Advising Investment Clients About Mortgage Debt

by Joe Tomlinson, FSA

The goal of this article is to help planners advise clients about mortgage debt and investments. An example would be helping a client choose between paying down his or her mortgage versus investing more in the stock market. The article develops a method to assess risk/return trade-offs, demonstrates the impact of investment time horizon and performs assessments with variations on the investment side, such as small company versus large company stocks, possible lower future stock market returns, and active versus passive management. The article also provides an appendix to give readers the tools to do these assessments themselves.

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Mortgage debt is a popular discussion topic between clients and advisors. Common questions include

- Should I pay down my mortgage faster?
- Should I take out a home equity loan and invest in the market? Is this a good time to invest?
- I just inherited money—should I invest it or use it to pay off my mortgage?

All these questions involve issues of leveraging investment portfolios with mortgage debt. In this article, I develop a framework to help planners advise their clients when such questions arise. I apply the framework to an example and then look at the following variations on the investment side and how they affect results:

- Length of investment time horizon
- Small company versus large company stocks
- Possible lower future stock market returns
- Active versus passive management
- Sector funds versus diversified portfolios
- Fixed income investments versus equities

For advisors addressing mortgage and investment issues with clients, the results will show that time horizon is a critical variable. Also, the advisor and client's long-term outlook for the stock market is crucial—that is, whether the stock market will continue to reward investors with levels of returns we have seen historically. For investors choosing to leverage equity investment with mortgage debt, I'll make a case for diversifying and keeping costs down. I'll also present an argument that, except for tax-advantaged portfolios, it rarely makes sense to leverage fixed-income investments with mortgage debt.

This article focuses mostly on fully taxable investments, except at the end, where I discuss relationships involving tax-advantaged investments.

Perhaps the most important conclusion from this article is that there are no easy rules of thumb that can be quickly applied when advisors and clients discuss issues involving trade-offs between investing versus paying down mortgage debt. What's best for a client will depend on that client's particular circumstances, approach to investing and attitude toward risk.

An Example

Let's say you have clients who have just inherited $100,000 and they ask your opinion about a couple of options:

- Use the $100,000 to pay down the balance on their existing mortgage
- Invest the $100,000 in the stock market

We'll assume your clients are a married couple in their mid-thirties and that they will be facing some heavy college costs ten years hence. Also, because they have been your clients for some time, their financial plans are in good order. Therefore, they can examine this particular decision in terms of its incremental impact on their overall financial situation. First, gather some data:

- Time horizon: ten years
- Rate on existing mortgage: 6.50 percent
- Tax rate on income: 30 percent

A quick way to look at their question is to

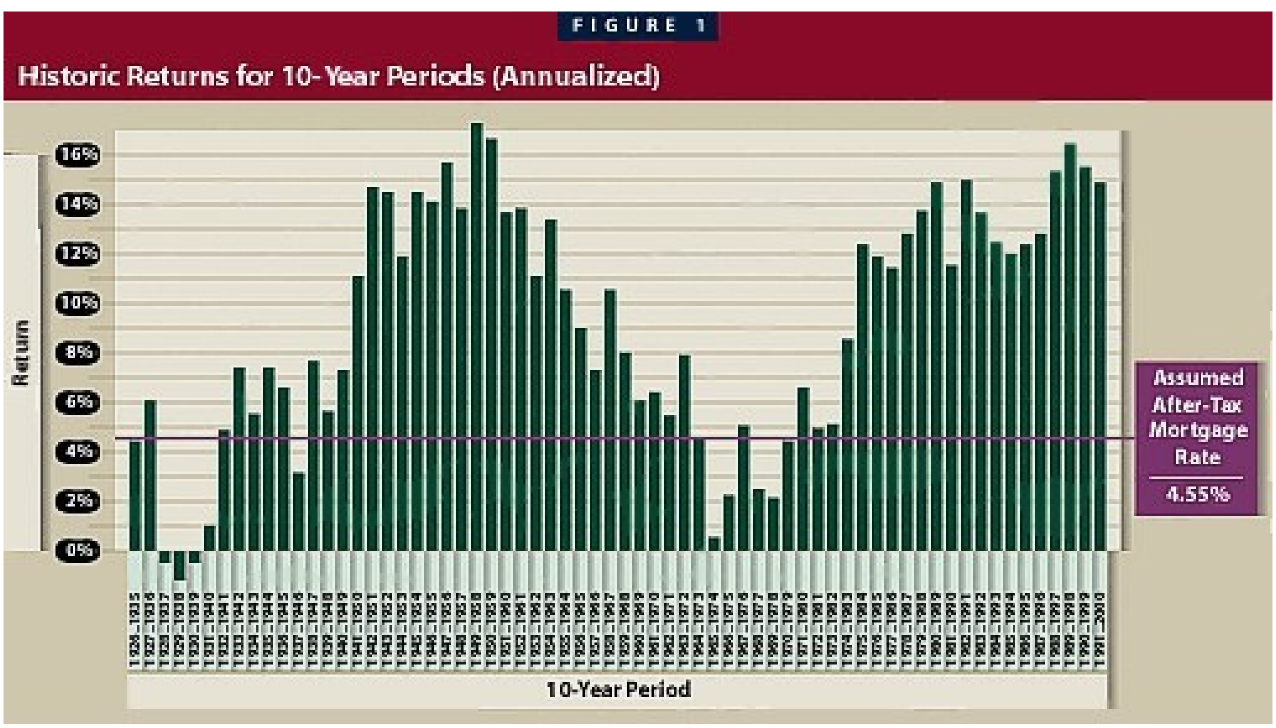
- Calculate the after-tax cost of the mortgage—4.55 percent = [6.50 percent x (1 – 30 percent)].
- Compare this cost with the after-tax returns they might expect from stock market investments.

