The "Hairy" Premium

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Abstract

In this study, we show that the market tends to consistently overestimate the trajectory of spot interest rates, leading to profitable opportunities. We introduce a new metric called the "Hairy" premium to quantify this phenomenon. For a 10-year horizon, for instance, the "Hairy" premium can range between a maximum of 4.75% and a minimum of non-negative 1% per annum for borrowers who pay it to access fixed-rate debts or investors who receive it to access fixed-rate assets. Borrowers, such as households and corporations who opt for floating-rate debt, generally save more money and face lower mark-to-market volatility than those who choose fixed-rate debt, except during very rare monetary tightening cycles when they are at least breaking even. Conversely, investors, such as banks, who choose fixed-rate assets, receive better returns by earning the "Hairy" premium, except for just before sharp monetary policy tightening cycles when the "Hairy" premium is squeezed and there is a risk of significant mark-to-market loss. We also reveal an asymmetric risk-reward profile in terms of magnitudes: if floating debt is the right choice, the benefit is significant; however, if floating debt is the wrong choice, the loss is small and the longer the term of the debt, the more likely it is that floating interest rates will save money for borrowers. The findings in the study are particularly relevant to the recent collapse and subsequent rescue of the major SVB Bank, which was primarily caused by ignoring the "Hairy" premium and the interim mark-to-market volatility effect from investing in fixed-rate assets financed by floating-rate liabilities.

JEL classification: E4, E52, G1, G2, G5, H63

Keywords: Hairy premium, Fixed interest rates, Floating interest rates, Mark-to-market

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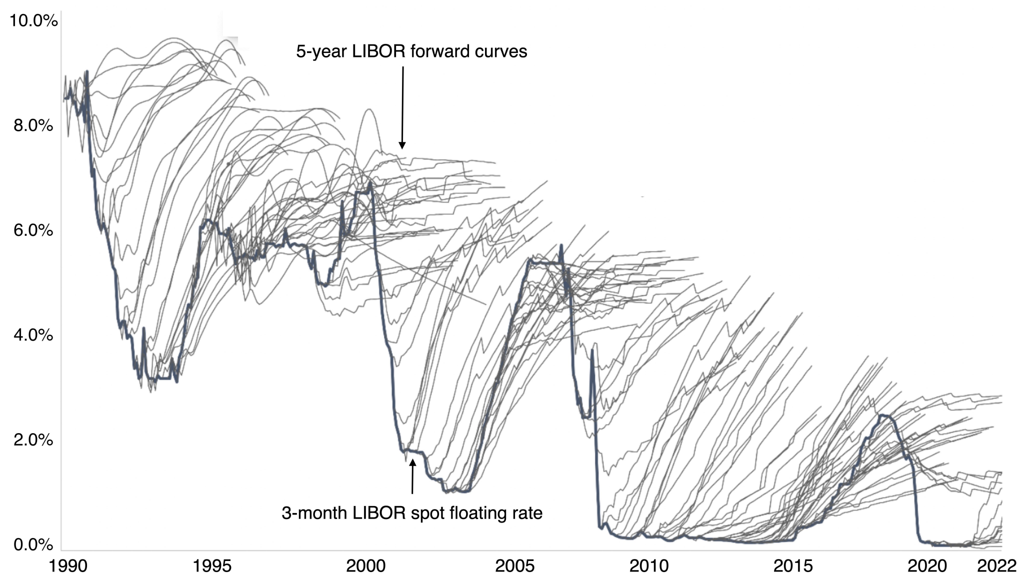
1 Introduction

Interest rates are a critical variable for both borrowers and investors, and the choice between fixed-rate and floating-rate debt or investment can significantly impact returns. For instance, borrowers and investors, such as households, banks, corporations, and sovereigns, rely on forward curves to estimate the interest rates they will be required to pay or receive for the duration of their project. Figure 1, "Hairy Graph", illustrates the degree of accuracy with which the market can anticipate floating interest rates over the next five years at any given point in time.[1]

Figure 1: The "Hairy" Graph



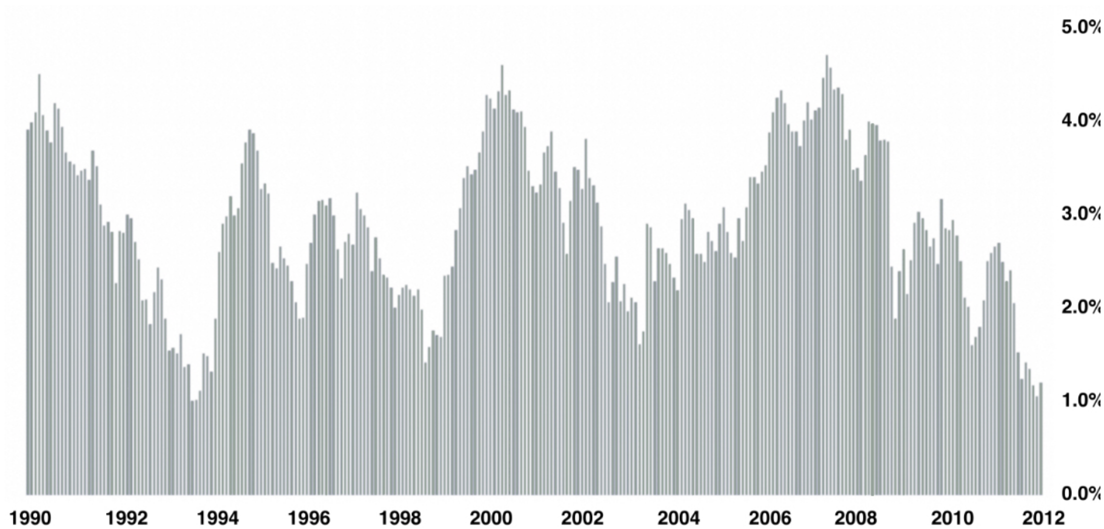
The blue line represents the floating spot rate, three-month LIBOR, while the grey lines represent the floating rate forward curves, which depict the market-predicted trajectory of the floating rate over the next five years. It is clear the market consistently overestimates the trajectory of the floating rate. When the market underestimates the trajectory of the floating rate, it usually does

[1] Note that we are referring to any interest rate, including Fed Funds, LIBOR, SOFR, etc., when we use the term "floating rates." In this study, we don't favor any particular interest rate since we focus on comparing the difference between the fixed and floating rates of the same interest rate. The different interest rates are also largely interchangeable since they are all used when borrowing and investing and they are all primarily controlled by the FOMC monetary policy.

so preceding and during periods of monetary policy tightening, when interest rates are sharply raised, which are disproportionately rare in the data.

We develop a metric, which we name the “Hairy” premium, to quantify the magnitude of this overestimation of the floating rate’s trajectory. We calculate it simply by measuring the annual cost of being in a fixed rate minus the average “effective” cost of being in a floating rate over the specified period. Figure 2, for example, depicts the ”Hairy” premium for the 10-year horizon.[2]

Figure 2: The “Hairy” Premium to Fix for 10-Year Tenor



Since the 1990s the maximum ”Hairy” premium paid (received) by borrowers (investors) for being fixed has been 4.75% per year for the next 10 years, while the minimum ”Hairy” premium” has been 1%, with no instances of being negative. Thus, over a 10-year horizon, a borrower (investor) will always be better off staying in floating (fixed) rates by as much as the ”Hairy” premium annually.

In this paper, we quantify the aforementioned ”Hairy” premium at multiple maturity horizons. We demonstrate that because long-term fixed interest rates are typically higher than spot interest rates due to the prevalent upward sloping term structure, this results in higher and overshooting

[2]The “Hairy” premium is equal to the difference between the 10-year fixed rate and the average effective floating rate over the next 10 years.

forward curves, giving rise to the so-called "Hairy" premium. Consequently, borrowers (investors) consistently incur (receive) this premium as a cost (profit) if they fix their interest rates.

Our study also reveals an asymmetric risk-reward profile in terms of magnitudes. For instance, for borrowers, if being in floating debt is the right choice, then the benefit is significant. However, if being in floating debt is the wrong choice, the loss is small. This finding is consistent with the literature highlighting the importance of analyzing individual circumstances and risk tolerance when choosing between fixed- and floating-rate instruments.

We also document the importance of the term of the debt. For instance, for the borrower, the longer the term of the debt, the more likely it is that floating interest rates will save money for the borrowers relative to the fixed-rate alternative. This result suggests that borrowers with a longer-term horizon may benefit more from choosing floating-rate debt than those with shorter-term horizons. Surprisingly, this finding is not consistent with the suggestion that longer-term debt exposes borrowers to greater interest rate risk because it suggests that the flexibility offered by floating-rate instruments is more valuable than hedging the interest rate risk. This is because it is suited to the longer term due to fixing the interest rates, so longer-term debt makes floating-rate instruments more valuable for borrowers.

One of the fundamental decisions that borrowers and investors must make is whether to lock in a fixed interest rate or opt for a floating interest rate that may change over time. This decision may be heavily influenced by the agents' risk aversion in the face of volatile interest rates. A borrower benefits from fixing floating interest rates because of payment predictability, protection against interest rate hikes, and lower risk, which is particularly beneficial for risk-averse borrowers who prefer a stable payment plan. On the other hand, for a borrower the risks of fixing include missing out on falling interest rate opportunities, paying more to refinance their loans in a falling interest rate environment, and having limited flexibility to pay off the loan early or make additional payments due to penalties or restrictions that they would not face with a floating interest rate debt. Another risk for corporations and banks that are borrowing is that they face mark-to-market volatility on their fixed-rate loans, whereas floating-rate loans are always marked at par; floating-rate loans offer no risk in terms of interim interest rate mark-to-market volatility.

An investor, on the other hand, benefits from fixed interest rates because of the certainty of cash-flows and protection against interest rate fluctuations. Nonetheless, this comes with risks, such as early withdrawal penalties, inflation risk, and missed opportunity for higher returns if floating interest rates rise. Due to the existence of the “Hairy” premium, it can be concluded that what is a benefit to a debt borrower is a loss to a debt investor; that is, if the borrower pays the ”Hairy” premium, the investor receives it. Thus, if a floating-rate debt is always better for the borrower, a fixed-rate debt investment asset must always be better for the investor.

Our analysis further investigates this and exposes situations where investors in fixed-rate assets could be at significant risk of loss. Only looking at whether the fixed rate is higher than the floating rate to fix the asset rate fails to fully consider the extent of potential loss and gain because it only considers immediate cash flows. Instead, accounting for the ”Hairy” premium, which considers all future cash flows but assumes the investor holds the investment until maturity, or factoring in the interim mark-to-market valuations of the fixed asset prices, provides a more accurate depiction of the risk-reward trade-off of investing in fixed assets.

