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Mortgage Financing: Floating Your Way to Prosperity

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THE INDIVIDUAL FINANCE AND INSURANCE DECISIONS CENTRE
AT THE FIELDS INSTITUTE

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Executive Summary

I provide detailed evidence that Canadian consumers are better off, on average, financing a mortgage with a short-term floating (prime) interest rate, compared to a long-term fixed rate. This conclusion, on its own, is not original, since most financial commentators have argued this for quite a while. The contribution of this report is to *rigorously quantify* the benefit of the floating strategy by introducing and developing the concept of the Maturity Value of Savings (MVS) and the Total Months Saved (TMS). More specifically, I show that during the period 1950 to 2000, Canadians would have saved approximately $22,000 in interest payments -- on a $100,000 mortgage amortized over 15 years -- by borrowing at prime versus the five year rate. The probability of success from borrowing at prime, versus the 5-year rate, ranged from 75% to 90%.

Introduction.

In this report I examine the age-old question of whether to go 'long' or 'short' on a residential mortgage. When you take out a mortgage, you have the choice of borrowing at either a fixed or a floating interest rate. With a fixed rate mortgage, the payments made are based on a “fixed” interest rate and as a result remain constant over a predetermined length of time. If you decide to take out a floating rate mortgage, your payments are linked to a “floating” interest rate and are therefore likely to change frequently depending on the arrangement. In this case, I have tried to quantify the risks and benefits from taking out a floating rate mortgage based on the prime rate--and renewing the loan on an

[1] Dr. Bernie Wolf, Professor of Economics at the Schulich School of Business provided the macro-economic commentary, and Dr. Chris Robinson, Associate Professor of Finance at the Schulich School of Business provided additional input and guidance. I would also like to acknowledge Mr. David Varadi for excellent research assistance, background work and editing of this report.

annual basis -- compared to borrowing at the 5-year (fixed) mortgage rate. The main conclusion that was drawn from the analysis is that Canadian consumers are generally better off borrowing money at the short (prime) rate as opposed to the 5-year long rate — provided they can tolerate moderate fluctuations in monthly mortgage payments. The superiority of borrowing at the floating (prime) rate is a direct result of the fact that the term structure of interest rates (yield curve) is more likely to be upward sloping than downward sloping. Consumers (and all borrowers) pay for mortgage stability by incurring higher interest costs in the long run.

During the period 1950-2000, I estimate that a consumer with a $100,000 mortgage -- that was to be repaid over the course of 15 years -- would have spent an average of $22,000 more in financing costs by borrowing and then renewing at the 5-year rate, compared to borrowing at prime and renewing annually. Historically, 88% of the time, a consumer would have been better off borrowing at prime, compared to a fixed 5-year rate. Moreover, even in today's relatively[2] flat yield curve environment, I estimate that the forward-looking probability of success from borrowing at prime is approximately 65% and the average savings on a $100,000 mortgage is approximately $10,000.

The main message is quite simple. Long-term stability has its price!

But, before we get into the technical details. Let me review some basics about mortgages in Canada. A mortgage, of course, is essentially a loan. Like other loans, a mortgage represents a personal pledge by the borrower that it will be repaid. However, unlike other loans, the lender's confidence that he or she will be repaid is not based solely on the investor's overall personal financial health but also on the property that effectively underwrites the mortgage. If you (the home owner) fail to meet your mortgage payments, the lender has the right to "foreclose" on the property — that is, the lender can take title to your house, sell it off, and pocket the amount owed by you, the borrower.

The basic components of a mortgage are as follows:

1. The ***principal***. This is the total amount borrowed or currently outstanding on the mortgage. It represents the amount that you owe to the lender.
2. The ***home equity***: This is the value of the house above (or below) the outstanding principal of the mortgage. It represents the portion of the house that is yours. The equity is equal to the book value of the house minus the principal balance.
3. The ***mortgage rate***. This is the interest rate that you are being charged on the principal. Obviously, the greater the principal and the higher the interest rate, the larger your monthly mortgage payments will be.
4. The ***mortgage payment***: This is the regular installment of cash, paid monthly and sometimes even bi-monthly, with which you repay the mortgage.

[2] As of late January 2001, floating mortgage rates are in the 7.00% to 7.50% range, and 5-year rates are in the 7.25% to 7.75% range.

5. The *amortization period*: the number of years it will take to completely repay the mortgage if you make the above-mentioned mortgage payments until the outstanding loan has been paid in full.
6. The *mortgage term*: the period of time covered by a specific mortgage agreement. When the term matures, the mortgage is renegotiated at prevailing interest rates. Hence, while the amortization period is typically on the order of 10 to 25 years, the mortgage term tends to be much shorter. It usually ranges from six months to five, or ten years at most. We say that a mortgage is 'long' if the term is closer to five years, and short when the term is closer to one year. However, THE most important thing to note about mortgages, and the essence of this report, is that mortgage interest rates (item 2) will depend on the term of the mortgage. In other words, if you pick a 5-year term, you might be charged 8% interest on the principal you are borrowing. While if you pick a 1-year term, you might be charged only 7% on the principal. The reason for the difference in rate, depending on term, is that the interest rate yield curve is not necessarily flat, but can be upward sloping or downward sloping depending on the period in question. Figures 1a,b, c provides sample yield curves for different points in Canadian history. More on this later.
7. The *prepayment options*. Depending on the institution, the term and the type of mortgage, you might be granted the right to prepay a certain portion of the loan at fixed points in time -- without incurring any penalties. This feature is related to the concept of open mortgage, versus a closed mortgage. One can always convert an open mortgage to a closed mortgage, but not vice versa.

The mortgage payment, incidentally, is not simply the interest on the loan. It includes both interest and principal components. In other words, your mortgage payments are structured in advance so that instead of paying interest at regular intervals and repaying the original principal at the end of the mortgage, each periodic payment includes both an interest component and some principal repayment.

The operating principle of a mortgage is quite simple. You initially receive a lump sum of cash, and then are obliged to repay it over time, in a series of blended payments including both principal and interest. If you fail to make these payments, foreclosure will take place. Then, the property will be sold, and your equity used to make a lump-sum payment, reducing if not eliminating the remaining balance owed on the loan.

In many mortgage agreements, of course, you have the right to pay down a portion of your principal. When and if you did so, you could then renegotiate (downward) the amount paid each month. Alternatively, you could keep the same total monthly payment, but finish paying off your mortgage much earlier than originally expected. In other words, with the reduction in the principal, you can change (in your favor) the ratio of principal and interest calculated into each payment. As more and more of your principal declined, more and more of each monthly or weekly payment would go toward paying off the balance; less and less would go toward interest payments.

The main question I would like to examine, once again, is what term you should select on your mortgage. Specifically, I would like to ask: "would consumers be better off if they picked a shorter term, like six months, or a longer term, like five years?" Recall that in a short-term mortgage, the interest rate can change each term, thus payments will change accordingly. In a long-term mortgage, the interest rate is fixed for the duration of the term, and therefore the payments are constant.

Has Anybody Ever Examined This Question Before?

I am not the first, and definitely will not be the last, to examine the issue of optimal mortgage financing. The common business press is replete with financial commentary and advice on the "*best practices*" for selecting mortgage rates. A variety of popular personal finance books on home buying contain similar nuggets of wisdom on mortgage financing. Indeed, many public commentators have argued that borrowing at short (floating) rates is preferred to locking-in long rates; and my data certainly provides some support for their intuition. Unfortunately, most of the existing folklore and advice is rarely subjected to formal statistical analysis and does not address the probability that a given strategy will be successful. After all, the future is random, and there is always a chance that current situation may change drastically. It is therefore inappropriate to say that one strategy is better than the other, without quantifying the risks and benefits.

My methodology is similar in spirit to a paper in the *Financial Services Review* (FSR), by W.K. Templeton, R.S. Main and J.B. Orris, (1996) in which they examined the costs and benefits of Fixed and Adjustable rate mortgages in the U.S. Although the U.S. mortgage environment is quite different from the Canadian one, the FSR article employs a very general simulation methodology for assessing costs and benefits, which can be imported to our context. M. Tucker (1991), in *The Financial Review* conducted similar Monte Carlo simulations to argue that adjustable rate mortgages (in our lingo, floating rate mortgages) were quite often the lower cost alternative. C. Sprecher and E. Williams (1993) in the *Real Estate Finance Journal* provide similar evidence as well.

In reviewing the research – which is mostly based on the U.S. market -- I find strong support for the notion that borrowing at a short-term floating rate will result in lower financing costs. Obviously, there are difficulties inherent in generalizing these results to the Canadian environment. The U.S. mortgage and interest rate environment is structurally unique because of the prevalence of longer-term mortgages (up to 25 years), the deductibility of mortgage interest payments and the somewhat easier ability to prepay (or even default) on a residential mortgage.