Over the past 75 years, compound annual returns on large company stocks have averaged 11 percent pre-tax.[1] If this couple invests in an inexpensive and tax-efficient index fund, they might expect to earn about nine percent after tax—certainly an attractive rate compared with the mortgage cost. Investing the $100,000 in the stock market is clearly an idea worth considering.

Risk: The Downside

"But what about risk?" they might ask. "The mortgage cost is fixed, but stock returns can vary. We expect to earn nine percent, but what's the chance we could have poor stock performance and earn less than what we're paying on the mortgage?"

One way to look at this question is to examine past stock market performance over ten-year periods. Figure 1 is based on data for large company stocks beginning in 1926.[2] It shows compound annual returns for overlapping ten-year periods. The returns have been reduced by estimated expenses and taxes (0.3 percent annual expenses, 30 percent income tax, 20 percent capital gains tax) to make them comparable with the after-tax mortgage rates. Of the 66 returns plotted, 54 (or 82 percent) came in above the 4.55 percent after-tax mortgage rate. Based on this limited evidence, you could tell the clients that they have better than an 80 percent chance of beating the cost of the mortgage and coming out ahead.



This approach is certainly valid, but it has a few problems. First, 66 data points may seem like a lot, but they overlap. There are really only seven independent observations. Second, the approach does not provide the flexibility to look at alternative scenarios for future stock market returns or volatility.

Other Methods

These shortcomings can be addressed by using either Monte Carlo techniques or direct statistical calculations. In both cases, the key inputs are (1) assumed future average stock market returns and (2) assumed stock market volatility as measured by the standard deviation of returns. A key assumption with both techniques is that the stock market is efficient and returns for any year are independent of prior-year returns.[3]

For this article I have used direct statistical calculations to generate results. The direct approach produces results similar to Monte Carlo methods, but does so much more quickly, and it's easy to run many different scenarios. The Appendix contains a detailed description of the direct statistical approach and also offers some pointers on using Monte Carlo techniques.

Results

Table 1 shows expected outcomes for the strategy of investing the $100,000 inheritance in the stock market versus using the money to pay down the mortgage.

TABLE 1

Expected Outcomes

Time Horizon (Years)	Average Yearly Return (After Tax)	Standard Deviation (Annual)	Median Gain (Present Value)	Probability of Success
10	10.72%	17.11%	$57,680	83%

- *Time Horizon* is the number of years the strategy is outstanding. In this example the clients are making a ten-year investment to fund future college education costs.
- *Average Yearly Return* is the expected arithmetic average annual return for the client's stock investments. The 10.72 percent is an after-tax number derived from the average annual return for large stocks (1926–2000) of 13 percent.[4] I've assumed that the couple invests in a tax-efficient and low-cost index fund or other index-like investment (84.7 percent tax efficiency and annual costs of 0.3 percent).
- *Standard Deviation* is based on 1926–2000 Ibbotson data for large company stocks, adjusted downward for the effect of taxes. In this case, the 20.2 percent from Ibbotson is multiplied by 84.7 percent to produce 17.11 percent.[5] This tax adjustment assumes the client can offset capital losses against gains from other investments.
- *Median Gain* is the present value of the median dollar gain the clients can expect—they have a 50 percent chance of doing better and a 50 percent chance of doing worse. The present value is based on a risk-free after-tax rate, so the median gain represents the excess they can expect to earn over a risk-free investment. I have used the after-tax mortgage rate (4.55 percent) as the risk-free rate for these examples, because the mortgage represents required payments that will not vary.
- *Probability of Success* is the probability that the clients will at least break even—that is, that their average annualized return on stocks over the ten-year period will be at least 4.55 percent.