As an example, while the ”Hairy” premium is consistently positive with a maturity horizon beyond 10 years, indicating profit opportunities for fixed-rate asset investors, it can become negative for shorter maturities, such as five years, in rare instances of monetary policy tightening. In such cases, fixed-rate investors may incur losses despite the fixed rate being higher than the floating rate at that moment in time. When the ”Hairy” premium is squeezed in this manner, we also observe a significant negative impact on the mark-to-market valuation of fixed assets in a leveraged manner with a magnitude relative to the asset's duration. Therefore, in this regard, the "Hairy" premium and the mark-to-market valuation move in the same direction and seem to capture the same risk factor, but the former is simpler to implement and compute for sensitivity analysis in asset-liability management (ALM).

The above finding particularly pertains to the recent collapse of Silicon Valley Bank (SVB) on March 10, 2023, and the subsequent bailout. SVB was the 16th largest bank in the U.S., with some $209 billion in assets as of Dec 31, 2002, and this was the second biggest bank failure in U.S. history (Michaels, 2023). One of the primary reasons for the bank's failure was its significant exposure to fixed-rate assets, which mainly consisted of government bonds, and the fact that it financed these assets with floating-rate liabilities such as deposits. This strategy enabled the bank to earn a positive difference between fixed and floating interest rates as a profit from an immediate cashflow perspective, and it was generating profits on average. However, the bank faced a problem when the Fed tightened its monetary policy, causing interest rates to rise. As a result, both the "Hairy" premium profit collapsed and the mark-to-market value of the fixed-rate assets on the bank's balance sheet decreased sharply due to the duration-scaled leverage. Conversely, the mark-to-market on the deposit side of the balance sheet remained the same, par, since they were in floating interest rates. This resulted in SVB becoming illiquid in terms of cashflow liquidity and insolvent due to the falling mark-to-market value of its fixed-rate assets, which eroded its capital to the point of failure.

In summary, our study contributes new insights to the existing literature by examining how the market perceives the trajectory of interest rates and how this perception affects borrowers and investors with fixed- versus floating-rate debts and assets in terms of cashflows and mark-to-market volatility. Our findings suggest that the market tends to overestimate the trajectory of spot interest rates, resulting in a "Hairy" premium, which impacts borrowers and investors with fixed-rate debts and assets differently and asymmetrically. We also highlight the importance of timing, risk tolerance assessment, and careful consideration of the optimal term of the debt when making financial decisions. These findings have significant implications for households, banks, and corporations when deciding between fixed and floating-rate debts and assets, as well as for policymakers evaluating the effectiveness of monetary policy.

2 Related Literature

This study is broadly related to several streams of literature that explore borrowing and investing in fixed versus floating interest rate financial instruments and consider the interaction of interest rates with credit spreads, equity returns or other factors having an impact on agent outcomes. These studies approach the subject from various perspectives and examine the outcomes of the interest rate types that firms and individuals use to manage their interest rate exposure.

Bicksler and Chen (1986) find that firms that finance long-term fixed-rate assets with short-term floating-rate liabilities lose when short-term interest rates in the market rise unexpectedly. This is relevant to the recent failure of SVB Bank, which is being bailed out by the U.S. government. Duffie and Liu (2001) find that credit spreads on floating-rate debt are larger than spreads on fixed-rate debt. This suggests that issuers of floating-rate debt may be charged a premium for the flexibility offered by these instruments. Longstaff and Schwartz (1995) further find that credit spreads are negatively related to interest rates, while Titman (1992) finds that firms that expect their credit quality to improve borrow in the short-term and use swaps to hedge interest rate risk.

Looking at the demand side of floating-rate debt, Faulkender (2001) finds that firms are hedging or timing the market when selecting the interest rate exposure of their new debt issuances, while Morellec, Valta, and Zhdanov (2012) find that firms with more growth options, with higher bargaining power in default, operating in more competitive product markets, and facing lower credit supply are more likely to issue bonds. Smithson and Wakeman (1988) find that positive covariance between real interest rates and real income and real asset values shifts preference toward adjustable loan contracts. This suggests that borrowers prefer adjustable loan contracts when interest rates and asset values are expected to rise, as they provide more flexibility in managing interest rate exposure. Turning to the maturity of debt, Fenn, Post, and Sharpe (1996) finds that those who avoid using swaps because of "transaction costs" issue less short-term debt than swap-users.

Regarding borrower characteristics, Goldberg and Heuson (1992) find that factors related to borrower, lender, and market characteristics are significant determinants of the equilibrium proportion of variable rate credit origin, highlighting the importance of considering multiple factors when analyzing the demand for variable rate credit; this is an important consideration for both lenders and borrowers. Similarly, for households, P. Blacklow and G. Wells (2010) and Dhillon, Shilling, and Sirmans (1987) find that borrower characteristics, such as income and capital risk, determine the choice between fixed- and flexible-rate mortgages.

Turning to the effect of the choice of interest rate management strategy on agent outcomes, Oberoi (2018) finds that firms that issue more fixed-rate debt have higher liquidity ratios and lower operating income ratios. This finding suggests that firms that issue more fixed-rate debt are more conservative in their financial management and better positioned to deal with changes in interest rates. However, this may come at a cost, as these firms can miss out on opportunities for growth and investment. Similarly, Samant (1996) finds that fixed-rate payers are more leveraged and more profitable, they have more growth options, less operating risk, lower ratios of fixed to total assets, and more divergent earnings estimates. Scott and Peterson (1986) find that the equity values of unhedged financial institutions are more sensitive to interest rate changes than the equity values of financial institutions that more closely balance the maturities of their assets and liabilities. This suggests that hedging interest rate risk can help to reduce volatility in equity values, which is important for financial institutions and their investors.

Memmel (2011) finds that changes in banks' market value and in their net interest income are highly correlated, irrespective of the banks' portfolio composition. Elijah Brewer, W. Jackson, and J. Moser (2001) find that the accounting and stock market characteristics of banking organizations that use derivatives are different from those that do not. They further suggest that banking organizations that use derivatives to manage interest rate risk hold lower levels of (expensive) capital than other institutions. This suggests that derivative usage (and interest rate risk management in general) allows banks to substitute (inexpensive) risk management for (expensive) capital. Their results also strongly suggest that large banks are far more likely than small banks to use interest rate derivatives and derivative users overall tend to have less systematic risk than non-users, meaning that interest rate derivative users are less risky than non-users.

Other notable studies contribute their findings by looking at the relationship between credit spreads and interest rates, the effects of interest rate policy choice on equity and other debt (Yang, Davis, and Leatham, 2001), and the importance of macroeconomic (Carmichael and Handford, 2014) and other factors (Kang and Long, 2001) in determining fixed-rate versus floating borrowing behavior. Several studies also suggest that fixed-rate payers generally have lower credit ratings, higher leverage ratios and higher percentages of long-term floating-rate loans, and they note that the use of interest rate swaps may help firms to reduce default risk and finance new capital investments (Li and Mao, 2002). Ho and Saunders (1983) show that the bank transforms fixed-rate loans commitment risk through a combination of financial future contracts in both interest rate and stock index and a reservation fee.

3 Empirical Analysis

3.1 Data

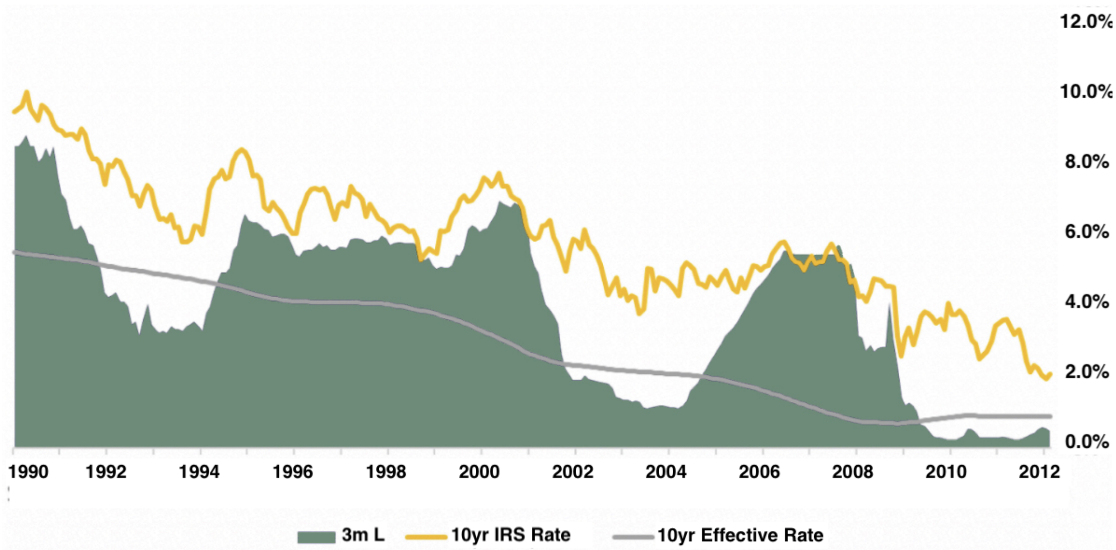
We focus on the U.S. interest rate market. The sample period is from January 1, 1990, to December 31, 2022, covering the Russian, the GFC and the COVID-19 crises, as well as the periods in between. We obtain daily data on 3-month LIBOR, OIS, SOFR floating rates and 2-, 5-, 10-, 20-, and 30-year interest rate swap rates (IRS) from Bloomberg. Appendix A.1 provides summary statistics and further information regarding data sources.

3.2 How Hairy is the "Hairy" Premium?

On a cashflow basis, the savings (costs) of being in a floating rather than a fixed interest paying debt (asset) are substantial for a borrower (investor) in the long run. The analysis below quantifies the historical difference between fixed and floating rates for a couple of maturity horizons. For example, the following Figure 3 helps quantify the cost (profit) borrowers paid (investors received) over the 10-year term by fixing the rate. We use interest rate swap (IRS) rates to represent the fixed rate (gold line) and LIBOR rates to represent the floating rate (green). The crucial line on the graph is grey, representing the historical average of the floating rate over the next 10 years, called the (average) "effective rate". This is the amount of annual interest the borrower (investor) would have paid (received) over the next 10 years if they had opted for a floating rate instead of a fixed rate. Thus, if the grey line is above the gold line, the borrower (investor) would have been better (worse) off from locking in a fixed rate on that day, as opposed to having a floating rate.