Interestingly, a U.S.-based study by M. Lino (1992) in the *Journal of Consumer Affairs,* demonstrated that borrowers, for the most part, are not able to evaluate and compute the present value of their mortgage decisions. As a consequence, consumers are unable to determine how costly their decisions might be in the long run, and which decision is superior on a present value basis. In other words, consumers have a hard time *quantifying the consequences* of paying half a percent more, or less, on a mortgage over long periods of time.

Not withstanding the above, my intention with this report is to (1) develop a rigorous methodology for quantifying the benefits of financing a mortgage using a floating rate, and (2) apply this methodology to a time-series of historical mortgage rates in Canada, and (3) use Monte Carlo simulations to create forward-looking projections of the benefits of financing a mortgage using a floating rate. More specifically, I want to estimate (a) how much money a consumer actually saves from borrowing at the short rate and (b) the odds of success from this strategy.

Methodology: How Do We Compare Apples and Oranges?

Consumers that borrow long versus short will likely be making very different payments during the life of the mortgage. Those who borrow short will have to renew their mortgage more frequently, and for differing periods and amounts. Those who borrow long are able to fix their financing costs for longer periods of time, but at the expense of a reduction in flexibility.

How can we compare the costs and benefits from using one financing strategy versus the other?

To answer this question I have devised two hypothetical consumers with similar mortgage needs. These consumers are stylized individuals that are meant to approximate the average Canadian in their decision-making process. Naturally, some of the results may be specific to our hypothetical characteristics, and I will address this concern later in the analysis.

I am now ready to introduce you to Linda Long and Shelly Short. They both own their own house, purchased back in 1996, and both live on the same street in the center of Toronto. By chance, both of them are about to renew their mortgage, whose current value is exactly $100,000. They would both like to amortize the payments over (i.e. completely pay-off the loan after) 15 years[3]. They pay their mortgage monthly (at the end of the month), with the last payment occurring at the end of the 180th month (15 years).

Linda Long has decided to re-finance the mortgage at the 5-year rate, while Shelly Short has decided to borrow at prime. Now, although Shelly is borrowing at the short (floating) rate, her mortgage will have a term of exactly one year. In other words, her financing costs (payments) are locked-in for the next year, at which point she will renew her mortgage.

[3] The typical first-time mortgage is amortized over 20 years, which leaves 15 years of payments after 5 years have gone by.

Shelly and Linda would like to know who is making the better decision.

Specifically, they would like to know who would have fared better historically, as well as the odds of success going forward. To help Shelly and Linda, I have obtained data from the Bank of Canada documenting the last 50 years of mortgage rates, both 5-year rates and prime on a month-by-month basis. The 50 years is somewhat arbitrary, but dictated by the availability of reliable data. In fact, I was able to extract very little relevant information from interest rates prior to the late 1960's, as we shall see later.

So, we start the analysis on January 1st, 1950, at which point we assume that Linda and Shelly begin the financing process. Linda makes the same payments for the next 5 years (60 months), while Shelly will (potentially) make five different payments (each 12 times) in each of the 5 years.

I emphasize that Shelly will renew her mortgage 14 times, but each time with an amortization period that is reduced by one year. Linda will renew her mortgage twice. In five years she will amortize the balance over ten years, and in ten years she will amortize the balance over the remaining five years. Finally, both of them will have completely paid off their mortgage on January 1st, 1965. This little exercise takes us through the 1950-1965 period.

Now for the most important part, we compare payments for Shelly and Linda. The way we do this is as follows. Each month, i.e. for the 180 payments, we subtract Shelly's mortgage payment from Linda's mortgage payment to get the monthly savings from *going short versus long*. (This number may, in fact, be negative if the yield curve was inverted for a substantial period of time.) We then take the monthly savings and compute the *FUTURE VALUE* on January 1st, 1965. We compute the future value using the T.Bill rates relevant for that time period. Specifically, we 'move' the monthly savings ahead in time, using the product of the rates applied during the remaining years. Doing this process for 180 months will give us ONE observation -- for January 1965 --which we label the *Maturity Value of Savings (MVS).*

The MVS measures the economic benefit from going short versus long. Note that this captures more than just the total amount of interest paid under the two strategies, but also the timing of those payments. After all, one dollar today is worth much more than one dollar in fifteen years. I am just as concerned about when Linda and Shelly have paid the interest, as well as how much interest they have paid. Indeed, if I were to accumulate the difference in payments at a zero interest rate, I would obtain the total amount of interest paid on the short versus the long. More on this later.

Of course, I am not done yet. I have simply computed one possible observation for the savings from borrowing short. I would like to see what happens for other months. Therefore, we start the process again, on February 1st, 1950. Linda and Shelly do the same thing, namely a $100,000 mortgage amortized over 15 years, etc. This will generate another Maturity Value of Savings (MVS) observation, for February 1965. This procedure is repeated over and over again.

After 35 years[4] of tracking Linda and Shelly, I have created 420 MVS observations. These 420 observations will form the basic statistical object of our analysis. We shall create a time series of these numbers, from 1965 - 2000, and compute the mean and variance, the min and the max, and the probability of negativity. This allows us to identify the best and worst 15 year period, as well as how bad things can get.

In theory, of course, a true floating rate of interest on a mortgage would imply that each and every day -- if the rate changes -- Shelly would be subjected to a different interest rate, and perhaps even payment. However, under this regime it would be very difficult to make the comparison between short and long, without knowing the exact magnitude of payment that Shelly makes on her mortgage, each time the rate changes. This, of course, would be arbitrary which is why I decided to assume prime is fixed on a year-by-year basis. You must trust me that this assumption does not materially affect our final result on the benefits of a floating rate mortgage. Furthermore, to address this point, in a later section I will examine the case where Linda and Shelly make the exact same payments – but Shelly's interest rate fluctuates monthly -- and show that Shelly will most likely pay off her mortgage sooner.

Another possible criticism of this methodology is as follows. In some sense, we might want to accumulate the difference between Shelly and Linda's payments at an *after-tax* rate of interest. This is because any interest gains, or losses, would be taxable (or deductible). Furthermore, if Shelly would have to borrow money on her credit card, in order to make up the difference in monthly payment, the relevant interest rate would be even higher. But these additional features would only serve to unnecessarily complicate the analysis. Remember that my objective is to simply quantify the benefits from financing a mortgage at one rate, versus another. I am not arguing that Shelly should borrow or invest the difference between her mortgage payments and the 5-year rate, rather I am simply trying to compute Shelly's *opportunity cost*. Therefore, I will ignore some of the technicalities and focus on the big picture.

Detailed Example:

Given the centrality of the Maturity Value of Savings (MVS) to our analysis, here is an example of how such a calculation would look. (Please refer to Table #1 and Table #2 at the end of the report). For purposes of analysis, let us take the period 1975 to 1990 as an example. Linda and Shelly borrow $100,000. Linda borrows at 11.80% (effective

[4] The first mortgage sample, which was assumed to have originated in January 1950, terminated in January 1965. The final mortgage sample, which originated in January 1985, terminated in January 2000. This provides us with the 35 years of data, or 420 observations.

annual) and Shelly borrows at 10.50% (effective annual). Linda pays $1,105.4 per month for the next year, while Linda pays $1,187.3 per month for the next five years. Shelly saves $81.9 per month, compared to Linda, which she invests in a savings account earning 7.39% for the entire year. At the end of the first year, Shelly renews her mortgage at 9.75% (effective annual) and amortizes the balance of the mortgage for 14 years. This induces monthly payments of $1,061.5, which compared to Linda, is a savings of $125.8 per month. This sum is invested in a savings account earning 8.86% for the entire (second) year. In addition, all of last year's savings is invested at this same rate as well. We continue the process year after year. All savings are invested, and any deficit is financed from the same account.

In 1981, for example, Shelly's mortgage rate is 18.25% (effective annual), which induces monthly payments of $1,464.4. This is higher than Linda's payment of $1,427.7, which implies a loss of $36.7 per month from going short versus long. This loss is deducted from any previous savings, or is accumulated as a debt at the same average T.Bill rate. This process is repeated for each year (or month in my analysis) and each individual loss or gain is added to compute the MVS. In this case, the effect of the higher floating relative to fixed payment was to reduce the Maturity Value of Savings. In the end, Shelly saves a total of $49,653 from this mortgage investment strategy.

I conduct the same analysis using (properly compounded) mortgage rates for all 15-year periods during January 1950 to January 2000. Furthermore, I accumulated all savings (both positive and negative) at the actual prevailing T.Bill rate for that month, as reported by the Bank of Canada.

As a slightly less cumbersome alternative to this computation, the methodology illustrated in Table #2 is exactly the same, except that all savings (or deficits) are invested at a *zero interest rate* over the entire 15-year period. I believe that this simplification is less accurate, from an economic standpoint, compared to using the average T.Bill rate, although it is somewhat more intuitive. Using the previous example, the result is a savings of $20,475, which is much lower than $49,653 because of the absence of interest compounding. Another way to state this is: For the mortgage that originated in January 1975 and matured in January 1990, Linda paid $20,475 more in total mortgage interest payments, compared to Shelly.

