Macroeconomic Policy and Corporate Debt Maturity Decisions: Investigating the Role of the Central Bank in the United States

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Abstract

This Master's thesis investigates the impact of expected changes in macroeconomic policies, proxied by the difference between the policy rate and the Taylor rule rate, on corporate debt maturity decisions in the United States. To examine this, a linear model is employed to regress bond maturity against the expected changes in monetary policy, using two distinct datasets ranging from 1993 to 2022 and 2001 to 2022 respectively. The main finding suggests that the expected changes in macroeconomic policies predicted by the Taylor rule do not influence bond maturity decisions. This conclusion offers valuable insights into capital structure theory and the relationship between macroeconomic policy and corporate finance.

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Contents

1 Introduction

The present thesis aims to study the impact of expected changes in macroeconomic policies on corporate debt maturity decisions in the United States and to comprehend the significance of these expectations for businesses. The decisions that corporate managers make are formed by a range of internal and external factors, including macroeconomic factors that substantially influence the corporate capital structure and country-specific characteristics. Therefore, understanding the magnitude and direction of external determinants of capital structure can help managers in making better financial decisions, achieving stable and successful growth of their firms (Mokhova & Zinecker, 2014). In addition, Bhamra et al. (2011) and Abaidoo and Kwenin (2013) indicate that there is a relationship between macroeconomic conditions and corporate features, such as the probability of default or corporate profit growth. Thus, understanding the degree to which central banks' macroeconomic decisions influence corporate financing strategies is crucial. Hence, this thesis aims to investigate whether and how expected changes in macroeconomic policy predicted by the Taylor rule impact corporate debt maturity decisions, given that these expectations have implications on economic stability, financial health, and firms' investments and growth prospects.

The objective of this thesis is to analyze the relationship between expected changes in the monetary policy of the United States (proxied by the difference between observed policy rates and rates predicted by the Taylor rule) and corporate decision-making regarding debt maturity financing. The present thesis reveals that this disparity generally produces statistically insignificant results. When testing the hypothesis, even under extreme variations in the policy rate disparity and across various time frames, the results consistently maintain their insignificance.

The theoretical foundation of this thesis is built upon Greenwood et al. (2010), who present a framework in which the risk aversion of arbitrageurs results in predictable variations in the expected cost of borrowing capital for long-term versus short-term debt. The authors formalized a model that represents the difference between the long-term rate and the product of the current short-term rate and the expected future short-term rate. This difference allows for inference of corporate debt maturity decisions, as a larger difference indicates that long-term financing would be more expensive, encouraging firms to issue more short-term bonds. In this study, a model is used where the expected future short-term interest rate is influenced by expected changes in monetary policy employed by the Fed, proxied by the difference between the United States Fed Funds rate and the Taylor rule rate. The expected short-term bond yields are typically more sensitive to changes in monetary policy than long-term bond yields. Thus, when a tight monetary policy is expected, the expected future short-term rates should increase more than the long-term rates. This leads to a lower difference in the model proposed by Greenwood et al. (2010), encouraging firms to issue more long-term bonds. Examining how these differences impact new bond issuances could provide valuable insights for central banks in promoting overall financial stability.

To empirically test this prediction, I estimate a linear model of the maturity of newly issued corporate bonds by U.S. nonfinancial corporations. The model is saturated with a 10-year fixed effect, and subsequently with an issuer identifier fixed effect; it also includes as continuous controls the same variable considered in a similar setting by Badoer and James (2016). This model is estimated using a dataset between 1999 and 2022, referred to as the quarterly dataset, and a robustness check is performed with a shorter dataset spanning from 2001 to 2022, referred to as the monthly dataset. The quarterly dataset has 14,232 observations and includes a sample of 1,986 different companies that issued bonds during the considered time frame. Conversely, the monthly dataset consists of 11,670 observations and includes a sample of 1,526 different companies. The key explanatory variable of interest is the difference between the United States Fed Funds rate and the expected rate based on the Taylor rule, referred to as *difference*. In both datasets the main key variable is statistically insignificant, leading to the preliminary conclusion that expected future changes in the policy rate predicted by the Taylor rule do not affect the debt maturity decision of the firms. Moreover, when the analyses in both datasets are restricted to instances where the variable *difference* is higher than its 95th percentile or lower than its 5th percentile, the results yield the same conclusion, enhancing its robustness. Consistent with Cochrane et al. (2019), the Taylor rule provides more accurate monetary policy forecasts from 1985 to 2000 than in the following periods. For this reason, the dataset comprising only the years spanning from 1993 to 1999 is considered. Unfortunately, the results are statistically insignificant due to data distribution issues, as approximately 2% (63 observations out of 2,228) of the *difference* has a negative value, while the remainder are positive. Consequently the results for this key explanatory variable are biased.