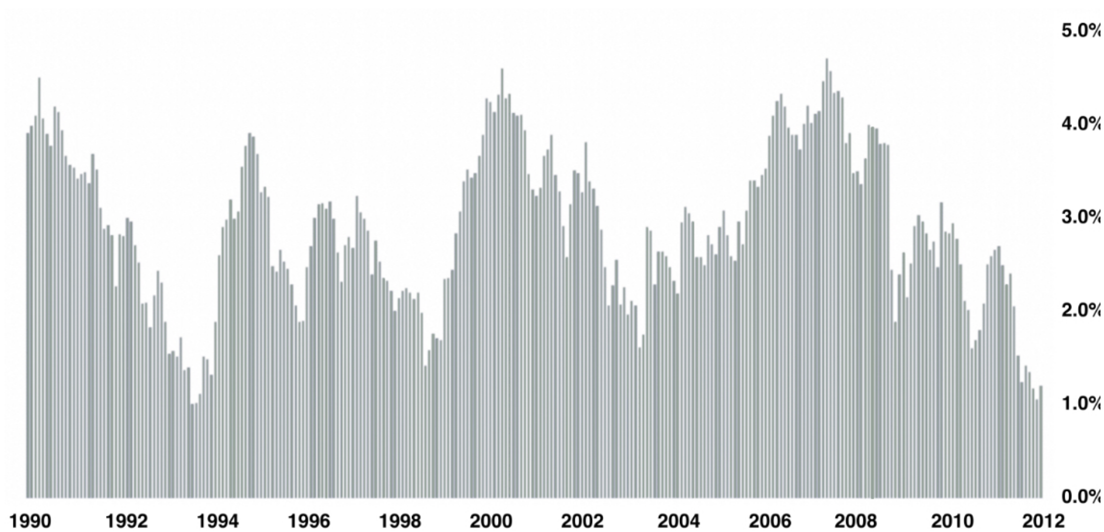
It is clear that fixing the rate has never been less expensive for a borrower, as the grey line is never above the gold in the decades examined in this Figure 3. On the other hand, fixing the rate has always been profitable for investors. This is further illustrated in Figure 4, which depicts the difference between the 10-year fixed rate and the 10-year effective rate (the difference between the

Figure 3: 10-Year Tenor - Fixed vs. Floating



gold and grey lines), which is our defined "Hairy" premium metric.

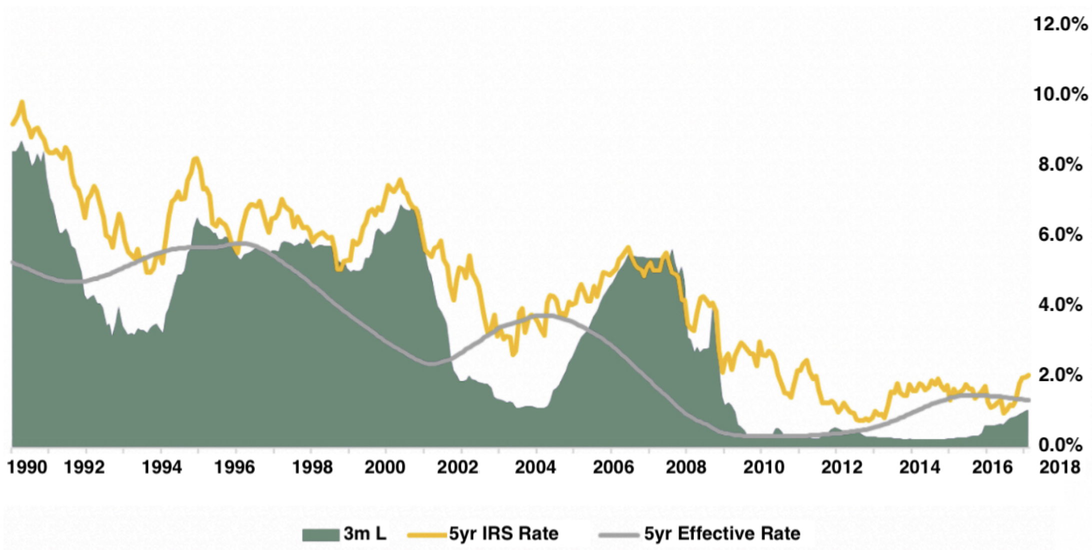
Figure 4: The “Hairy” Premium to Fix for 10-Year Tenor



It is also particularly notable that, from the 1990s onwards, the minimum "Hairy" premium was a non-negative 1% annually, while the maximum was 4.75% annually over the next 10 years, with no single instance of being negative, which would be a loss (gain) for a borrower (investor) if they were paying (receiving) a fixed (floating) rate.

Rerunning the above analysis for the five-year maturity horizon yields the same result, with the exception that there is now a small chance of 10% rather than 0% of the time that it is better for the borrower (investor) to fix (not fix) the rate of the debt (asset), as shown in Figure 5.

Figure 5: Five-Year Tenor - Fixed vs. Floating

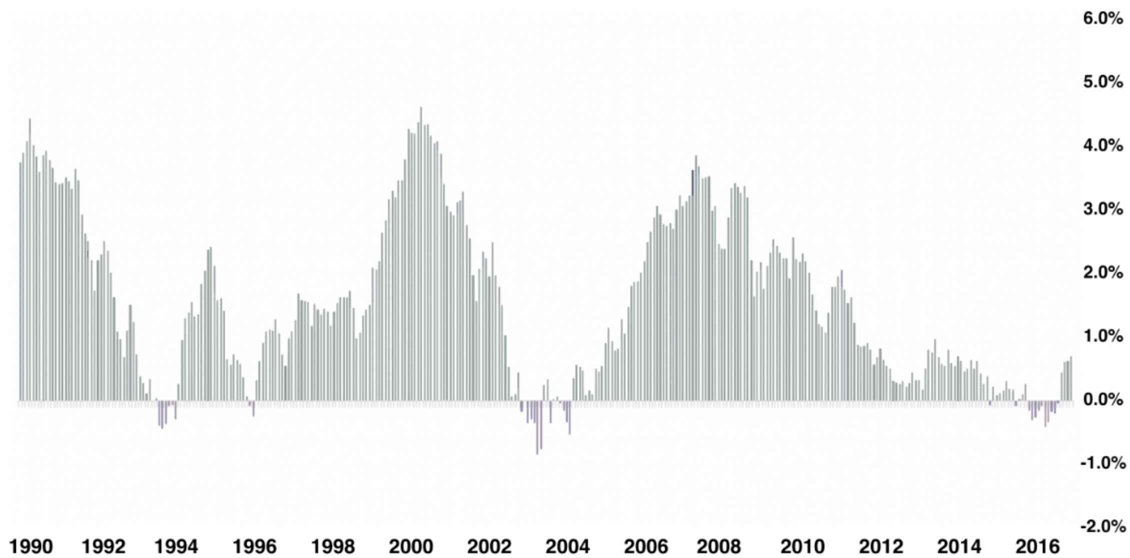


The minimum "Hairy" premium is now a negative -1% annually, while the maximum is 4.75% annually over the next five years, as shown in Figure 6. This means that if a borrower had chosen to fix the rate on their five-year debt, they would have had a 10% chance of overpaying by 1% annually, and a 90% chance of saving an impressive 4.75% annually over the next five years. The cashflows of the investor are the inverse.

The evidence presented above suggests that the risk-reward of floating versus fixed interest rates is asymmetric. For borrowers (investors), when it is right to be in a floating (fixed) rate, the savings are an impressive 4.80% per year, whereas when it is wrong to be in floating (fixed) rate, the costs are only -0.95% per year.

The longer the term, the more the forward curves overshoot the spot interest rate and the higher the likelihood that the borrower (investor) will save (lose) money by choosing floating interest rates

Figure 6: The “Hairy” Premium to Fix for Five-Year Tenor



over the fixed-rate alternative.

To illustrate what the ”Hairy” premium suggests, we consider two scenarios: one in which a borrower is breaking even, and one in which a borrower saves money by choosing a floating rate. Let’s examine Figure 5. For example, in 1996, all three lines converge at 5.90% and the green shade indicates that 3m LIBOR was also 5.90%. The gold line represents the fixed rate that a borrower could have switched to – a fixed rate for five years at 5.90% – while the gray line indicates that if a borrower opted to stay with the floating rate, the interest rate would have averaged 5.90% over the next five years (ending in 2001). Therefore, in 1996, no matter if the borrower chose to remain floating or switch to a fixed rate, they would have paid the same 5.90% interest rate for the next five years. Consequently, whether the borrower remained floating or switched to fixed in 2006, they would still have paid 5.90% for the next five years.

As a contrast, let’s consider another period, such as mid-2007. The green shade in Figure 5 shows that 3m LIBOR was around 5.70%. The gold line shows that a borrower could have switched to a fixed rate for five years at 5.00%, while the gray line shows that if the borrower remained floating, the interest rate would have averaged 1.50% annually over the next five years (ending in mid-2012). In this case, the borrower must have faced a difficult decision because the fixed rate was lower than the floating rate. If they had opted to stay floating, they would have paid an average effective interest rate of only 1.50% annually over the next five years because the Federal Reserve dramatically reduced rates during the Great Financial Crisis (GFC).

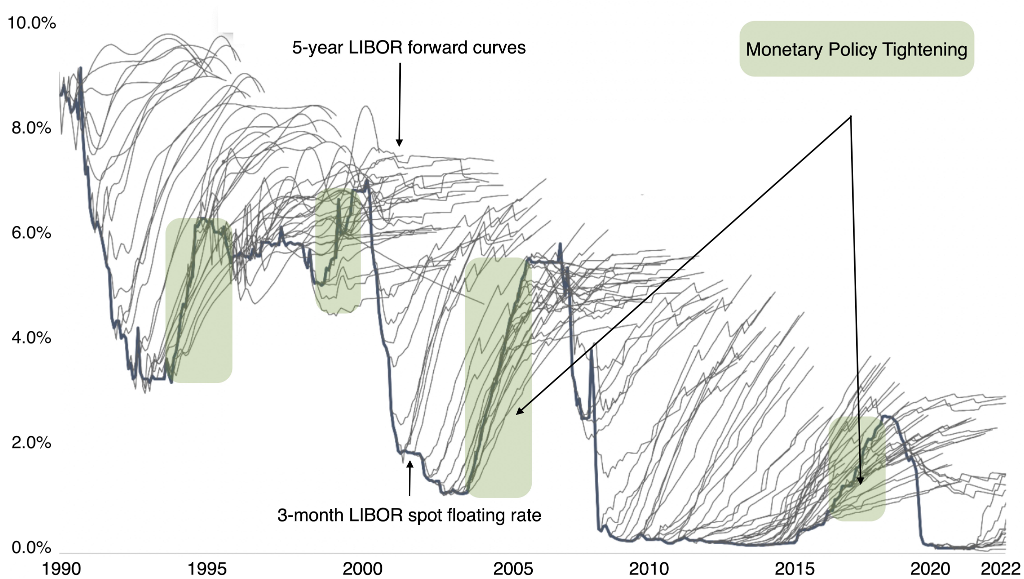
Figures 4 and 6 display the distribution of savings or costs resulting from floating debt. These figures summarize the analysis presented above and highlight three critical observations when considering cashflows until maturity. Firstly, there are significant savings associated with floating debt for borrowers and fixed-rate assets for investors. Secondly, there is an asymmetry in the risk-reward ratio between fixed and floating securities. Lastly, fixing interest rate immediately before a monetary policy tightening cycle, which occurs less frequently, is the optimal approach for borrowers, but not for investors.