The Historical Evidence: 1950 - 2000

In Figure #2, I have plotted the prime and 5-year mortgage rates during the period 1950-2000. Figure #3, displays the spread, or difference, between these two rates. As one can see, the spread was relatively constant at 125bp to 150bp during the 1950 - 1965 period. (A basis point, abbreviated bp, is a one hundredth of a percentage point.) The prime business rate was relatively stable at 4.5% until 1956 and was at 5.5% until the late 1960's. Interest rates peaked in the late 1970's and early 1980's, at close to 25%, which was a very painful period for anybody with a mortgage, whether it was fixed or floating.

Over the entire period, the average spread between 5-year mortgage rates and prime was 135 basis points. The largest spread was 340bp, experienced in August of 1972, and the lowest value of this spread was *negative* 275 bp, in February of 1981. The standard deviation of the spread was 104 bps. This spread was positive 81% of the time. The two severe episodes of negativity occurred during the period 1979 - 1982 and 1989 - 1991. And I will discuss more about this anomalous period in the section on the macro-economic environment.

I then used this dataset to compute the Maturity Value of Savings during the period 1951-2000. Table #4 displays the individual MVS for each month over the 50-year period, while Table #3 contains a statistical summary of the probability of attaining a given level of MVS. The striking observation that one should make in Table #3 is that the MVS becomes negative, only at the 10^{th} percentile level.

Interpretation of the Results

Here is an example of how to interpret the numbers. Assume that Linda and Shelly finance a $100,000 mortgage (15 years amortization) in January 1950, at the 5-year long and prime short rate respectively. In January 1965 their mortgage has been paid off completely. The table indicates that Shelly will have saved $7,917 from going short versus long. As we mentioned earlier, this number properly accounts for the time value of money by investing the monthly savings (even if negative) at the T.Bill rate applicable during the entire 15-year period.

To contrast this case, let us examine the situation where Linda and Shelly finance a $100,000 mortgage in January 1979. This particular mortgage is paid off by January 1994. As one can see from the table, Shelly will have saved a *negative* $11,669 by borrowing short versus long. The negative number implies that Shelly does not really save money. In fact, she loses by borrowing short versus long. It is Linda who comes out ahead from this particular case. Linda will have saved $11,669 by going long.

In fact, most 15 years mortgages that terminated in the 1991 - 1994 period, resulted in a negative Maturity Value of Savings, which implies that Linda is the one that saved money by fixing her borrowing costs for 5 years at a time.

A casual examination of the table reveals that Shelly had her best result in September 1995. The MVS is (an astonishing high) $99,854 on a $100,000 mortgage. Indeed, Shelly's mortgage -- which she took out in September 1980, and paid off by September 1995 -- resulted in savings of close to 100% of the value of the mortgage. This number may seem outrageously high at first glance. However, we remind the reader that this analysis fully accounts for the time value of money. Recall the period of high interest rates in the early 1980s. Both Linda and Shelly were making large payments on their mortgage, but the high level of credited interest on those same savings magnified the minor savings of going short versus long.

In stark contrast, April 1992 was the worst case scenario for Shelly Short. The account (MVS) on the mortgage that she took out in April 1977, matured at a loss of $41,936 compared to Linda Long. The culprit for this painful result again is the high level of interest rates during the early 1980s. Using the zero interest rate methodology would have resulted in substantially lower MVS data. The time-value adjusted MVS were inflated by the high level of interest yields that were characteristic of this period.

Overall, we counted an average MVS gain for Shelly of $22,210. Stated differently, one can think of $22,210 as the average cost of Linda's safety. Furthermore, 88.6% of the time Shelly came out ahead, compared to Linda. The evidence is pretty straightforward: History has been kind to Shelly-- but nature can be vindictive every once in a while.

1-Year Rates versus Prime

Some might question the wisdom of using the prime rate for our floating (short) rate proxy. Indeed, perhaps the 1-year rate would be more appropriate if the mortgage choice is between a pure 5-year and 1-year term. However, after casual examination of the 1-year numbers (from 1980 - 2000) I found an average difference of approximately 7bps, between prime and the 1-year rate. Figure #5 plots the range of difference between 1-year and 5-year rates and it does vary widely. It reached a high of 175 bps during September 1982, and a low of negative 300 bps during January 1981. However, despite the occasional spike, 65% of the time, the difference between 1-year rates and prime is within *plus or minus* three quarters of a percentage point.

A Slightly Different Methodology

To further reinforce the benefits of borrowing short versus long, I will now examine a slightly different strategy for comparing the two alternatives.

Imagine the same Shelly and Linda with a $100,000 mortgage that is to be paid off in 15 years. This time, however, Shelly will borrow at prime but will make the <u>same monthly payments</u> as Linda. In other words, regardless of the actual interest rate on the floating rate loan, Shelly will make mortgage payments based on the 5-year rate. Then, depending on the specific mortgage (prime) rate that is applicable in that month, a portion will go towards interest payments, and the rest will go to pay down the principal.

Now, as you can imagine, if the 5-year rate is relatively higher than prime, Shelly will be paying down a larger portion of the principal, compared to Linda, and would thus pay off her mortgage sooner. If, on the other hand, the prime rate exceeds the 5-year mortgage rate in any particular month, Shelly would have to extend[5] the amortization period on the mortgage, so that her payments cover the minimum that is required.

Table #5 displays the data set for the Total Months Saved (TMS) for a mortgage cycle during the time period 1970-2000. I chose the recent 30-year period, which better reflects current financial conditions[6]. Figure #6 depicts a histogram, or the frequency with which numbers appeared, of the TMS. Each TMS represents the number of months that Shelly (who borrowed short) saved in paying down the entire principal of the mortgage versus Linda (who borrowed long), based on a maturity of 15 years. If and when a negative number appears, it means that Shelly did not save any monthly payments, but rather she had to make even more payments, compared to Linda.

Here is an example of how to read these numbers. If Linda and Shelly took out a $100,000 mortgage in January 1970, Linda would have paid-off her mortgage by January 1985, while Shelly would have paid off her mortgage 38 months earlier (i.e. November 1981). This is because a larger portion of Shelly's payments would have gone towards paying down the principal – since her interest rate was lower for the most part — and thus would have paid of her mortgage sooner. In contrast, if Linda and Shelly took out a $100,000 mortgage in January 1972, Linda would have paid-off her mortgage by January 1987, while Shelly would have paid off her mortgage 11 months later (i.e. December 1987). This is because at some point during the life of the mortgage Shelly's (prime) interest rate exceeded her monthly payment. She was then forced to extend the amortization period of the mortgage so that her payments could remain the same as Linda's. Once again, I am not suggesting that Shelly should extended her mortgage whenever (floating) prime rates exceed the 5-year rate. Rather, it is simply an accounting technique for quantifying the costs and benefits from this strategy.

A casual examination of the table reveals that, once again, the worst period for Shelly was the mortgage maturing in April 1992. This 'cost' her 50 months more of mortgage payments. While the best period corresponded with the 15 year mortgage maturing in September 1995, in which she 'saved' 73 months of mortgage payments by borrowing at prime versus the fixed 5-year rate. Indeed, during the entire period 1970 - 2000, the Total Months Saved was positive 74% of the time with an average of 18 months, and a median of 25 months. Stated differently, three quarters of the time, Shelly would have completely paid off her mortgage before Linda; even though she made the exact same monthly payments. These results are qualitatively similar to those of the previous section, where I computed the Maturity Value of Savings.

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[5] We obviously are assuming that Shelly can, indeed, extend the length of her mortgage in order to keep her monthly payments under a certain level. In practice, of course, she might be forced to make higher payments if the floating rate goes above the 5-year rate.

[6] In fact, doing the same analysis for the period including 1950-1970 would actually strengthen the results, since the Total Months Saved (TMS) would be even higher. But, not withstanding the MVS analysis, the lack of volatility, or negativity, in spreads during 1950-1970 renders that period somewhat uninformative in today's environment.

I conclude that history is unanimous in its verdict and the odds favor floating rate interest payments as a cheaper alternative to long-term fixed rate financing.

What Does the Future Hold?

Hindsight is twenty-twenty, and a high success rate in the past does not guarantee such odds going forward. To that end, I conducted a Monte Carlo Simulation to forecast future MVS values. The method of Monte Carlo Simulations is a scientific technique developed over the last few decades to deal with complicated questions in physics and mathematics. These days, it's used in everything from traffic control to designing better soap. This approach can be applied to help quantify a variety of investment decisions such as asset allocation, and choosing between lump sum versus dollar-cost average strategies. [7] The same methodology can be equally useful in this context as well.

