20
0
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
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