Now we come to the central question: What should you advise these clients to do? If the probability of success were close to 100 percent, it would clearly make sense to invest the money. If the chance of success were 50 percent or less, you would recommend they pay down their mortgage. But when we look at numbers in the 65 percent–85 percent range, the right answer depends on individual client attitudes toward risk taking. In economic terms, the answer depends on their utility function with respect to the possible outcomes.

For this example, we will assume that the clients, with your help, decide they want at least a 75 percent chance of coming out ahead in order to invest. They also will look at the present value of the median gain to be sure the "dollars are worth it." So for these particular clients, the prospect of making close to $60,000 on $100,000 of risk capital, with a better than 80 percent chance of not losing money, looks like a risk worth taking.

Alternative Scenarios: Varying the Time Horizon

Now let's extend this exercise to vary our assumptions and see how the expected outcomes change. First, let's look at the impact of time horizon. Table 2 varies the time horizon and also varies the average yearly returns to reflect differences in tax efficiency as influenced by time horizon. Standard deviations also change to reflect differences in tax efficiency. For this table and the others that follow, tax efficiency ranges from approximately 80 percent for the one-year horizons to 90 percent for the 20-year examples.

TABLE 2

Varying the Time Horizon

Time Horizon (Years)	Average Yearly Return (After Tax)	Standard Deviation (Annual)	Median Gain (Present Value)	Probability of Success
1	9.97%	15.96%	$4,280	61%
5	10.34%	16.54%	$23,853	74%
10	10.72%	17.11%	$57,680	83%
20	11.22%	17.90%	$166,779	91%

Table 2 demonstrates that longer time horizons give a better chance of success. The one-year result is a bit better than a coin flip, while a 20-year horizon yields over a 90 percent chance of coming out ahead. The present value of the gain also increases as the time horizon increases, and it's worth noting that if we divide the median gain by the time horizon, the "gain per year" also increases—$4,280 for one year and $8,339 for 20 years.

Small Company Stocks

You and your clients might want to examine changing the investment strategy to focus on small company stocks, with the expectation of greater returns. Small company stocks have averaged 17.3 percent over 1926–2000, versus 13.0 percent for large company stocks.[6] However, to get these higher returns, we need to accept the prospect of higher volatility—33.4 percent standard deviation (pre-tax) based on the Ibbotson data. Table 3 shows the results.

TABLE 3

Small Company Stocks

Time Horizon (Years)	Average Yearly Return (After Tax)	Standard Deviation (Annual)	Median Gain (Present Value)	Probability of Success
1	13.21%	26.45%	$5,443	59%
5	13.87%	27.76%	$32,667	70%
10	14.48%	28.92%	$81,837	78%
20	15.20%	30.29%	$256,595	86%

If we compare these results with those in Table 2, we note that the median gain numbers increase, but the probabilities of success get smaller. The 10- and 20-year numbers still pass the 75 percent threshold, but by smaller margins. The higher assumed annual returns increase the expected dollar values, but the greater volatility more than offsets this impact and therefore reduces the probability of success.

Lower Stock Market Returns

Table 4 is based on a scenario that future stock returns fall short of the returns we have seen in the past. As we experience the current environment, with two years of negative returns following the exuberant late '90s, such a scenario seems likely enough to merit serious consideration in investment planning. For this particular example, I have assumed that future returns for large company stocks fall three percent below the long-term historical averages.[7] (**Editor's note:** See "Changing Equity Premium Implications for Wealth Management Portfolio Design and Implementation," by Harold Evensky, in this issue.)