So in fact, together with some researchers at the Individual Finance and Insurance Decisions (IFID) Centre in Toronto, I constructed a computer program that generated thousands of different forward-looking scenarios for interest rates, yield curves and the Maturity Value of Savings. In other words, I have *randomized* the Maturity Value of Savings. This provides me with a probability distribution for the MVS numbers. Essentially, I simulated many thousands of Shellys and Lindas who took out mortgages at prime versus 5-year rates. Each time 'a' Shelly or 'a' Linda borrowed money, the interest rate paid was selected from a distribution that was similar to what has been observed during the last 30 years. Sometimes Shelly paid more and sometime Linda did. Any difference in payment, whether positive or negative, was accumulated at a 5% interest rate -- to proxy for a true Maturity Value of Savings. I simulated 50,000 such scenarios, and assumed that any shocks to interest rates would slowly dissipate and revert back to historical means.

Putting this all together, for example, I found that when we start with a 7.5% short (prime) rate and 8.00% long (5-year) rate on a $100,000 mortgage, the forward-looking probability of a positive MVS is approximately 65%. The average savings are between $10,000 and $12,000 depending on which economic model[8] you prefer for the simulation exercise.

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[7] I refer the interested reader to my book *Money Logic: Financial Strategies for the Smart Investor* (Stoddart, 1999) in which the Monte Carlo paradigm and probability of success methodology is explained in greater detail.

[8] Without getting too technical, I assumed a one-factor mean-reverting model for the short rate, off which the entire yield curve is generated. For our purposes, I believe this to be adequate. Also, from a marginal impact point-of-view, the spread is more important than the nominal level of rates, as it pertains to the MVS. In fact, when I started with a 7.25% short (prime) rate and a 7.75% long (5-year) rate, the probability of a positive MVS was slightly higher than 65%.

These numbers are certainly lower that the historical average savings of $22,000 with an 88.6% probability of success. But, as I explained earlier these simulations are forward looking assessments of the variation in mortgage rates. Also, the current spread between long and short rates is very small -- perhaps even 25 basis points -- which somewhat reduces the magnitude of the benefit from floating. However, it is still sizeable and likely to persist due to the macro-economic reasons I will discuss in a moment.

Aside from the actual numbers, the simulations further confirm the intuition held by many financial experts that in periods of (temporary) high interest rates, the odds are that they will revert back to their historical mean. As such, one is much better off with a mortgage that floats at prime. Likewise, when interest rates are at (temporarily) low levels, one is much better off locking-in at long-term rates. Of course, one is never sure where exactly interest rates are headed, which is why, for the most part, consumers are better off not guessing and simply going with the floating rate arrangement.

Mortgage Financing and the Macro-economic Environment

Up until now, I have illustrated the savings that come from borrowing short versus long, without explaining the reasons for the savings. In this section I address the question of why this works out to be the case.

The main reason offered by economists is that short-term interest rates (like prime) are actually supposed to be lower than long-term interest rates (like 5-year mortgage rates). You see, banks, trust companies and other lenders want to be compensated for the greater uncertainty that they are subject to by lending longer. Clearly, they are tying up their money for a longer period of time. Hence, there is a greater chance that interest rates could rise, the longer the period. If this were to occur, financial institutions could lend out their funds at a higher interest rate, if they were not already committed. On funds lent out, any given change in interest rates will have a bigger impact on the value of their asset. Indeed, the longer the maturity the greater is the impact. To compensate for this risk, they charge more. When you borrow money for longer periods of time (read: at a fixed rate) you are paying a price for the stability. The price goes directly to the financial institution making the loan, to compensate and pay them for the instability they face.

For example, a one-percentage point (or one hundred basis points) increase in interest rates will have a significantly larger impact on the bank's long-term assets, like bonds, mortgages and other loans (depending on their exact maturity), compared to their short-term assets. This is because the effect of the interest hike is felt so much longer. Indeed, the value of the long-term asset will decline much more than that of the short-term asset.

This phenomenon is a reflection of the financial fact that asset prices are inversely related to interest rates. When interest rates rise, fixed yield assets decline in value and vice-versa. Let's suppose that, due to interest rate hikes, lenders are able to obtain assets that generate higher yields than those issued earlier. To be competitive, with these new financial instruments, older ones have to have the same effective yield as the new ones. To do so, they must fall in price. Let's illustrate the principle with a bond that does not mature. You'll have to trust me that this simplifies the analysis, but does not change the principle. Suppose that this perpetual bond is issued at $1000 and pays $50 per annum in interest for a yield of 5%. Interest rates now rise to 10%, so that a newly issued bond without a maturity date pays $100 per annum in interest for a yield of 10%. Then the first bond issued must fall in price to $500 in order to yield 10%. Bonds that mature will not have to fall that far because at maturity the bond will be redeemed for $1000. The longer the time to maturity, the more their price will have to decline. A bond with a 30-year maturity will have to decline almost that far in price, whereas one that matures in a year only has to fall a little in price.

Now, in spite of the general tendency for short-term interest rates to be lower than long-term rates, there are some occasions where the yield curve becomes inverted. In other words, long-term rates are lower than short-term rates. By inverted -- in the context of mortgages -- we mean that 5-year rates are lower than prime. In the common usage of the term, it represents cases where yields (interest rates) on long-term Government bonds are lower than on short-term Treasury Bills. If and when this happens, it is quite likely that long-term mortgage rates will be lower than short-term (floating) rates, and the previously mentioned *spread* will be negative. But as one can see from Figure #3, this is a rare phenomenon.

In general, it is indicative of a situation where the central bank is implementing extremely tight monetary policy in order to fight actual or potential inflation. The central bank through its policy levers -- moving funds from the chartered banks to reduce their lending capabilities or by selling bonds to the public in exchange for money -- can actually decrease the money supply or just slow down the rate of growth of the money supply. However, these monetary instruments work chiefly on short-term funds leaving long-term rates relatively less affected. Thus, the so-called credit crunch is seen more at the short end of the yield curve than at the long end.

In the fifty-year period considered in this analysis, there have only been two major inversions of the yield curve in the zero to five-year range. These occurred in the period 1979-1982, the time of the second "oil shock" that was in response to the Iranian Revolution and again, in 1989 to 1991 when the Governor of the Bank of Canada, John Crow, instituted a "zero inflation" policy that required an extremely tight monetary policy. In both of these instances, the inversion was quite severe.

Today (late December 2000) the yield curve in the 1-to-5 year range is essentially flat. The Bank of Canada has tightened rates at the short end of the curve, but not by enough to invert the first five years of the curve very much. Some analysts had been concerned that the relatively low value of the Canadian dollar combined with the rise in word crude oil prices could precipitate inflation. In turn the Bank of Canada would have then felt obliged to extinguish it with much tighter monetary policy, especially if the United States Federal Reserve Board raised short-term US rates significantly. However, high rates of productivity growth in the United States, and to some extent in Canada, as well as crude oil prices falling precipitously from recent highs and the stiff competition from imported goods and services, have kept the lid on inflationary pressures. With the softening in the United States economy that seems to be happening, the expectation is that interest rates will now stabilize or even drop. If so, the normal rising yield curve should prevail.

Both the Canadian and United States economies have been experiencing an extremely long expansion phase. In other words, economic growth continues unabated without a downturn in output. Central banks have not had to step in and put on the brakes very hard in order to curtail excessive inflation by raising nominal interest rates a great deal. Consequently, there is no tendency for long-term rates (which we take to mean five years in our example) to be much lower than short-term rates. Moreover, given the continuing rapid pace of technological change, the lower prices of crude oil, the slowing of rates of growth of North American economies and the increased globalization, there is little likelihood that Shelly Short will pay more on her mortgage, compared to Linda Long. In fact, the norm will probably be lower short-term interest rates than long-term interest rates, which means that Shelly Short has the winning strategy.

Conclusion and Some Final Remarks

I believe that Canadian consumers are better off, on average, financing a mortgage with a short-term floating interest rate, compared to a long-term fixed rate. This conclusion on its own is not by any means original, since most financial commentators have stated this to be the case for a long time. My contribution is to *quantify* the benefit of the “floating” strategy by introducing and developing the concept of the Maturity Value of Savings (MVS) and the Total Months Saved (TMS). I have also developed a framework for evaluating the forward-looking probability of success in mortgage financing decision.

The MVS represents the time value of money-adjusted benefit from borrowing short versus long. It captures the *monetary* savings from borrowing at (floating) prime. The TMS captures the *time* savings from borrowing at (floating) prime. Both are legitimate measures of the savings that one receives by going short versus long, and more importantly, both point to the same conclusions.

Historically, during the period 1950-2000, the MVS was positive 88.6% of the time. On a $100,000 mortgage, the average magnitude of the Maturity Value of Savings was $22,210. On the flip side, a consumer would have lost money by borrowing at the prime rate, compared to the 5-year rate, only 11.4% of the time. At it's absolute worst, a consumer would have paid $40,000 more by borrowing at prime. However, as I argued in the previous section, the two periods of substantially negative MVS' were concentrated around unlikely economic scenarios. I believe that this type of severe yield curve inversion is not likely to occur in the future. In a similar manner, during the period 1970 - 2000, the TMS measure was positive 74% of the time and had an average of 18 months, and a median of 25 months.