3.3 Monetary Policy Tightening Cycles and Interest Rates

When analyzing the "Hairy" graph, it becomes apparent that the market tends to overestimate the trajectory of floating rates, except for periods immediately preceding a monetary tightening cycle. The shaded green boxes in Figure 7 indicate the periods that are immediately before tightening cycles.

The figure highlights three notable takeaways. Firstly, the market tends to underestimate the number of rate hikes by one to two in the first year and two to three by the end of the second year. Secondly, monetary policy tightening cycles are relatively short-lived. Historically, the duration between the first rate hike and the first rate cut has not generally exceeded 3.2 years, as illustrated by the period from June 2004 to August 2007. Thirdly, the market often fails to factor in the inevitable economic downturn. Within two years of the start of a monetary tightening cycle, there is a high likelihood that floating rates are already beginning to trend lower. While rates may

Figure 7: Periods of Monetary Tightening



initially rise, they eventually fall, following the adage that "what goes up must come down".

3.4 Borrower's Perspective: Should they Fix Below Floating Rates?

If a borrower has the opportunity to secure a long-term fixed rate below their current floating rate, should they take it? Based on the historical backtesting of cash flows, the worst time for a borrower to lock in a fixed rate is typically at the start of a monetary easing cycle when the yield curve is inverted. However, for an investor investing in fixed-rate assets, the opposite is true, as discussed in the next section taking the investor's perspective. It is important to note that this analysis only considers the cash flows of liabilities held until maturity, and it does not account for spreads, hedging costs, transaction costs, or prepayment penalties.

3.4.1 Historical Backtesting

There have been six inversions of the yield curve since 1990, as indicated in Figure 8.

Although it may seem straightforward, this figure is important to our analysis. In what follows, we examine each yield curve inversion separately and provide an in-depth explanation of the pre-

Figure 8: Recessions - Yield Curve Inversions

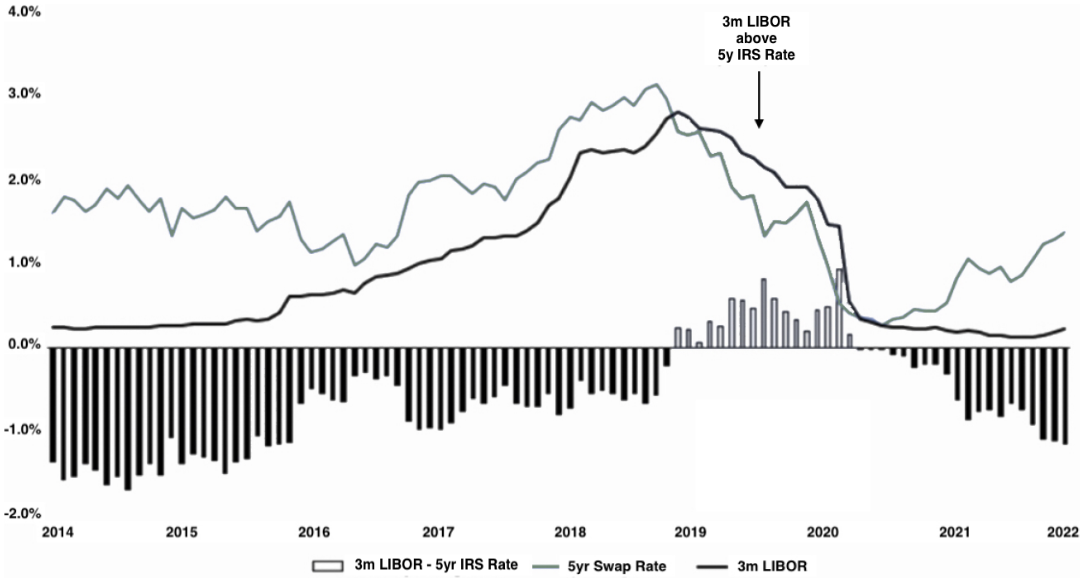
COVID-19 and pre-financial crisis inversions, before analyzing the remaining ones. We selected five-year fixed rates as a compromise between three-year and 10-year fixed rates. As mentioned above, longer fixed rates are even more punitive than shorter ones, so we want to present a case that is most unfavorable to our argument to make our results as robust as possible.

Pre-Covid: Between December 2018 and May 2020, borrowers had the opportunity to secure a fixed interest rate lower than their floating rate for a considerable period of time, as illustrated in Figure 9.

Note that the five-year interest rate swap (IRS) rate is depicted by the blue line, while the three-month LIBOR is represented by the black line. The shaded bars serve to highlight the inversion period, while all bars indicate the difference between the three-month LIBOR and the five-year IRS rate.

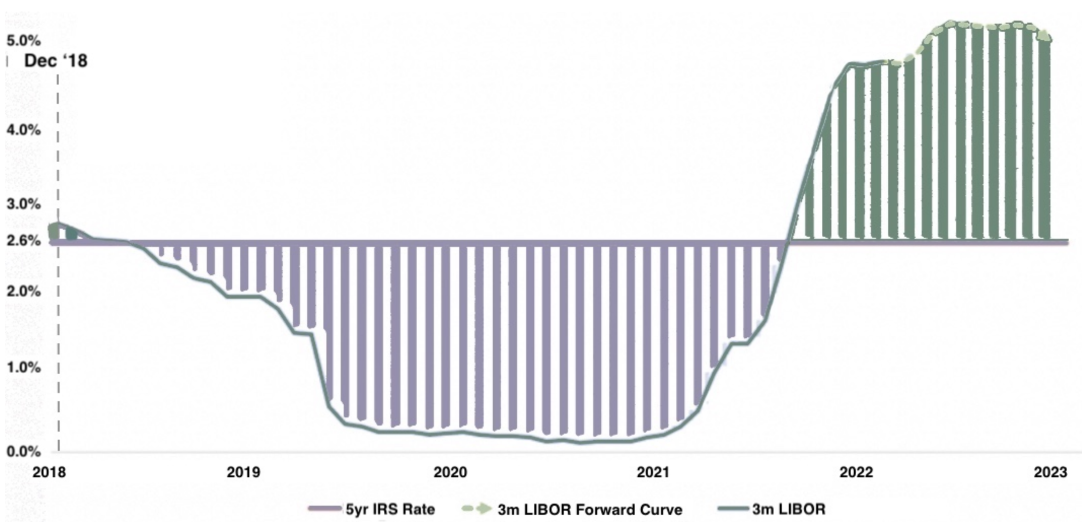
Moreover, Figure 10 demonstrates that if a borrower had chosen to fix their rate at 2.60% in December 2018, and held that fixed rate for five years, the missed savings would have been significant until August 2022, as depicted by the purple bars. After August 2022, there may have been some

Figure 9: Pre-COVID-19 - Yield Curve Inversion



potential missed losses, as shown by the green bars. However, it is important to note that we haven't yet reached the five-year mark since fixing in December 2018, which will be in December 2023, and thus a complete evaluation of this scenario is not yet possible.

Figure 10: Five-Year IRS vs. Floating Rate - December 2018

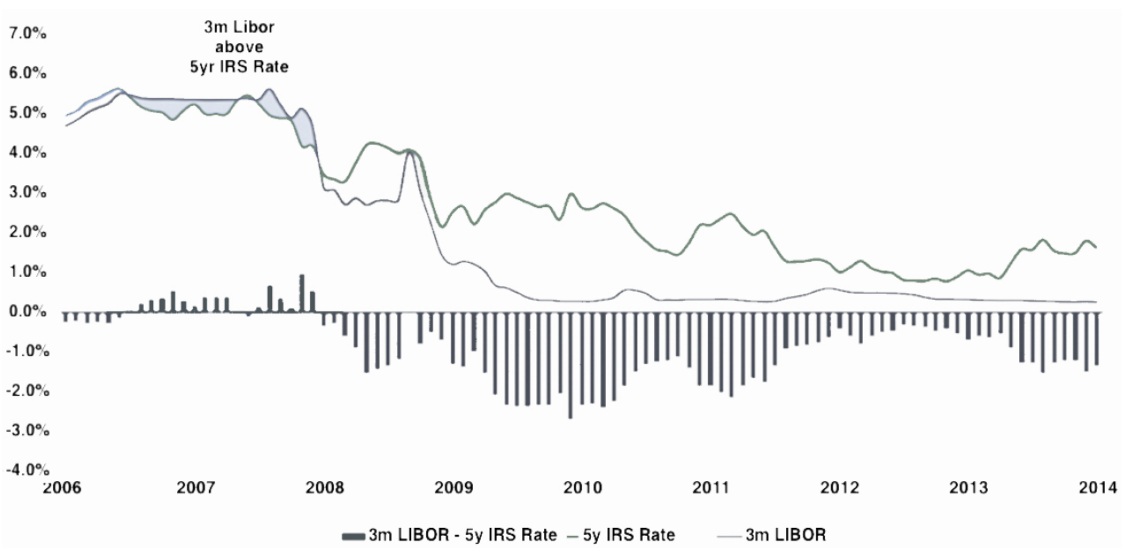


However, it is also worth considering that based on the calculated purple bars (representing savings) and the green bars (representing losses), the yield curve inversion scenario before the COVID-19 pandemic may be unique in that a borrower could reach a point of indifference between fixed and floating rates. This scenario could be one of very few where a borrower would be significantly indifferent to fixed or floating interest rates.

Below, we continue to evaluate scenarios that are feasible for us and concentrate on all previous yield curve inversions.

Global Financial Crisis: Between July 2006 and December 2007, borrowers had the opportunity to secure a fixed interest rate lower than their floating rate illustrated in Figure 11.