TABLE 4

Lower Stock Market Returns

Time Horizon (Years)	Average Yearly Return (After Tax)	Standard Deviation (Annual)	Median Gain (Present Value)	Probability of Success
1	6.97%	15.96%	$1,195	53%
5	7.34%	16.54%	$7,575	59%
10	7.72%	17.11%	$19,019	64%
20	8.22%	17.90%	$52,212	72%

Even with a 20-year time horizon, we still fall short of the 75 percent threshold. For planners who really believe that future stock market returns will fall significantly below historical averages, it would make sense to caution even "long-horizon" clients who want to leverage stock investments with mortgage debt.

Active Versus Passive Management

The examples so far have assumed passive management involving investment in index funds, index-like securities (like SPDRs) or buy-and-hold strategies with well-diversified portfolios of individual stocks. The planner and client may decide to follow an active management strategy with a goal of producing better-than-average performance. However, pursuing such a strategy will likely entail higher costs in the following areas:

- Investment expenses
- Transaction costs
- Taxes

It would not be surprising for these extra costs to total as much as three percent. To succeed, an active management strategy would have to cover the extra costs and then produce significant additional return.

I must admit, here, my strong bias favoring index funds. I personally would stay away from actively managed funds if I were leveraging a portfolio with mortgage debt. Bringing in active managers is really making two bets: (1) that the market will do well and (2) that the manager will be able to outperform by enough to more than offset extra costs and taxes.

Sector Funds

Some advisors or clients may feel they can earn higher returns by focusing on investments in attractive industries or sectors. This strikes me as a bad idea. The truly legendary investment managers like Peter Lynch and Warren Buffett have achieved success by picking companies, not sectors. I am not aware of any serious studies that show sector picking really working as a long-term strategy. My view is that sector concentration will likely add significantly to volatility without helping returns. Table 5 shows expected results for a sector funds strategy assuming:

- Sector funds are 1.5 times as volatile as total stock market index funds (based on an analysis I did on Fidelity Sector Funds using Morningstar data).[8]
- Sector funds generate gross returns in line with total stock market averages. (Some sectors do better and some do worse, but all sectors combined are the market.)

TABLE 5

Sector Funds

Time Horizon (Years)	Average Yearly Return (After Tax)	Standard Deviation (Annual)	Median Gain (Present Value)	Probability of Success
1	10.46%	27.09%	$2,613	54%
5	10.88%	28.17%	$14,740	60%
10	11.30%	29.21%	$33,992	64%
20	11.85%	30.57%	$87,674	70%

None of the probabilities of success exceeds the 75 percent threshold. Diversified portfolios offer a better chance of success.

I should also mention that an extension of the sector funds approach involves single company stock. For single company investments, I would expect to see higher standard deviations and lower probabilities of success than for sector funds.

Fixed Income Investments

What about investing in bonds or other fixed income investments instead of stocks? We don't need the tables or the statistical analysis for this one. Borrowing money at a fixed rate and then putting the funds in fixed income investments is almost always a bad idea. Let's consider an example from the mortgage market. The borrower's cost equals the mortgage rate plus the impact of any points, closing costs and other charges buried in the rate to cover profit and expense. The investor in such a mortgage receives the mortgage minus investment expenses. If the borrower and lender are the same person, the net result is a loss equal to what the "middlemen" receive on both the borrowing and lending side.

A client who has investments of $500,000—60 percent stocks and 40 percent fixed income, and also owns a $300,000 house with a $200,000 mortgage—really has an asset allocation that is 50 percent stocks and 50 percent residential real estate. Such a client would likely be better off cashing in the fixed income investments and paying down the mortgage balance. Even if the investments carried above-market coupons, they could be cashed in at a premium. An exception to this recommendation would be for a client with a fixed mortgage at a rate significantly below current mortgage rates—not easy to find given the current low rates.

This is not to say that one cannot find fixed income investments at rates higher than mortgage rates. However, such investments tend to offer much narrower spreads over mortgage rates than we might expect from stock investments, and they also may carry risks that do not diminish significantly with longer time horizons.

Tax-Advantaged Investments

Thus far we have been comparing after-tax mortgage costs with returns we might expect from fully taxable investments. But many investment alternatives carry tax advantages—IRAs, 401(k)s, 403(b)s, SEP and SIMPLE plans, 529 plans, and nonqualified deferred compensation plans, to name some examples.

Common stock investments in tax-advantaged accounts can be analyzed using the same techniques as for taxable stock investments. The key difference is in how we calculate the estimated average yearly returns. Let's look at an example where the client raises the question, "Should I pay down my mortgage faster, or contribute more to the diversified stock option in my company's 401(k) plan?"