To augment the historical analysis, I conducted extensive Monte Carlo computer simulations to estimate the probability distribution of future Maturity Value of Savings, given today's economic environment. Indeed, even with a (current) 50 basis point spread between the short (prime) rate and the long (5-year) rate, I conclude that a typical Canadian consumer will save between $10,000 and $12,000 on a $100,000 mortgage, if they borrow at prime, compared to the prevailing 5-year rate.

Of course, these results must be interpreted with a degree of caution. Here are some further issues you might want to consider when taking on a mortgage.

1. Financing under the short rate entails more volatility. Fluctuating payments can wreak havoc on tight budgets since it is quite possible that in any given month Shelly's floating mortgage payment might exceed Linda's fixed (5-year) payment. It is therefore very important that consumers be aware of the inherent cash-flow uncertainty that comes with this strategy and make absolutely sure that their monthly budget can in fact sustain this variability -- which is the long run will be rewarded. Personally, I would recommend floating rate loans for consumers that are refinancing a mortgage -- as opposed to first time homebuyers -- who already have substantial equity in their home.
2. The cyclical nature of economic cycles and interest rates dictate that when rates are high, compared to historical averages, they tend to move back down. Likewise, when rates are low, they tend to move back up. Indeed, with twenty-twenty hindsight it is trivial to identify December 1998 as having been a great time (at 6.6%) to lock-in 5-year mortgage rates, and September 1981 as a disastrous time (at 21.75%) for mortgages. Unfortunately, looking forward, it is extremely difficult to predict exactly when the cycle is over, and how low (or high) rates will still go. Therefore, I advise that consumers refrain from speculating on the future direction of interest rates, and instead focus on their budgeting ability to withstand fluctuating mortgage payments.
3. Financing a mortgage at the short (floating) rate endows the consumer with an option to lock-in future financing if they so desire. The reverse is not true. Consumers that borrow long, but decide to terminate (break) their mortgage in order to re-finance at lower costs, face 3-4 months of interest penalty. The lack of symmetry implies another reason for going short versus long.
4. The long-term mortgage rates posted by banks and other financial institutions are almost always negotiable. In some cases you might end up paying 1% (100 basis points) lower than the advertised number. This is a recent trend in mortgage financing, which casts some doubts on the relevance of documented mortgage rates during the last 5-10 years. This is important for two reasons. First, you have more

bargaining power than you think. And second, the savings from going 'short' versus 'long' might not be as high (nor as volatile) as they were in the past. However, after re-running the last 10 years of MVS numbers using a 75 basis point reduction in the posted 5-year rate, (which is equivalent, in financial terms, to at least a 4% mortgage bonus), I did not find any substantial difference in the results. See Table #6 for the results of the period and rate sensitivity analysis. Specifically, the historical probability of doing better with the floating rate mortgage, still hovered around 70% to 80%. The magnitude of savings was somewhat lower, at $18,065, since Linda was obviously not paying as much on her mortgage, but the benefit to Shelly was still there.

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<u>Table #1:</u> Detailed example of the calculation of the Maturity Value of Savings, assuming all savings are invested at the specified T.Bill rate for the year.

Table #1: **Calculation of The Maturity Value of Savings (MVS)**

Avg. T.Bill	Year #	Prime Rate	5yr Rate	Prime Payment	5yr Payment	*Short v. Long Total Savings* *(time-value adjusted)*
7.39%	1975	10.50%	11.80%	$1,105.4	$ 1,187.3	$ 1,017
8.86%	1976	9.75%		$1,061.5	$ 1,187.3	$ 2,684
7.33%	1977	9.25%		$1,034.3	$ 1,187.3	$ 4,787
8.67%	1978	8.25%		$ 984.0	$ 1,187.3	$ 7,758
11.68%	1979	12.00%		$1,165.3	$ 1,187.3	$ 8,993
12.79%	1980	15.00%	15.50%	$1,310.4	$ 1,427.7	$ 11,706
17.72%	1981	18.25%		$1,464.4	$ 1,427.7	$ 13,480
13.65%	1982	16.50%		$1,387.0	$ 1,427.7	$ 15,960
9.31%	1983	12.00%		$1,215.2	$ 1,427.7	$ 20,173
11.05%	1984	11.00%		$1,183.1	$ 1,427.7	$ 25,607
9.40%	1985	11.00%	12.25%	$1,183.1	$ 1,279.0	$ 29,322
8.97%	1986	11.00%		$1,183.1	$ 1,279.0	$ 33,262
8.14%	1987	9.25%		$1,153.4	$ 1,279.0	$ 37,638
9.48%	1988	9.75%		$1,159.2	$ 1,279.0	$ 42,868
12.05%	1989	12.25%		$1,174.6	$ 1,279.0	*$ 49,653 (MVS)*

Table #2: Detailed example of the calculation of the Maturity Value of Savings, assuming all savings are invested at a **zero interest rate**. This number collapses to the difference in interest paid on the mortgage, without accounting for the time value of money.

***Table #2*: Calculation of The Maturity Value of Savings (MVS)**

Year	Prime Rate	5yr Rate	Prime Payment	5yr Payment	*Short v. Long Total Savings*
1975	10.50%	11.80%	$ 1,105.4	$ 1,187.3	$ 983.2
1976	9.75%		$ 1,061.5	$ 1,187.3	$ 2,493.0
1977	9.25%		$ 1,034.3	$ 1,187.3	$ 4,329.8
1978	8.25%		$ 984.0	$ 1,187.3	$ 6,769.3
1979	12.00%		$ 1,165.3	$ 1,187.3	$ 7,033.8
1980	15.00%	15.50%	$ 1,310.4	$ 1,427.7	$ 8,441.6
1981	18.25%		$ 1,464.4	$ 1,427.7	$ 8,001.2
1982	16.50%		$ 1,387.0	$ 1,427.7	$ 8,490.1
1983	12.00%		$ 1,215.2	$ 1,427.7	$ 11,040.1
1984	11.00%		$ 1,183.1	$ 1,427.7	$ 13,975.2
1985	11.00%	12.25%	$ 1,183.1	$ 1,279.0	$ 15,126.0
1986	11.00%		$ 1,183.1	$ 1,279.0	$ 16,276.8
1987	9.25%		$ 1,153.4	$ 1,279.0	$ 17,784.3
1988	9.75%		$ 1,159.2	$ 1,279.0	$ 19,222.3
1989	12.25%		$ 1,174.6	$ 1,279.0	*$ 20,475.5 (MVS)*

Table 3: Distribution of Maturity Value of Savings (MVS)
1950 – 2000

How much would you have saved on a $100,000 mortgage at floating prime rates each year, compared with five year fixed rates, for a total term of 15 years? What was the likelihood of realizing a given level of savings, or a loss? The mortgages start each month from Jan. 1, 1950 to Jan. 1, 1985, and mature respectively each month from Jan. 1, 1965 to Dec. 31, 1999. The percentile is the probability that you would have earned (read: saved) less than the MVS shown to the right. For example, there is only a 20% chance you will save less than $13,690. In other words, 80% of the time, you will save more than $13,690.

Percentile	**MVS**
95%	**$59,380**
90	**50,894**
85	**42,220**
80	**36,669**
75	**29,865**
70	**26,839**
65	**25,012**
60	**23,598**
55	**21,404**
50	**19,916**
45	**18,993**
40	**17,758**
35	**16,694**
30	**15,932**
25	**15,107**
20	**13,690**
15	**11,351**
10	**(8,393)**
5	**(17,974)**