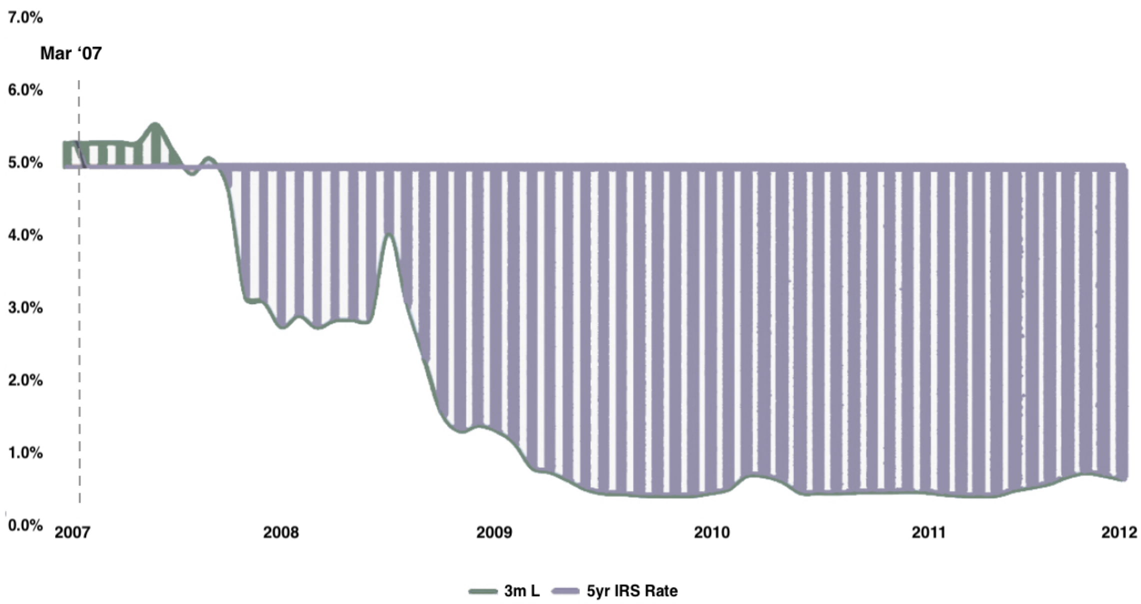
Figure 11: Global Financial Crisis - Yield Curve Inversion



Considering the scenario in which a borrower chose a fixed rate of 4.90% in March 2017 instead of a floating rate for the next five years, Figure 12 shows that there would have been a significant amount of savings that the borrower would have missed out on, as indicated by the purple bars.

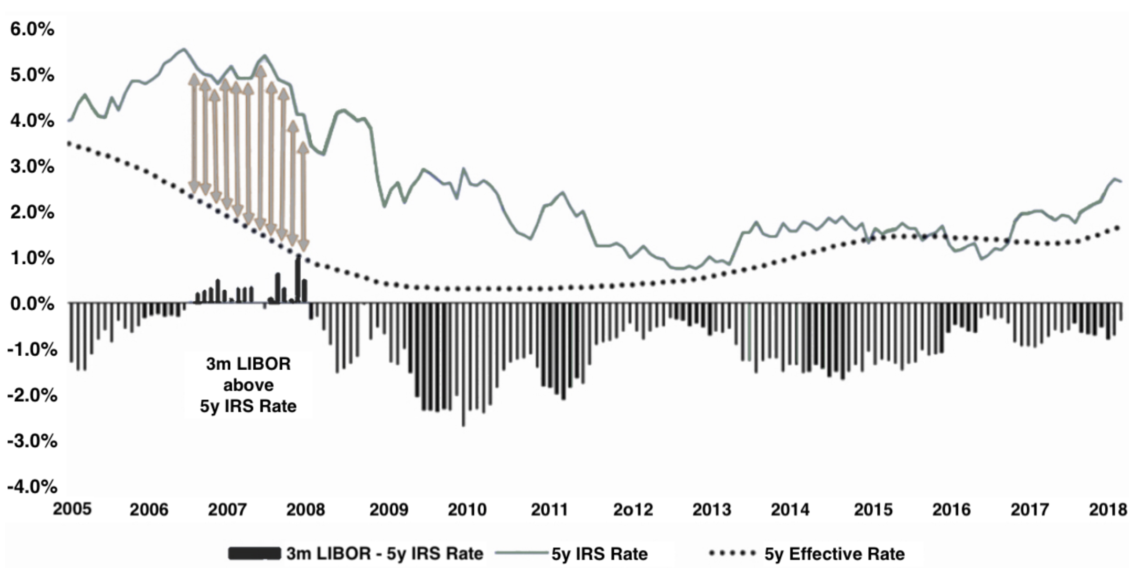
Figure 13 illustrates that the "Hairy" premium was at its highest during the GFC. The five-year IRS rate is represented by the blue line in the figure, while the dotted line shows the average effective rate over the next five years if the borrower had opted for a floating rate. Importantly, the dotted line does not depict the three-month LIBOR. To determine the effective rate if the borrower

Figure 12: Five-Year IRS vs. Floating Rate - March 2007



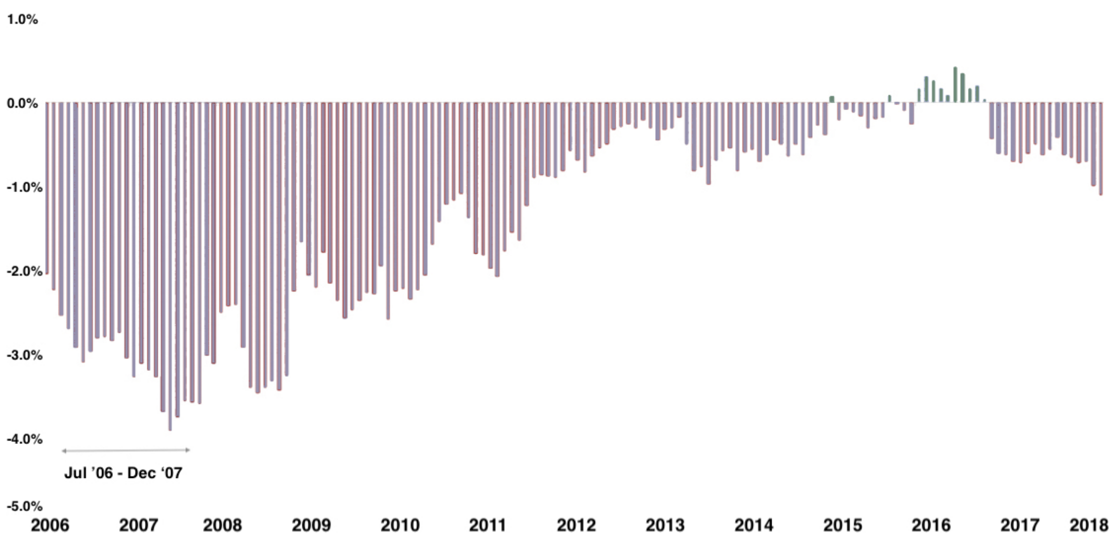
had chosen to float, we can select any point on the blue line and follow the red arrows directly down, with the difference between the two rates indicating the "Hairy" premium.

Figure 13: Five-Year IRS vs. Five-Year Effective Rate



In Figure 14, the five-year "Hairy" premium is shown in detail, represented by the purple bars. This shows the amount a borrower would have overpaid by locking in a fixed rate over the following five years. Notably, this graph is not a time series graph, so the negative bar with the largest value indicates that if the borrower had locked in a fixed rate at that point in time, they would have ended up overpaying by about 4.0% per year for the next five years. The most expensive period to lock in a rate was during the yield curve inversion, as indicated by the arrowed area.

Figure 14: Five-Year "Hairy" Premium - Cost to Fix

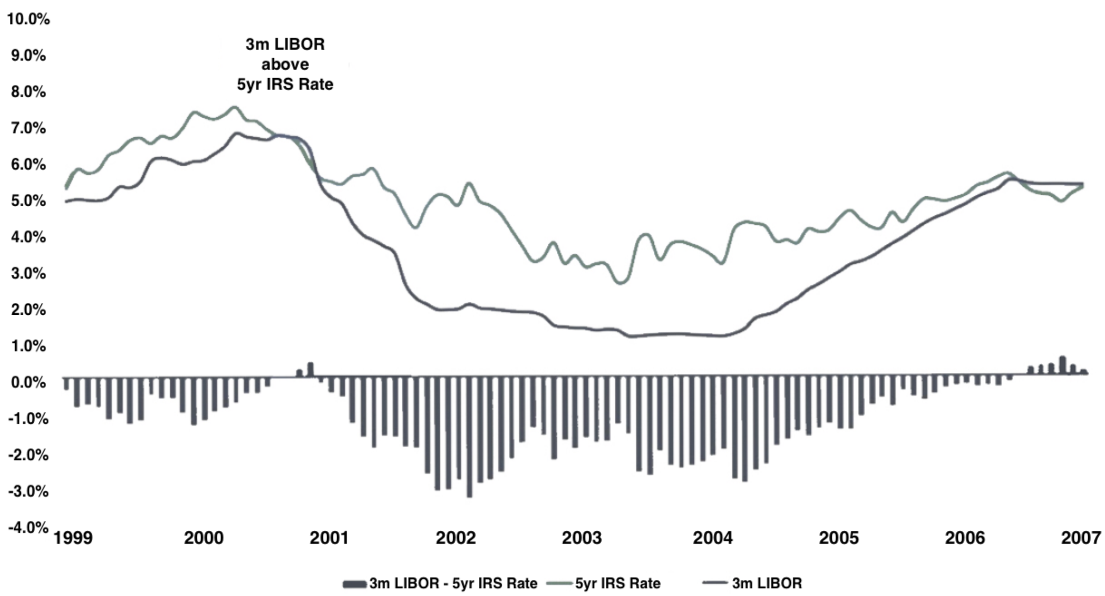


In general, borrowers who fixed their rates during the yield curve inversion before the GFC ultimately paid up to 4.0% more per year for the next five years. This was likely also exacerbated by higher prepayment penalties across different types of fixed-rate debt, which made it difficult for borrowers to refinance and benefit from lower rates.

Some believe that the Global Financial Crisis (GFC) was the kind of severe recession that occurs only once in a generation and it is therefore an anomaly. Therefore, our findings may not be consistent. To address this, we further investigate the four other instances of yield curve inversions that have occurred since the 1990s.

Dot-Com Crash: The inversion of this yield curve was relatively brief, lasting only six months, and it was not as pronounced as the inversion that occurred during the GFC of 2007, as illustrated in Figure 15.