The thesis is organized as follows: Section 2 presents a detailed literature review, discussing the determination of the term structure and the agents influencing it, the impact of interest rate changes on the term structure, the introduction of the difference between the United States Fed Funds Rate and the Taylor rule rate, as well as its impact on the maturity of new bonds issued by U.S. firms, and the hypothesis formulation. Building upon the elements introduced in the first section, Section 3 examines the data and the methodology. Subsequently, Section 4 discusses the results of the regression analysis, and finally, Section 5 presents the conclusion and discussion.

2 Literature Review

2.1 Theories on the determination of the yield curve

The present paper recalls the model developed by Greenwood et al. (2010), in which risk aversion among arbitrageurs leads to predictable differences between the expected cost of capital borrowing for long-term versus short-term debt. In this model, long-term rates are endogenous, while short-term rates are exogenous and exhibit a first moment that remains constant over time. Short-term rates can be seen as determined by monetary policy. If a two-time period is considered, the short-term rate from time 0 to 1 is known at time 0, in contrast to $r2$, the short-term rate from time 1 to 2, which is random at time 0 and has a mean of $E[r2]$ and variance of $Var[r2]$. By considering preferred-habitat investors, the government, and arbitrageurs as actors in this model, it is possible to deduce the firm's objective function to minimize. The solution yields the optimal proportion of their requirement from long-term debt, denoted as $f^*(P)$.

$$f^*(P) = z - \left[\frac{(P^{-1} - (1 + r1) * (1 + E[r2]))}{\theta} \right] \tag{1}$$

The debt maturity of corporations in equilibrium depends on the difference (Δ) between the sure cost of long-term debt financing and the expected cost of short-term debt financing:

$$\Delta = P^{-1} - (1 + r1) * (1 + E[r2]) \tag{2}$$

Where P^{-1} represents the long-term rate, $r1$ is the actual short-term rate, and $E[r2]$ the expected future short-term rate.

Generally, the yield curve represents the interest rates of bonds with different maturity dates but similar risk, liquidity, and taxation characteristics. It can exhibit upward, flat, or downward slopes (Mishkin, 1990). Various models and theories have been proposed to determine the yield curve, including the Pure Expectation Theory, Risk Premium Model, Market Segmentation Theory, and Preferred Habitat Theory.

The Pure Expectation Theory states that long-term rates are equal to the average of expected short-term rates (Kessel, 1971). Unlike the actual interest rate, which is the agreed-upon rate between borrowers and lenders at a specific time, the expected interest rate is based on investors' or economists' future forecasts of economic conditions such as inflation, economic growth, and central bank policy. According to the Pure Expectation Theory, long-term interest rates are entirely driven by expectations about future short-term rates: investors should expect the same returns investing long-term or rolling over short-term investments over the same period. Therefore, the Pure Expectations Theory implies that Δ, defined in Equation 2, must be equal to zero. Thus, this theory implies that any information about the expected short-term rate is already reflected in the current long-term rate, and thus, over a given horizon, there is no expected difference in the interest rate paid by borrowing at short-term or long-term maturities.

Another theory proposed is the Risk Premium Model, formulated by Hicks (1939). This theory incorporates the liquidity premium and states that the yield curve rises more than it does in the Pure Expectation Model. This means that the long-term rate is always higher than the average of the short-term rate and expected short-term rate ($\Delta > 0$). Based on this theory, firms should always tilt toward short-term debt financing. Only the existence of other costs of deviating from the otherwise optimal maturity structure, captured by the parameter θ in Equation 1, prevents firms from getting financed only via short-term debt.

The Market Segmentation Theory suggests that investors and issuers have preferences for specific maturities, leading to completely independent markets for different maturity segments (Culbertson, 1957). According to this theory, Δ can assume any value, as P^{-1} is fully exogenous to (expected) changes in short-term rates, while the firms' capital structure is not influenced by it, as firms face infinite costs of deviating from their preferred maturity structure (i.e. $\theta \to \infty$).