Table #4: *The Maturity Value of Savings: January 1965 - December 1999*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1965	$7,918	$8,125	$8,171	$9,237	$10,993	$11,334	$12,430	$12,795	$13,944	$14,336	$14,868	$15,110
1966	$14,986	$15,445	$15,266	$14,365	$14,962	$15,744	$15,958	$15,635	$15,347	$15,440	$15,580	$15,833
1967	$16,391	$16,483	$15,874	$14,750	$14,755	$15,348	$15,096	$14,624	$15,401	$15,301	$15,854	$16,095
1968	$15,971	$16,288	$16,057	$14,447	$14,376	$14,846	$14,542	$14,483	$15,658	$15,292	$15,748	$15,975
1969	$16,098	$16,352	$16,017	$14,958	$12,739	$12,990	$12,402	$11,355	$12,013	$12,021	$12,712	$13,006
1970	$12,941	$13,308	$13,290	$12,102	$12,066	$12,756	$13,221	$14,107	$14,632	$15,326	$16,469	$16,599
1971	$16,924	$17,507	$16,911	$16,129	$15,524	$17,374	$17,260	$17,230	$18,200	$18,636	$19,047	$19,075
1972	$19,083	$18,909	$17,719	$17,098	$16,888	$17,005	$16,384	$16,792	$16,813	$17,109	$17,749	$17,259
1973	$18,209	$17,925	$17,395	$16,510	$15,953	$16,879	$16,597	$18,185	$20,681	$20,780	$22,048	$21,720
1974	$21,868	$21,212	$21,035	$21,193	$20,514	$20,505	$19,632	$20,168	$19,892	$19,413	$20,377	$19,940
1975	$19,662	$19,330	$18,661	$18,674	$18,502	$18,920	$18,835	$19,471	$19,753	$19,827	$20,695	$19,630
1976	$19,665	$18,960	$18,647	$17,510	$16,008	$17,546	$17,793	$17,764	$17,844	$19,695	$21,134	$19,768
1977	$21,492	$21,157	$21,773	$22,297	$21,624	$20,785	$20,974	$21,856	$21,476	$21,264	$22,719	$21,295
1978	$23,672	$23,548	$23,678	$24,056	$22,976	$23,370	$25,058	$26,969	$27,593	$28,062	$29,996	$29,402
1979	$29,330	$27,099	$26,362	$25,901	$25,299	$24,118	$25,624	$26,802	$26,791	$27,893	$29,376	$27,876
1980	$27,008	$26,628	$23,913	$22,851	$22,133	$21,843	$23,991	$25,355	$24,852	$24,255	$24,987	$22,003
1981	$21,224	$19,319	$18,280	$16,584	$15,801	$16,745	$19,021	$18,245	$17,066	$20,961	$23,713	$20,224
1982	$24,618	$24,704	$25,960	$26,690	$26,509	$24,772	$25,465	$25,165	$24,303	$23,791	$28,588	$26,927
1983	$32,860	$35,414	$34,715	$36,035	$38,645	$40,247	$44,277	$47,102	$48,414	$51,771	$59,158	$56,853
1984	$59,593	$57,944	$59,380	$56,791	$50,512	$50,106	$50,412	$50,872	$51,089	$52,579	$55,184	$51,161
1985	$49,384	$49,461	$44,587	$40,240	$42,779	$42,199	$44,648	$46,484	$42,203	$36,588	$30,573	$21,345
1986	$19,747	$19,834	$18,511	$12,493	$14,696	$15,881	$14,219	$8,795	$1,911	($3,704)	($2,537)	($9,065)
1987	($11,777)	($8,231)	($9,544)	($15,939)	($14,709)	($14,945)	($13,017)	($12,242)	($11,856)	($13,620)	($8,381)	($13,514)
1988	($13,318)	($8,505)	($10,297)	($6,041)	$7,027	$9,602	$12,972	$18,218	$22,113	$28,154	$39,359	$24,464
1989	$22,687	$25,081	$26,240	$29,719	$10,844	$13,785	$19,462	$24,340	$33,461	$37,676	$38,793	$38,460
1990	$34,569	$35,052	$33,922	$39,386	$54,669	$55,986	$64,041	$74,733	$75,210	$56,547	$41,569	$28,548
1991	$26,101	$23,154	$18,145	$16,307	$25,504	$26,006	$22,781	$12,056	$7,232	($8,362)	($12,025)	($22,106)
1992	($30,367)	($33,135)	($38,008)	($41,937)	($36,070)	($41,160)	($37,047)	($35,249)	($31,776)	($35,242)	($29,115)	($35,349)
1993	($38,094)	($40,956)	($39,260)	($40,452)	($26,710)	($28,930)	($23,930)	($22,150)	($14,057)	$1,873	$19,188	($8,685)
1994	($11,669)	$11,863	$28,453	$37,439	($10,050)	($17,757)	($8,550)	($3,449)	$10,592	$24,630	$31,114	$30,220
1995	$27,740	$24,887	$28,396	$39,865	$54,047	$53,451	$69,112	$91,053	$99,854	$88,037	$64,954	$67,193
1996	$80,412	$85,772	$81,433	$90,501	$92,786	$89,207	$83,240	$76,511	$69,576	$54,612	$45,623	$51,546
1997	$37,876	$32,152	$27,687	$29,821	$28,828	$26,663	$34,188	$44,065	$35,489	$31,493	$26,103	$30,922
1998	$30,226	$23,969	$37,519	$43,737	$53,326	$53,048	$59,383	$48,372	$42,317	$41,509	$36,657	$37,271
1999	$24,014	$37,595	$43,829	$53,447	$53,160	$59,511	$48,466	$42,391	$41,582	$36,719	$37,323	$35,148

Table #5: ***Total Months Saved (TMS):*** the data represent the total months saved by borrowing at prime versus the 5-year rate. The year and month correspond to the maturity of the 15 years. For example, if Linda and Shelly took out a $100,000 mortgage in January 1970, Linda would have paid-off her mortgage by January 1985, while Shelly would have paid off her mortgage 38 months earlier (i.e. November 1981). In contrast, if Linda and Shelly took out a $100,000 mortgage in January 1972, Linda would have paid-off her mortgage by January 1987, while Shelly would have paid off her mortgage 11 months later (i.e. December 1987).

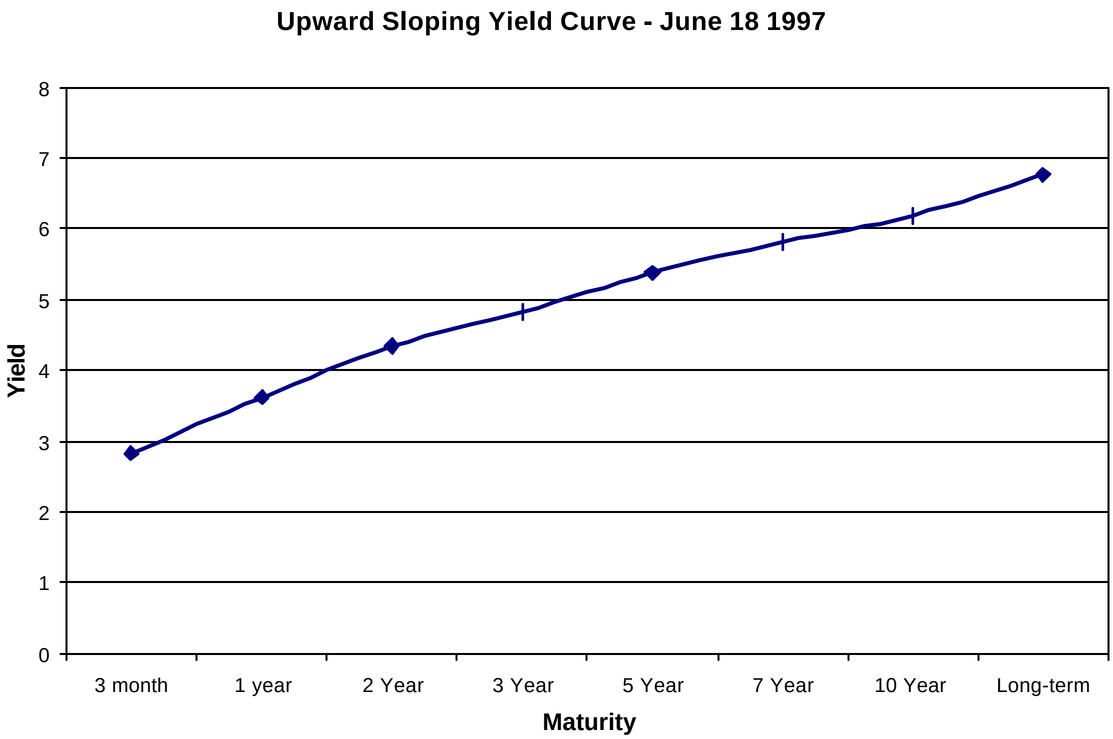
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1984	44.9	43.0	43.4	41.9	40.3	40.1	39.9	40.1	39.4	40.0	41.0	39.0
1985	38.0	37.6	34.6	31.4	31.8	31.6	32.4	32.6	29.8	27.3	24.1	18.0
1986	16.4	16.3	15.5	10.8	12.2	13.1	11.9	7.7	1.9	-3.0	-1.8	-8.2
1987	-11.2	-7.8	-9.1	-16.2	-15.1	-15.7	-13.4	-12.6	-12.1	-13.8	-8.1	-13.6
1988	-13.3	-8.3	-10.1	-5.4	6.2	8.5	10.9	15.4	18.3	22.3	29.5	20.2
1989	19.0	20.1	20.5	22.9	9.5	12.3	16.6	20.2	26.3	28.7	29.0	28.9
1990	26.2	26.9	26.2	29.7	38.5	39.1	43.1	48.1	48.1	38.3	30.3	21.8
1991	19.9	17.8	13.9	11.8	18.7	18.9	16.6	7.9	4.1	-10.0	-13.1	-23.8
1992	-32.7	-37.0	-44.5	-49.7	-41.5	-49.8	-43.8	-41.2	-36.4	-40.4	-32.3	-39.3
1993	-42.6	-47.4	-45.9	-47.5	-30.6	-34.5	-28.8	-26.3	-16.6	-0.1	16.3	-10.2
1994	-13.1	8.6	22.2	28.6	-12.1	-20.7	-10.9	-5.9	7.6	19.8	25.9	24.3
1995	22.4	20.6	24.0	33.6	43.9	43.2	53.7	67.3	72.6	66.8	54.1	55.1
1996	64.4	68.9	66.4	71.1	71.9	70.4	67.7	63.7	59.1	48.3	41.6	45.4
1997	34.8	30.5	27.6	29.5	28.2	26.4	32.5	40.3	33.4	30.1	26.0	30.0
1998	29.7	23.9	34.8	39.7	47.3	46.1	50.3	42.5	37.9	37.4	33.6	33.3
1999	31.3	37.4	39.9	39.0	39.7	34.2	35.8	33.0	32.2	32.8	30.2	28.5

Table #6 Displays the average Maturity Value of Savings (MVS) for various sub-periods. As a comparison, the table also presents the average MVS *assuming* the posted 5-year fixed mortgage rate had been hypothetically reduced by 75 basis points during the last ten years.