Figure 15: Dot-Com Crash - Yield Curve Inversion



However, borrowers who opted for a fixed interest rate during this period did not benefit from the subsequent decrease in LIBOR rates. Figure 16 displays numerous purple boxes that represent the extent of savings borrowers missed out on if they fixed their rate.

Figure 16: Five-Year IRS vs. Floating Rate - November 2000

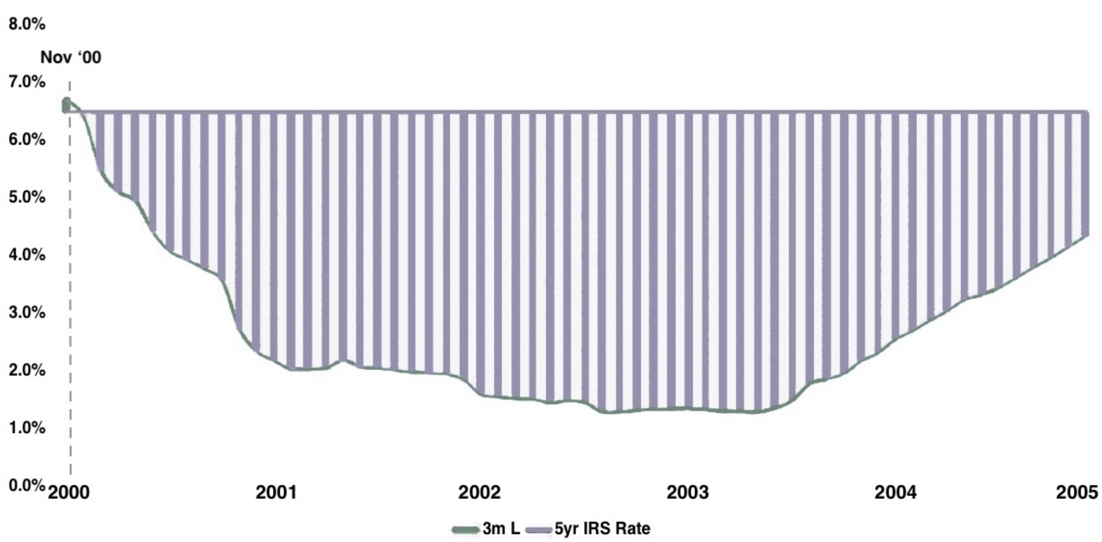
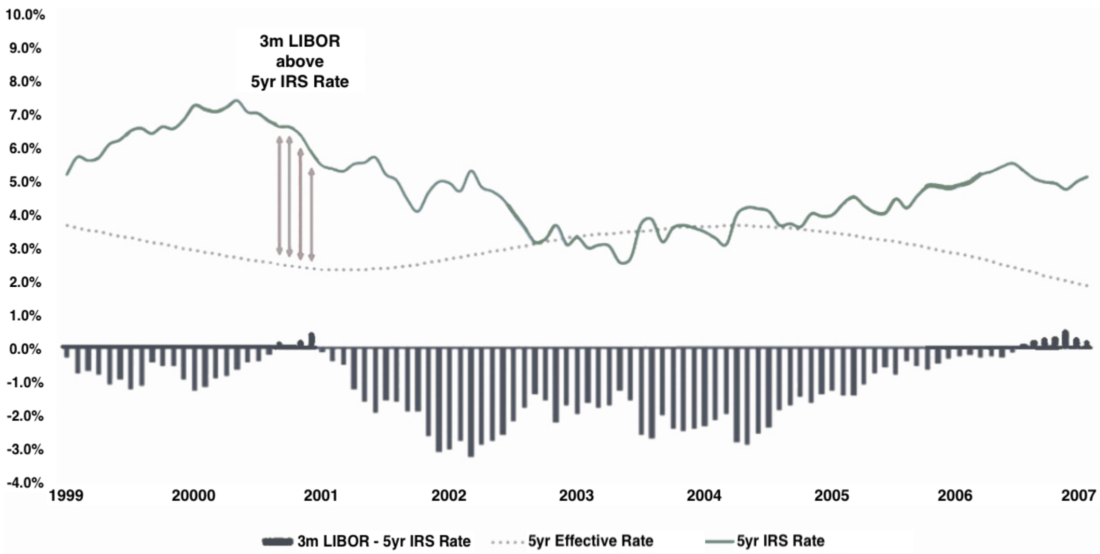


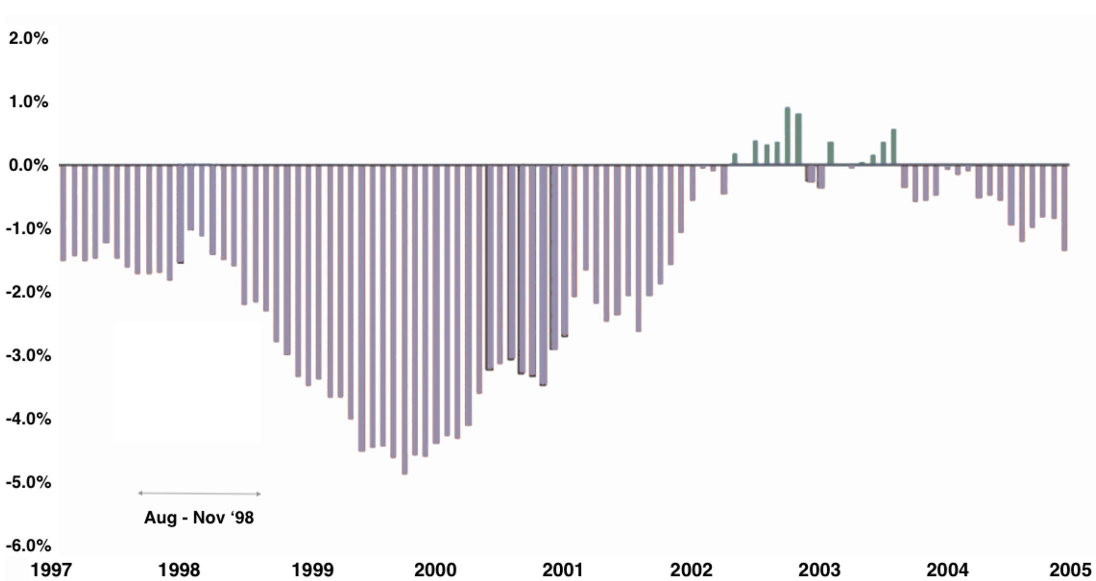
Figure 17 further illustrates what the borrower's effective rate for the remaining term would have been if they had remained floating and not locked in at the fixed rate (blue line) during the inversion; it is lower that the fixed rate line.

Figure 17: Five-Year IRS vs. Five-Year Effective Rate



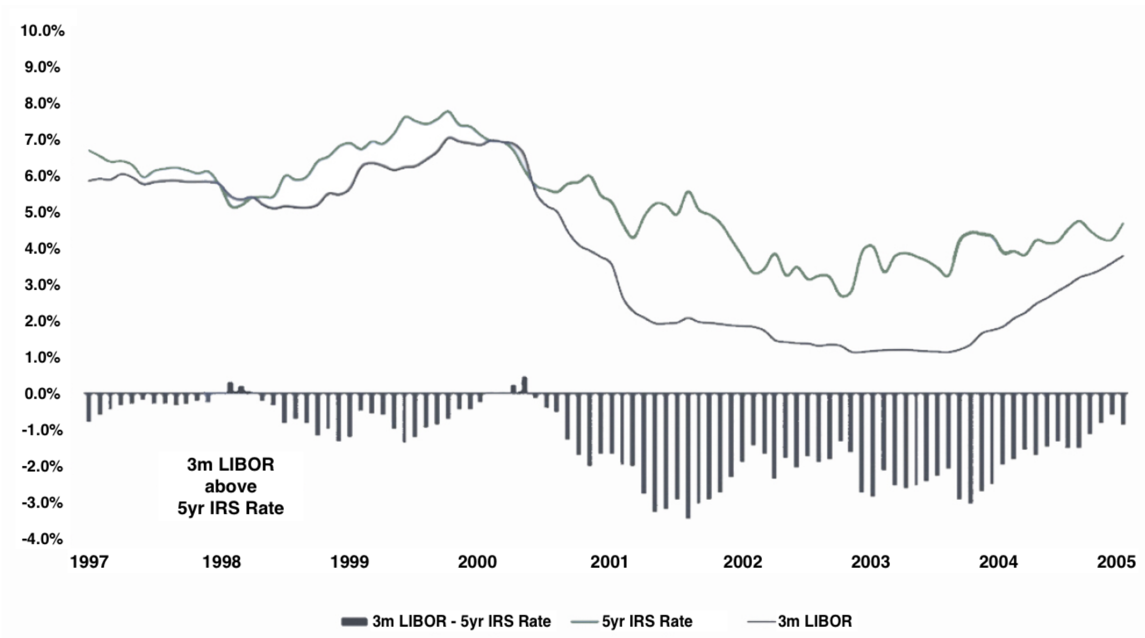
Finally, the "Hairy" premium, as demonstrated in Figure 18, indicates that the time just prior to the yield curve inversion was the most expensive period for securing a fixed interest rate, even though the inversion itself also carried a considerable cost.

Figure 18: Five-Year "Hairy" Premium - Cost to Fix



Russian Crisis: The yield curve inversion during this period was relatively short-lived, lasting only three months, and relatively moderate, as depicted in Figure 19. However, since it was immediately followed by the more severe Dot-Com inversion, it is somewhat challenging to draw broad conclusions in the subsequent analysis.

Figure 19: Russian Yield Curve Inversion



As illustrated in Figure 20, being in a fixed interest rate during this yield curve inversion was not as costly as previous ones, but borrowers who opted for fixed rates still missed out on potential savings, as evidenced by the numerous purple boxes after the initial savings represented by the green boxes at the start.

Nonetheless, borrowers would still have been better off floating by about 1.00%, as shown in Figure 21.

The yield curve inversion was also not the most unfavorable time to secure a fixed interest rate, as it was followed by the even more severe Dot-Com crisis, which was particularly punishing for fixed-rate borrowers. Finally, the "Hairy" premium remained significant, as depicted in Figure 18.