The Preferred Habitat Theory, introduced by Modigliani and Sutch (1966), combines key elements from all the previous three models. This theory suggests that agents have specific risk aversion and prefer operating within certain maturity ranges. However, they are willing to move out of their preferred habitat if a sufficient premium is offered to compensate for increased risk. The theory implies that yield differences between long and short securities are influenced by future interest rate expectations and the number of securities with different maturities. Indeed, the Preferred Habitat Theory, combined with an expectations formation model, can explain the term structure behavior, suggesting that long-term interest rates are driven by financial market expectations regarding future short-term rates (Modigliani & Shiller, 1973). Therefore, Vayanos and Vila (2021) incorporate the preferred habitat view into a no-arbitrage term-structure framework, demonstrating how short-rate shocks are transmitted to bond yields through arbitrageurs. In their model, P^{-1} is not exogenous as in pure market segmentation theories; but arbitrageurs' supply of capital is not infinitely elastic as in the pure expectation theory. This is because they are risk-averse. Like in Pure Expectation Theory, markets try to arbitrage away Δ different from zero; but their arbitraging activity is insufficient to bring Δ back to zero. Therefore, θ is not infinite as in the Pure Market Segmentation Theory. Hence, the bond risk premium is positively related to the term structure slope, and monetary policy actions can be viewed as a source of arbitrageur rent.

Also with this theory, Δ can assume any value, but differently from the Market Segmentation Theory, investors can change their preferred habitat if another one is more convenient. This implies that a difference in the interest rate paid by borrowing at short-term or long-term maturities is expected over a given horizon. In the Preferred Habitat Theory, the yield differences between long and short securities are influenced by future interest rate expectations as in the model proposed by Greenwood et al. (2010). Cox et al. (1985), who analyze the determination of the yield curve as a problem in general equilibrium theory using all these elements, highlight how anticipations of future events and specific preferences about consumption (a preferred habitat) are important.

2.2 How the interest rate impacts the bond yield curve

Greenwood et al. (2010) base their research on the Preferred Habit Theory, hypothesizing that shocks to the supply of both long-term and short-term bonds are associated with changes in the maturity structure of U.S. government debt. These shocks are relatively larger than the stock of available arbitrage capital. Arbitrageurs, attempting to enforce the Pure Expectations Hypothesis (which implies that any information about expected short-term rates driven by monetary policy is already reflected in the current long-term rate), are unable to fully do so due to these supply shocks, resulting in some predictability in the bond returns. Greenwood et al. (2010) base their theoretical assumption on findings of Baker et al. (2003), who state that managers tend to issue more short-term debt when the expected return on short-term debt is below that of on long-term debt, and vice versa. Consequently, the authors analyze how the impact of the policy rate, which changes the maturity structure of U.S. government debt, affects the expected future short-term and long-term rates.

Movements in the policy rate are associated with the shifts in the expected short-term rates, while the long-term rates, such as the 10-year Treasury bond, appear to follow their own decreasing trend, though they exhibit some comovement. Changes in the policy rate impact the yield curve since there is a strong negative correlation between the Fed funds rate and the term premium (Martin, 2017). Hence, given that the policy rate can certainly affect the yield curve when the central bank raises the interest rate, the long-term rates tend to increase, but not as much as expected short-term rates (Estrella & Mishkin, 1997). Therefore, I expect that the long-term rate will increase less than an increase in the future expected short-term rate when the central bank raises its policy rate. Hence, $E[r2]$ increases more than P^{-1} when the monetary policy rate is raised, leading to a lower Δ, presented in Equation 2. This means that the derivative of Equation 2 with respect to $E[r2]$ is negative.

In fact, from the bond pricing function can be derived that the effect of an increase in the current interest rate has the same direction for all maturities but it has a larger effect for the expected shorter ones, as Hicks stated: "If short rates are not expected to change, the long rate will exceed the short rate by a normal risk-premium; if the current short rate is regarded as abnormally low, the long rate will be decidedly above it; the short rate can only exceed the long rate if the current short rate is regarded as abnormally high." (Hicks, 1939).

Therefore, changes in expected short-term rates are empirically significant factors that impact long-term rates. If the central bank raises its short interest rate and market agents expect them to decline gradually back, the long rate will increase less than the expected future short-term interest rate. However, if they believe that the interest rate will keep increasing, then, the long rate will increase more than the short rate (Taylor, 1995). Given that the Fed uses the federal funds rate to achieve stable prices and maximum employment as part of its dual mandate, in this thesis the hypothesis is assumed that investors believe that the policy rate will decline gradually back, such that if the policy rate is raised the expected short rate, $E[r2]$, increases more than the long-term rate, P^{-1}.

2.3 Macroeconomics and Corporate Finance

Considering that there are shocks to the supply of long-term and short-term bonds associated with changes in the maturity structure of U.S. government debt which are relatively larger than the stock of available arbitrage capital, leading to some predictability in the bond returns, and considering that managers tend to issue more short-term debt when the expected return on short-term debt is below the expected return on long-term debt, Greenwood et al. (2010) state that companies act as macro liquidity providers. Consequently, they issue more long-term when government funds itself with more short-term debt, and vice-versa. Practically, if Δ is large, long-term debt is expensive, and thus, corporations issue less long-term debt. Hence, the macroeconomic factors lead to some predictability in the bond returns, and to exploit them the managers change their debt maturity decisions.