The client will pay income taxes on the full amount of any 401(k) funds withdrawn, but earnings and capital gains will be tax deferred as they accumulate. We also need to recognize that contributions to the 401(k) plan will be made with pre-tax dollars, while any mortgage payments will be made with after-tax dollars. When we sort our way through this complex problem, we discover that all we need to do for the 401(k) returns is use average yearly returns before any taxes and we develop the appropriate comparison. Table 6 compares the base case from Table 2, at 10 and 20 years, with the same stock investment in a 401(k) account. Note that we have scaled down the investment amount from $100,000 to $11,000 to reflect 2002 limits on 401(k) contributions.

TABLE 6

Taxable vs. 401(k) Account

Time Horizon (Years)	Average Yearly Return	Standard Deviation (Annual)	Median Gain (Present Value)	Probability of Success
10	10.72% (after tax)	17.11%	$6,345	83%
10	12.70% (401(k))	20.20%	$8,894	85%
20	11.22% (after tax)	17.90%	$18,346	91%
20	12.70% (401(k))	20.20%	$24,980	93%

We can see that the higher 401(k) returns generate significantly higher median gains. Probabilites of success are only somewhat higher, reflecting higher volatilities assigned to the 401(k) investments consistent with their pre-tax treatment.

I'll also briefly address issues involving fixed income investments in tax-advantaged plans. Because of tax differences, it may make sense for a client with mortgage debt to also be holding fixed income investments inside a tax-advantaged plan. We could analyze potential financial results by doing the same calculations as I did for stocks using market data for returns and volatility for various fixed income instruments. But I feel this kind of analysis can be both too complicated and misleading. The misleading part comes from assuming fixed investments exhibit volatility, but mortgage debt does not. In reality, the market value of mortgage debt implicitly changes as interest rates change.

My suggestion for analyzing fixed income investments is to compare the pre-tax rates on the tax-advantaged investments with the after-tax mortgage rate and then make a subjective judgment about whether the spread is sufficient to cover risks on the fixed income investments.

Conclusion

The conclusion I reach from this analysis is that there are no simple answers when a client begins asking questions about investments and mortgage debt. A thoughtful answer requires gathering data from the client about existing mortgages, investment time horizon and tax situation.

The advisor then needs to understand the client's attitude toward risk and work with the client to develop either a shared view for the long-term market outlook or a range of possible outlooks to test.

Armed with this information, the advisor may either (1) use the examples in this article to give the client general guidance or (2) use Monte Carlo simulations or direct calculations to develop a more customized approach for the client. It is hoped that this article provides a framework to help both advisors and clients address these important issues and reach more informed decisions.

Endnotes

1. Ibbotson Associates Inc., *Stocks, Bonds, Bills and Inflation, 2001 Yearbook*, 2001, p. 31.

2. Ibid., pp. 290–294.
3. The best-known work on the efficient market hypothesis is *A Random Walk Down Wall Street*, Burton G. Malkiel (W. W. Norton, 1996). Jeremy J. Siegel, in his landmark book, *Stocks for the Long Run* (McGraw Hill, 1998), observes that over long periods, stocks have exhibited less volatility than predicted by the random walk assumption—that is, stock returns have exhibited mean reversion. To the extent such mean reversion continues into the future, the projections in this article contain a conservative bias.
4. Ibbotson Associates Inc., *Stocks, Bonds, Bills and Inflation, 2001 Yearbook*, 2001, p. 31.
5. Ibid., p. 31.
6. Ibid., p. 31.
7. See William Reichenstein, "The Investment Implications of Lower Stock Return Prospects," *AAII Journal*, October 2001, pp. 4–7, for a succinct discussion of this topic with references to recent studies.
8. Morningstar Premium Fund Selector.

Appendix: Stock/Mortgage Calculations

Direct Statistical Calculations—Building the Spreadsheet

What follows is a column-by-column description of inputs and equations needed to build an Excel spreadsheet to produce the Tables in the article. In the description, variables "A" through "J" correspond to spreadsheet columns. Those columns involving calculations are written as Excel formulas showing the columns (but not the rows), for example, H=(F–G)/G. Columns' names shown in bold correspond to the columns displayed in the tables.

Working with investment projections requires familiarity with the following statistical concepts:

- Arithmetic mean (or average) return
- Geometric mean return
- Standard deviation
- Normal distribution
- Lognormal distribution

All of these concepts are well explained in *Stocks, Bonds, Bills, and Inflation* produced annually by Ibbotson Associates. This is a valuable source of data and explanatory material for anyone doing investment projection or asset allocation work.