Figure 20: Five-Year IRS vs. Floating Rate - September 1998

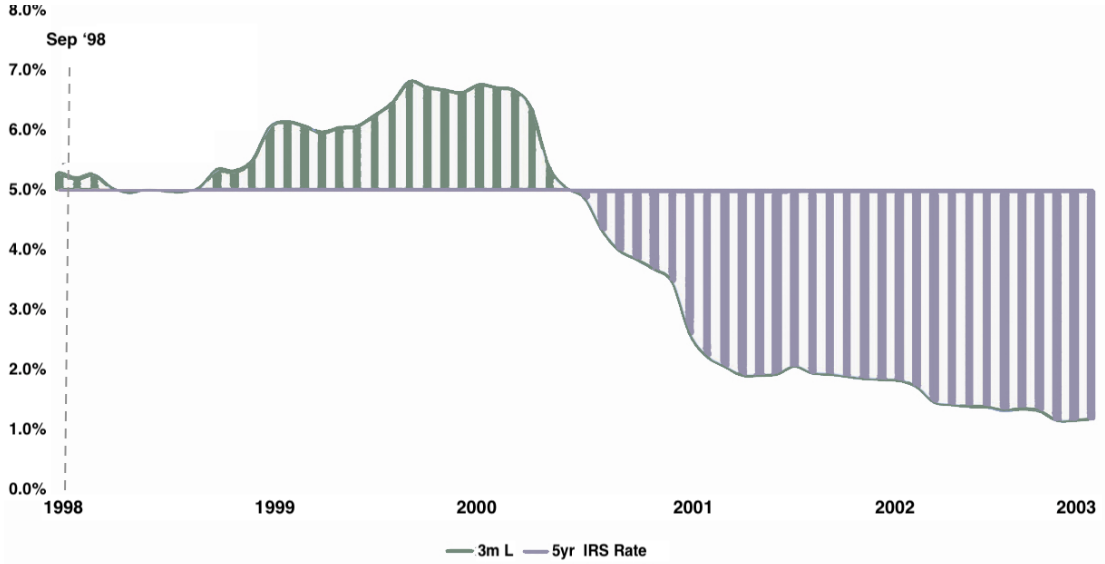
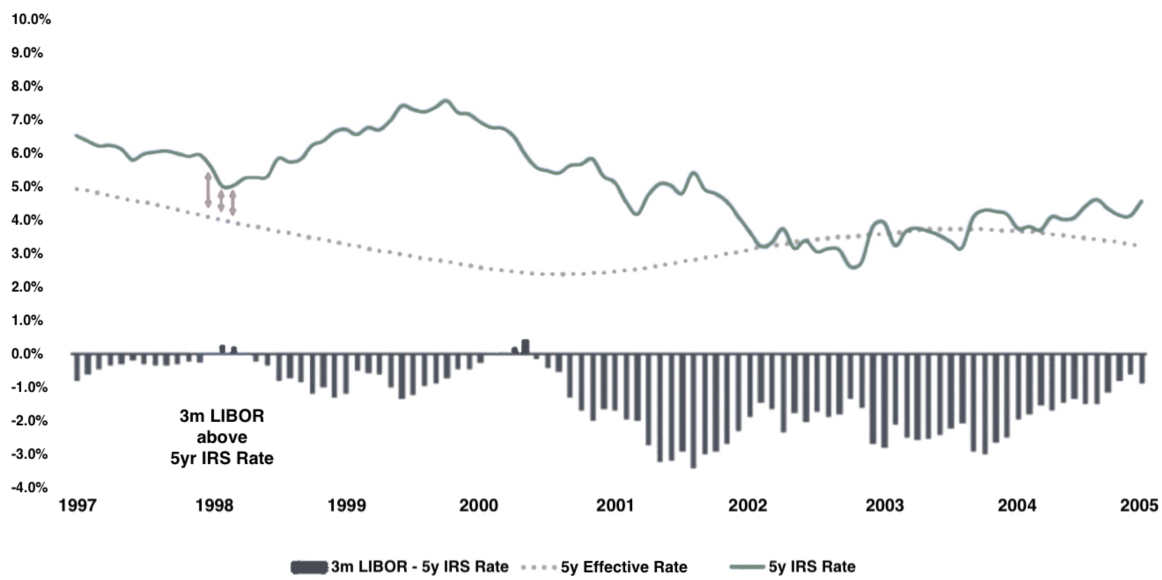


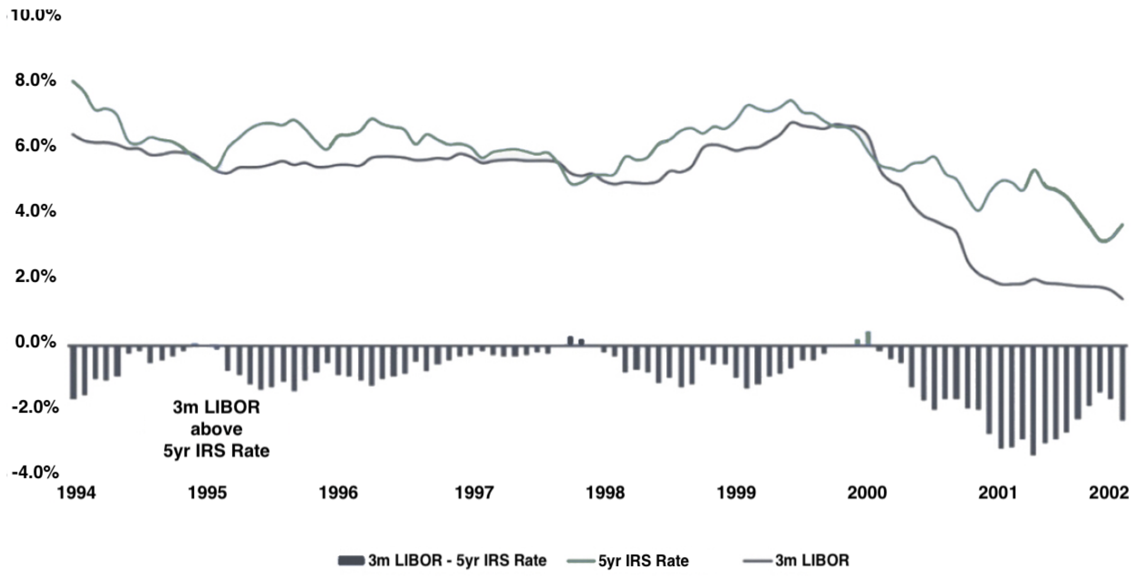
Figure 21: Five-Year IRS vs. Five-Year Effective Rate



The 1994 Fed 3% Hike: In 1994, the Federal Reserve raised interest rates by 3%, resulting in an increase in Fed Funds from 3% to 6%, which caused a brief inversion in the same year, as illustrated in Figure 22.

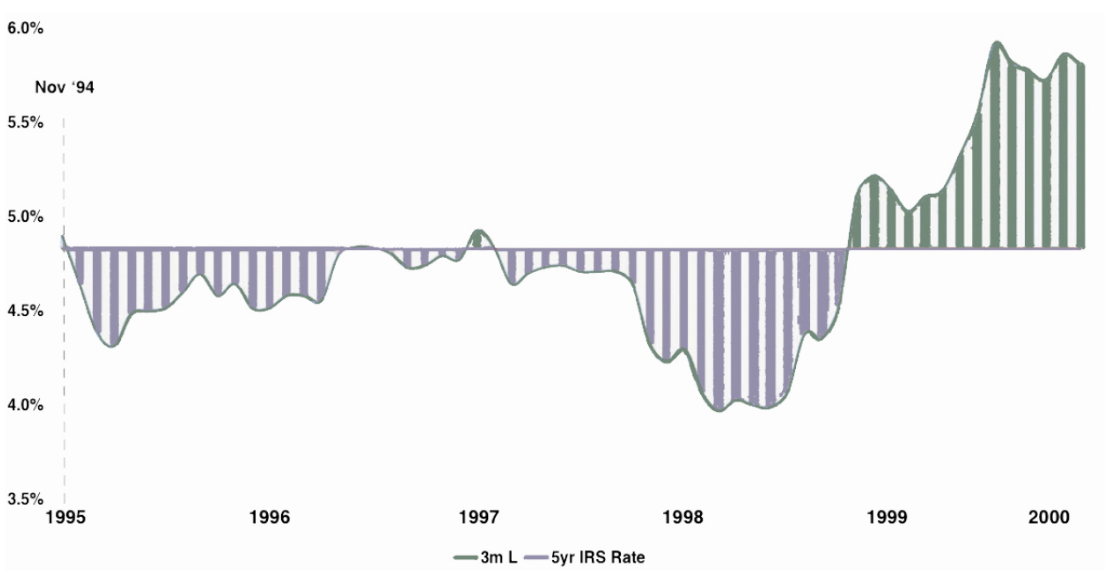
Assuming that a borrower selected the prevalent fixed rate of 4.70% during the yield curve inversion in November 1994, Figure 23 illustrates the subsequent trajectory of the floating rate over the

Figure 22: 1994 Fed Hike - Yield Curve Inversion



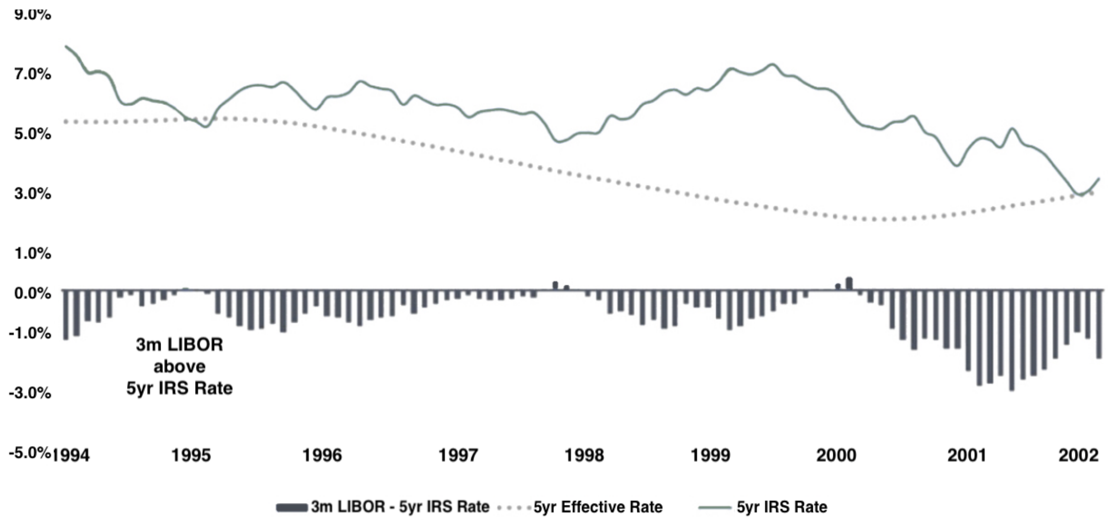
following five years. By analyzing the purple boxes that represent missed savings and the green boxes that represent missed losses, we can conclude that the borrower would have essentially broken even if they had chosen a fixed rate.