	1965-2000	$ 22,210	
	1970-2000	$ 23,534	
	1975-2000	$ 23,534	
	1980-2000	$ 24,727	
	1985-2000	$ 25,309	
	1990-2000	$ 22,659	
	1965*-2000*	$18,065	

* Assuming a 75 b.p. reduction in 5-year rates during the last decade.

Figure 1a. ***An Example of An Upward Sloping Yield Curve***



<u>Figure 1b.</u> ***An Example of A Downward Sloping Yield Curve***

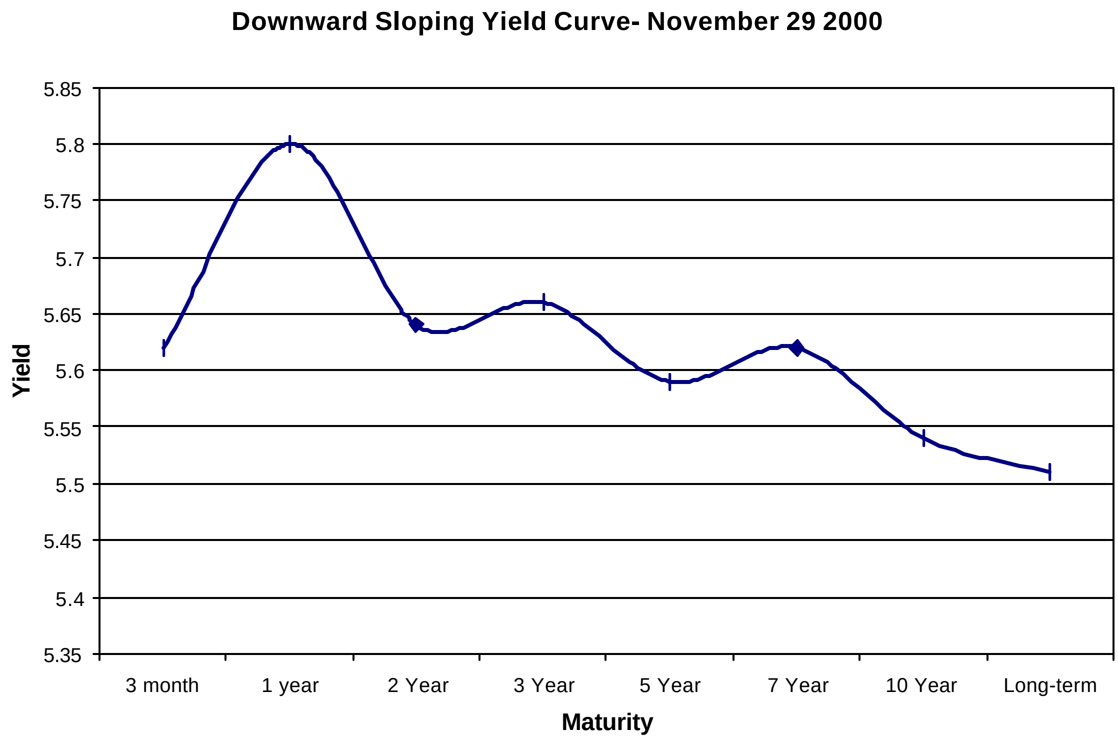


Figure 1c. ***An Example of A (Relatively) Flat Yield Curve*.**

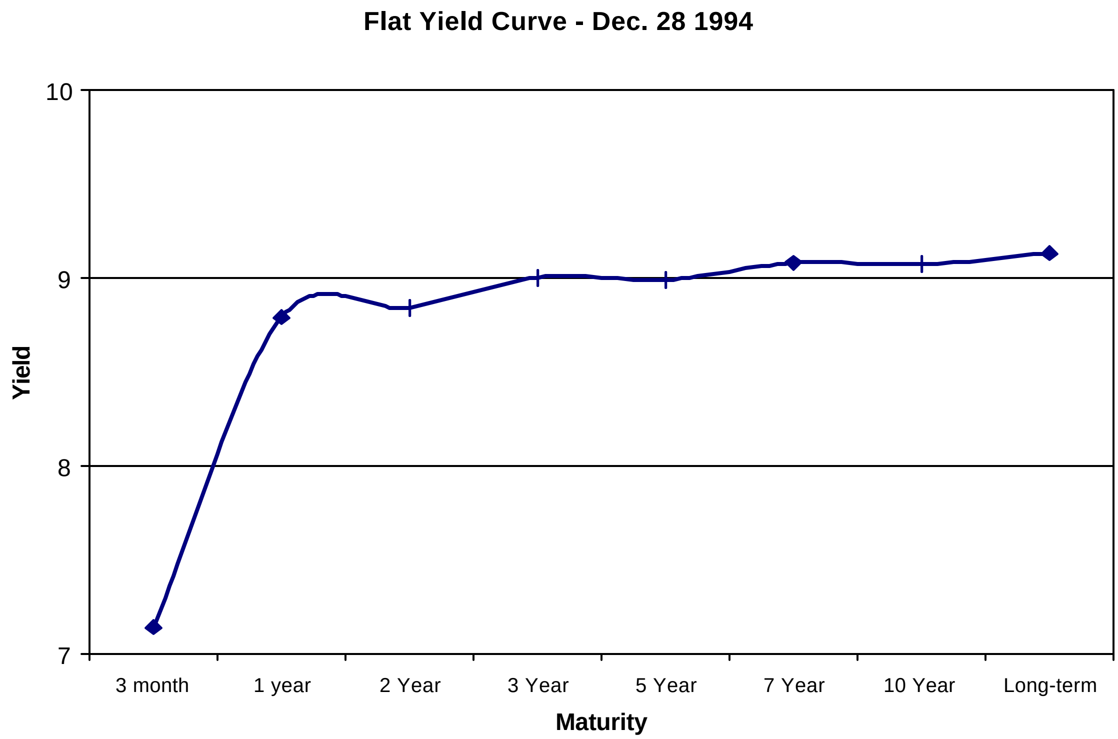


Figure #2: Mortgage Rates during the last 50 years: 5-year rate vs. Prime rate.

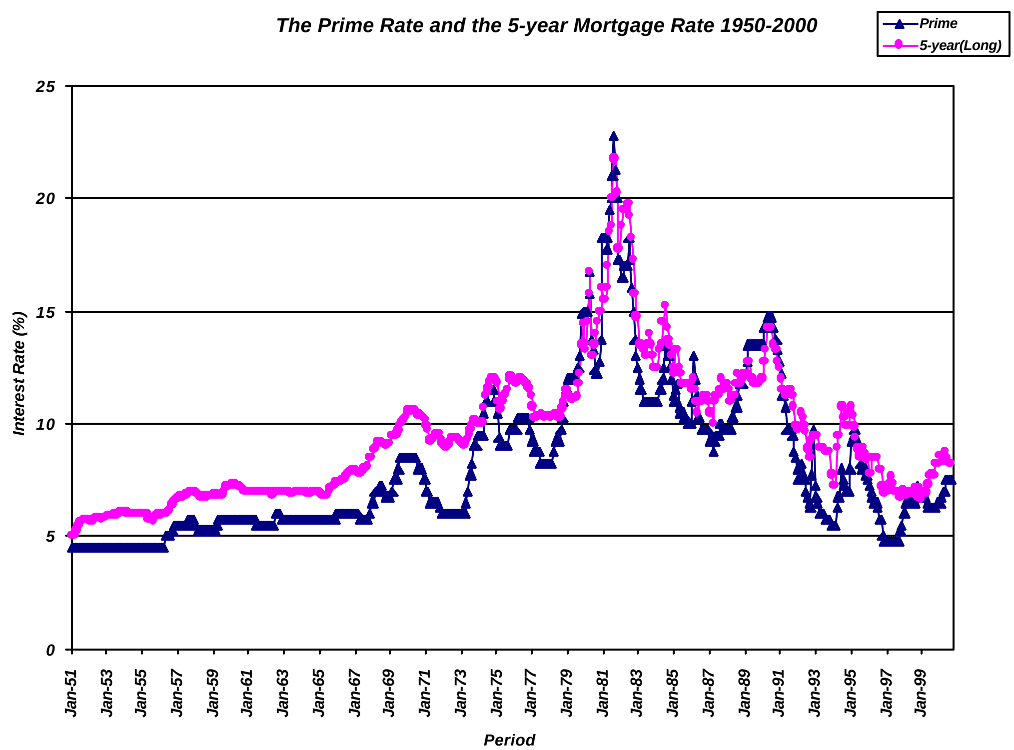


Figure #3: Mortgage Rates during the last 50 years: 5-year rate minus the Prime rate.