The Spreadsheet (column by column),—based on the example from Table 1

- Column A: Input variable A = the time horizon in years, in this example =10.
- Column B: Input variable B = one plus the assumed (arithmetic) average yearly return, in this example =1.1072 (based on a 10.72 percent return).
- Column C: Input variable C = the assumed standard deviation of (arithmetic) annual returns, in this example =17.11 percent or .1711.
- Column D: Calculated variable D (the mean of the normal distribution underlying the lognormal distribution of returns) =–.5LN((C^2+B^2)/B^4). In the example =.09004
- Column E: Calculated variable E (the standard deviation of the normal distribution underlying the lognormal distribution of returns) =(2*LN(B)–(2*D))^0.5. In the example =.15362
- Column F: The median accumulation (based on a starting $1) over the time horizon

  =EXP(A*D). In the example =2.46047.
- Column G: The accumulated after-tax mortgage cost (based on a $1 mortgage) over the time horizon. Assuming a 4.55 percent after-tax rate =1.0455^A. In the example =1.56042
- Column H: The median gain (present value) =$100,000*(F–G)/G. In the example, $57,680
- Column I: The point on a standard normal distribution (mean =0, and standard deviation = 1) corresponding to break even—that is, the investment accumulation equals the mortgage accumulation. =[LN(G)–LN(F)]/

(E*A^0.5). In the example =–.94

- Column J: probability of success—derived by looking up
    1. (–1 times) the number in Column I as the Z value in a standard normal table
    2. Calculating the probability of success as .5 plus the probability number from the table.

In the example, .94 corresponds to the probability .33 in the table and we need to add .5 to translate this to the probability of success =83 percent.

Monte Carlo Simulations

Direct statistical calculations using the spreadsheet described on previous page provide the most efficient way of producing the results shown in the tables in the article. An alternative approach involves running multiple scenarios using Monte Carlo simulation techniques. This type of analysis can be done using "Data Analysis" found under the Excel Tools menu and following these steps.

Develop a spreadsheet containing items B, C, D and E shown in the spreadsheet.

Enter the assumed:

(1) B = 1 plus arithmetic mean and

(2) C = Standard deviation of returns as columns B and C of the spreadsheet. The spreadsheet then calculates the mean (D) and standard deviation (E) of the normal distribution underlying the assumed lognormal distribution of returns.

Use the Random Number Generation analysis tool from the Data Analysis ToolPak with the following inputs:

- Number of Variables: Time Horizon =10.
- Number of Random Numbers: Number of Scenarios =200. (More scenarios give more accurate results, but too many scenarios require lots of processing time. For my machine, I settled on 200 and then did 5 successive runs to produce a total of 1,000 for any given mean and standard deviation of returns.)
- Distribution: =Normal
- Mean: =D (.09004 in the example)
- Standard Deviation =E (.15362 in the example)
- Random Seed: =leave blank
- Output Range: =A1: J200

Clicking "OK" gives a 10 x 200 matrix of returns.

We then set K1=EXP(A1), and drag the fill handle of this cell to T200. The 200-row matrix with columns K through T is a set of 2000 randomly generated annual accumulations, which is lognormally distributed based on mean B (1.1072 in the example) and standard deviation C (.1711 in the example).

Each row represents 10 consecutive annual accumulations. Column U can then be calculated as =PRODUCT (K1:T1) for the first row, and this cell can be dragged by the fill handle to fill in the entire column U.

Column U thus contains a set of 200 randomly generated 10-year accumulations based on a lognormal distribution with mean B and standard deviation C. In Column V we can place the mortgage accumulation which =1.0455^10 for every cell in the column.

We can then calculate present value of the gain in column W as =$100,000* (U1–V1)/V1 and drag this cell by the fill handle to fill in column W.

The median gain can be calculated as =MEDIAN(W1:W200)

The probability of success can be calculated as the percentage of cells in column W that are positive numbers. This can be done by setting column X = IF(W1>0,1,0), dragging the cell to fill column X, summing column X, and dividing the result by 200.

Reruns of the scenarios can be easily done by running random number generation successively without changing parameters. New scenarios can be run by putting in new numbers for B and C. It works best to set up separate worksheets for 1-, 5-, 10- and 20-year scenarios.