Figure 23: Five-Year IRS vs. Floating Rate - November 1994



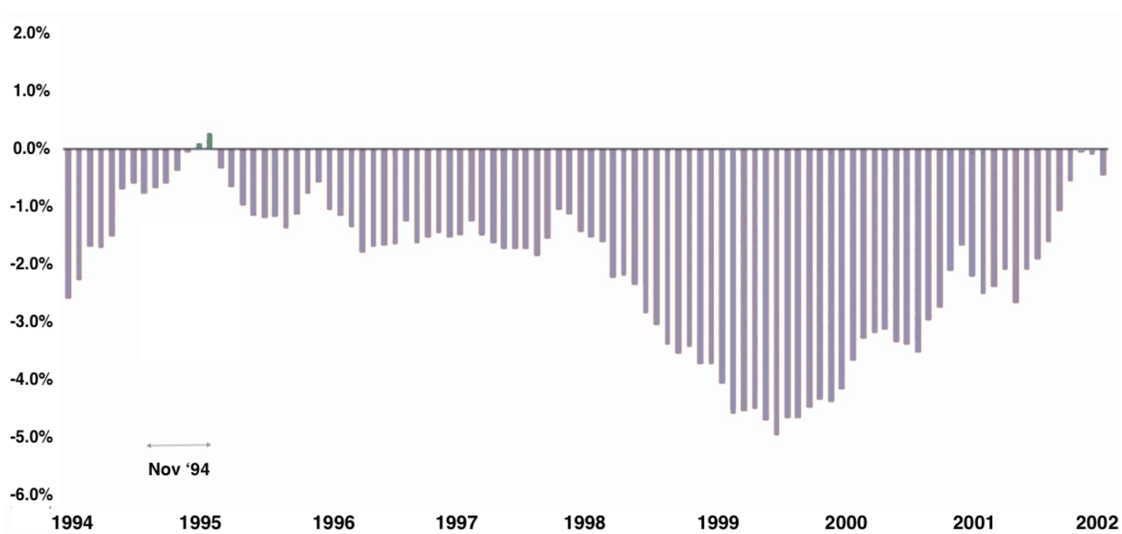
This brief one-month inversion essentially resulted in rates that a borrower would have been indifferent to, as depicted in Figure 24. The fixed rate and the average effective rate ended up being the same.

Figure 24: Five-Year IRS vs. Five-Year Effective Rate



As the Fed raised rates very quickly (3% in one year) and abruptly, the inversion wasn't the worst time to lock into fixed rate, as seen in the collapsed "Hairy" premium in Figure 25 in November 1994.

Figure 25: Five-Year "Hairy" Premium - Cost to Fix



It is worth mentioning that when the interest rates inverted in 1994, borrowers who chose to fix their rates didn't experience any negative effects, but they didn't really gain any benefits either. As a result, the most favorable outcome for borrowers was arguably to neither gain nor lose money. In sum, historically, an interest rate yield curve inversion is shown to be one of the most unfavorable times to opt for a fixed rate as a borrower. When borrowers chose a floating rate and it turned out to be the wrong decision, the impact was not significant. However, when they opted for a fixed rate and it was not the right decision, the impact was significant; this is due to asymmetric risk-reward properties. Even during the inversion of 1994, borrowers who chose to fix their rates did not necessarily gain any benefits; they simply broke even. The longer the fixed rate term, the more the borrower eventually overpaid. A fixed rate of two or three years was not as punitive in terms of the "Hairy" premium, since it matured quickly and allowed the borrower to revert to floating, recapturing some savings. On the other hand, a fixed rate of 10 or 30 years was more punitive than a five-year fixed rate considering the "Hairy" premium.

3.5 Investor's Perspective: Should they Fix Above Floating Rates?

We might logically assume that when fixed rates are higher than floating rates, an investor or lender should opt for fixed rates to secure the interest rate differential. The straightforward answer is yes, they should, but this is only the case if the investor does not take the "Hairy" premium into account. If they do, the answer is no.

To illustrate, we consider the period just before the 1994 Fed 3% rate hike. In Figure 5, we can see that the five-year IRS fixed rate was about 5.20%, while the three-month LIBOR was lower at 3.50% for a five-year maturity horizon. If an investor had locked in their five-year rate, they would have earned a difference of 1.70% in the first year. However, this benefit would have been short-lived, only lasting for one year. Looking at the grey line, which represents the five-year effective floating rate, we can see that it was higher than the gold line, indicating that the investor would have been better off staying with floating based on the average floating effective rate they would have earned over the next five years. This is even more evident in Figure 6, which shows that just before the 1994 yield curve inversion, the "Hairy" premium was in fact negative (about -0.50%), as indicated by the purple bars, meaning the investor would have suffered losses if they stayed in fixed.

Another example is from the end of 2003; at this time the five-year IRS fixed rate was roughly 2.60% and the 3m LIBOR rate was lower at 1%, enabling a lender or investor to secure 1.60% for the first year, as presented in Figure 5. Nevertheless, it is clear that, if they had done so, the "Hairy" premium they would have faced in the following five years could have been negative, up to -1.00%, as indicated by the purple bars in Figure 6.

Thus, for investors like bank lenders, the simple method of choosing the higher fixed rate over the floating rate is an inadequate strategy that disregards the "Hairy" premium. This approach can result in suboptimal asset liability management (ALM) decisions and lead to cash-flow losses.

3.6 What about Intermediate Mark-to-Market Considerations?

The conclusions drawn above regarding the perspectives of borrowers and investors are solely based on cash flow considerations and assume they will retain their debts or investments until maturity without attempting to sell them beforehand. The analysis does not consider the possible impact of mark-to-market effects on prices if they were to sell their loans or investments before maturity.

Even with these considerations, we demonstrated that a borrower would again prefer a floating-rate debt, except during infrequent monetary policy-induced yield curve inversions where, at worst, the borrower would be indifferent to fixing their debt. The analysis did not account for the mark-to-market effects on the debt's prices should the borrower opt to sell it before maturity. Nevertheless, even when considering mark-to-market factors, the result for borrowers remains the same since every floating-rate instrument is always marked-to-market at par as long as there is no correlation between credit risk and interest rates. Therefore, if a borrower decides to sell their loan before maturity, the price they receive will always be at par, with no risk of price fluctuations.

It may seem logical to assume that if the borrowers consistently lose by fixing their debt, then investors such as a lender must fix the loans to consistently profit by fixing the interest on the assets. However, because of the "Hairy" premium, as shown in the previous sections, this is not the case, even if we factor in the investor wanting to sell the investment before maturity, thus consider the mark-to-market effect on fixed-rate assets. Unlike floating-rate assets, which are mark-to-market always at par, fixed-rate assets are always marked-to-market based on the market yield curve at any point in time. Thus, in cases where the yield curve becomes very steep and upward-sloping, when monetary policy tightening is expected, then the mark-to-market price of these fixed assets falls significantly. Even more so, they in fact decrease, on top of this, on a leveraged basis, with the leverage growing proportionally to the duration of the assets.

It might seem reasonable to assume that investors such as lenders who fix the interest rate on their assets, consistently profit, given that borrowers consistently lose by fixing their debt. However, this is not the case. This is not only because of the "Hairy" premium discussed above, but also because fixed-rate assets are subject to mark-to-market effects, especially if the investor wants to sell the investment before maturity. Unlike floating-rate assets, fixed-rate assets are always marked-to-market based on the market yield curve at any point in time. Therefore, when the yield curve becomes very steep and upward-sloping, anticipating monetary policy tightening, the mark-to-market price of fixed assets declines considerably. They also decline on a leveraged basis as the leverage grows proportionally with the duration of these assets.

To demonstrate, we again consider the period just before the 1994 Fed rate hike. As we have shown in the previous section, an investor could have gained a profit of about 1.70% in the first year just before the 1994 yield inversion, as shown in Figure 5, if they fixed their rate. However, the "Hairy" premium at that time was in fact negative at approximately -0.50%, as indicated by the purple bars in Figure 6, meaning that the investor would have incurred losses in the next five years if they had opted for the five-year fixed rate. Furthermore, in 1994, right after the investor fixed their interest rate, the Fed cut rates by 3%. For the sake of simplicity, assuming that the yield curve was flat and it just shifted downwards at the moment of the rate cut, a rough estimate for the impact on the mark-to-market is that the price of the fixed rate asset would have fallen by the leverage, which can be approximated by the maturity or duration times the interest rate cut. This suggests that the price of the fixed asset would have been marked-to-market down by approximately 15% ($3\% \times$ 5 years = 15%) in just one day.

It is important to note that the “Hairy” premium and the mark-to-market valuation move in the same direction and appear to be capturing the same risk factor, but the former has the advantage of being much simpler to implement and compute for sensitivity analysis in ALM.

In summary, while an investor could have potentially gained 1.70% in the first year before the 1994 yield conversion by fixing their interest rate, they would have incurred losses due to the negative ”Hairy” premium of -0.50% and the significant mark-to-market price decline of -15% on their fixed-rate assets after the Fed cut rates by 3%. Therefore, considering the ”Hairy” premium and mark-to-market volatility, choosing a floating rate would have been a more optimal strategy for the investor.

4 Conclusions

The focus of this paper is on documenting the market’s tendency to overestimate the trajectory of spot interest rates and show how this affects borrowers (investors) who have fixed- and floating-rate debts (assets). We quantify this overestimation with a metric we developed called the ”Hairy” premium at multiple maturity horizons. We demonstrate that because long-term fixed interest rates are typically higher than spot interest rates due to the prevalent upward-sloping term structure, this results in higher and overshooting forward curves, giving rise to the so-called "Hairy" premium. As a result, borrowers (investors) consistently incur (receive) this premium as a cost (profit) if they fix their interest rates.

The study also reveals an asymmetric risk-reward profile in terms of magnitudes; further, the longer the term of the debt, the more likely it is that floating interest rates will save money for the borrowers relative to the fixed rate alternative. As a result, our findings highlight the benefits of using floating-rate debt, as well as the optimal duration of such debt to maximize savings. We also highlight the importance of timing and understanding the market's perception of interest rate movements when making decisions about fixed-rate asset investments.

In conclusion, our findings provide important insights into the benefits and risks of choosing between fixed- and floating-rate instruments, highlighting the importance of considering the specific circumstances of each individual or firm and timing when making such decisions. The study further underscores the importance of considering the length of the term when evaluating the relative merits of fixed- versus floating-rate instruments. Overall, our study contributes to a deeper understanding of the relationship between interest rates, credit, and borrowing and investing in fixed- versus floating-rate financial instruments.

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