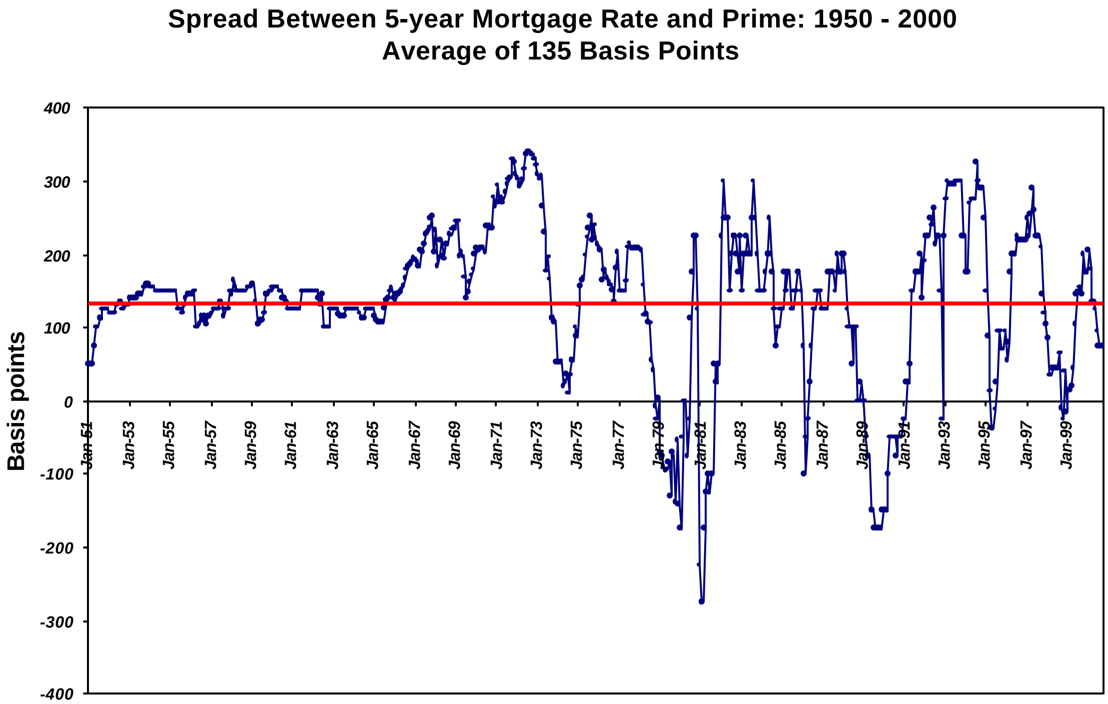


Figure #4:

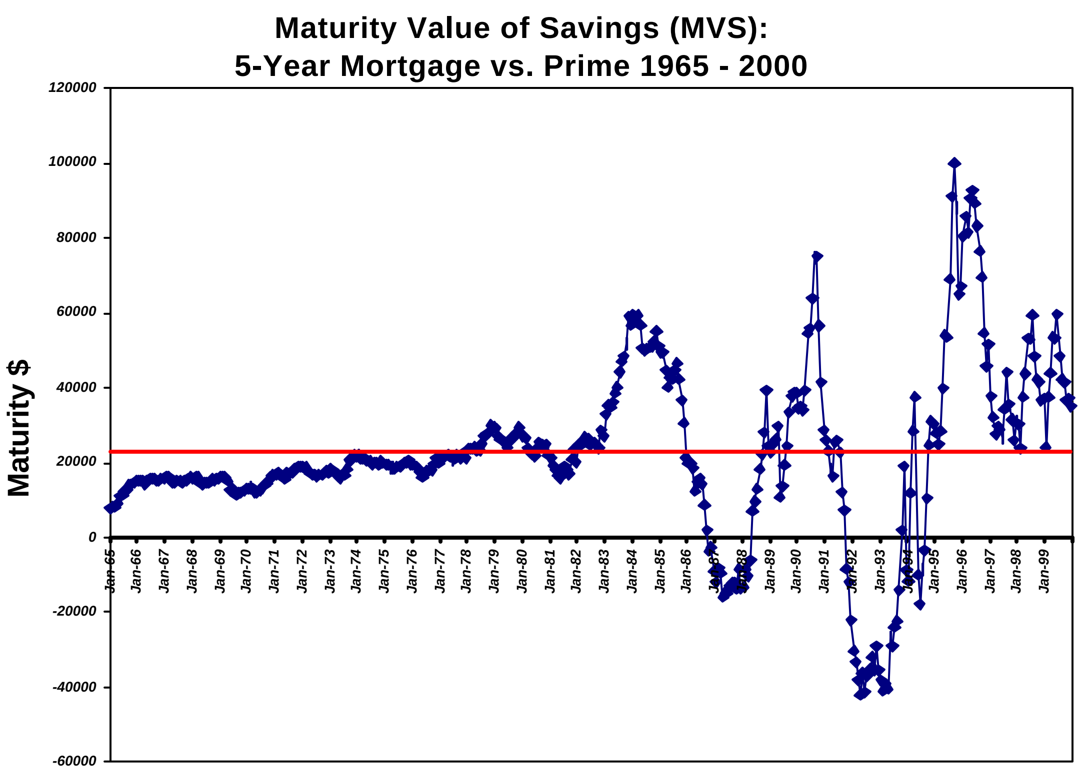

Maturity Value of Savings (MVS):
5-Year Mortgage vs. Prime 1965 - 2000
Maturity $
120000
100000
80000
60000
40000
20000
0
-20000
-40000
-60000
Jan-65
Jan-66
Jan-67
Jan-68
Jan-69
Jan-70
Jan-71
Jan-72
Jan-73
Jan-74
Jan-75
Jan-76
Jan-77
Jan-78
Jan-79
Jan-80
Jan-81
Jan-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-89
Jan-90
Jan-91
Jan-93
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99

Figure #5: How close is the prime rate to the 1-year mortgage rate?

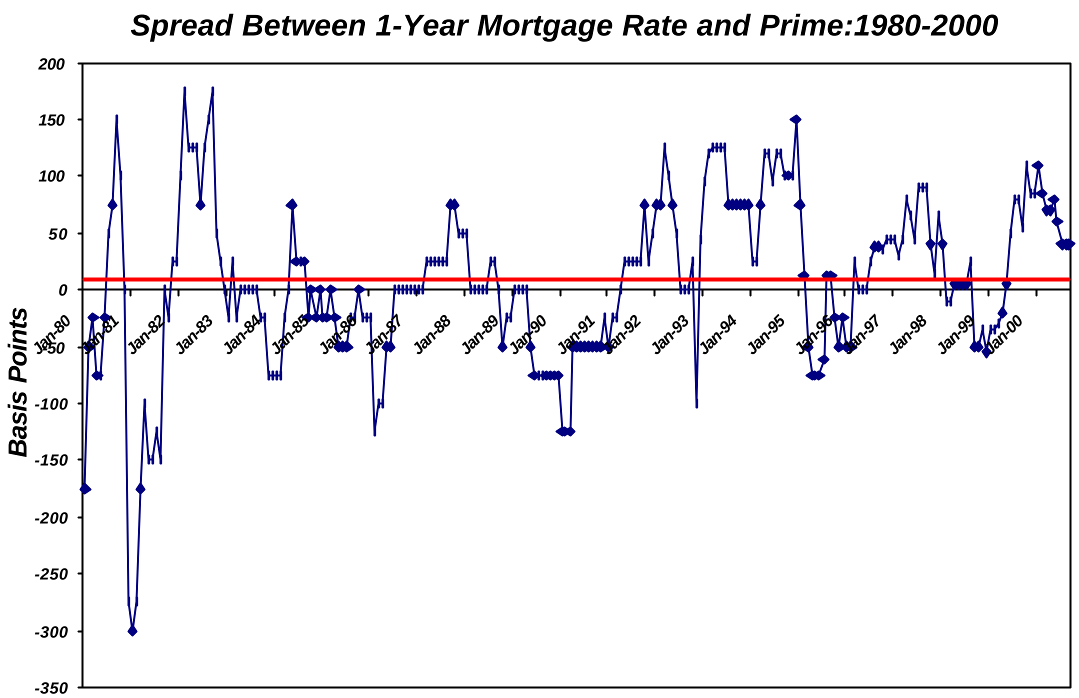


Figure #6: The Histogram of the Total Months Saved (TMS) When Borrowing Short Versus Long.