The corporates debt choice depends on different factors, such as the firm size; in fact, large firms tend to issue more long-term bonds (Barclay & Smith Jr, 1995). However, the firms' choice can be affected also by the preferred habitat investors. This is demonstrated by the fact that in the last 40 years, the average maturity of new corporate bond issues in the U.S. has declined substantially for the impact that has been given by the insurance company ownership in the corporate bonds (Butler, Gao, & Uzmanoglu, 2023). Then, managers take their decisions according to internal and external factors, including macroeconomic factors, since both have a significant influence on the corporate capital structure and its countries' specifics. Therefore, knowing the magnitude and direction of external determinants of capital structure will support managers to make precise financial choices to achieve stable and successful development of their firm (Mokhova & Zinecker, 2014). In this regard, Bhamra et al. (2011) and Abaidoo and Kwenin (2013) demonstrate that there is a relationship between macroeconomic conditions and corporate features, such as the probability of default or corporate profit growth.

It has been theoretically demonstrated that if the policy rate is raised, the expected future short-term rate, $E[r2]$, increases more than the long-term rate, P^{-1}, and this implies that Δ is lower and consequently, firms should increase their long-term bonds. This means that there is a positive effect of $E[r2]$ on debt maturity.

2.4 Expected future changes in Monetary policy and Corporate Finance

This thesis mainly aims to examine how expected future changes in monetary policy affect expected future short-term rates and their subsequent impact on firms' debt choices.

An indicator of the expected future changes in the central bank's monetary policy and market expectations is the difference between the United States Fed Funds rate and the interest rate predicted by Taylor's rule. This difference will serve as my main independent variable. To examine this variable, some of the hypotheses from Greenwood et al. (2010) are altered to align with the research question. Instead of treating the expected value of the future short-term rate (mu) as time-invariant, I propose that it is driven by the disparity between the United States Fed Funds Rate and the optimal rate based on the Taylor rule. Thus, expectations of changes in monetary policy affect the expectation of future short-term rates, $E[r2]$.

Taylor's rule is an interest rate forecasting model that suggests how central banks should adjust interest rates in response to fluctuations in inflation and the output gap. Taylor's study was primarily focused on the Fed's action. According to this rule, the Fed should raise interest rates when inflation or when the GDP growth exceeds equilibrium, and vice versa.

$$r = \pi + 0.5y + 0.5(\pi - \pi^*) + r^* \tag{3}$$

$$r = \pi + 0.5y + 0.5(\pi - 2) + 2(1) \tag{4}$$

Here, r represents the federal funds rate, π the rate of inflation over the previous four quarters, and y the percent deviation of the output gap (deviation of GDP from equilibrium). Taylor set $\pi^* = 2$ and $r^* = 2$ (Taylor, 1993). In this formula, Taylor used a 2% inflation target even before it was adopted as a target by the Fed, the BOJ, and the ECB. Taylor chose 2% instead of 0% to avoid zero lower bound problems and to account for the bias inflation measurements at that time (Taylor, 2018).

Generally, if the United States Fed Funds rate is below the rate predicted by the Taylor rule, the monetary policy is expected to be "tight", which means that the central bank is concerned about economic growth or employment levels. Conversely, a "loose" monetary policy is inferred when the Fed Funds rate is above the Taylor rule prediction and correlates with concerns about inflation or financial stability. Hence, the difference between the United States Fed Funds rate and the rate predicted by Taylor's rule provides information about future central bank decisions.

Investigating the correlation between the term structure spread and a direct tool of monetary policy, such as successful monetary policy tightening, should produce distinct yields on expected short-term and long-term interest rates. In the short term, the primary outcome should be tightening of credit supply, leading to increased interest rates. However, on the longer end, changes in anticipated inflation and real long-term rates ex-ante will have a much larger impact. If the tightening is credible and effective, then, lower inflationary expectations for the long term should offset the impact of tighter initial credit conditions. As a result, long-term interest rates will generally increase by a smaller degree than short-term rates (Estrella & Mishkin, 1997).

Following the Preferred Habitat Hypothesis, the same reasoning applied to the only interest rate on the expected returns on short-term bonds and long-term bonds is also used for this difference. The theory states that markets perceive long-term rates and the compounded short-term rates to have different expected returns, presenting a speculative, rather than an arbitrage, opportunity. Given that the exact future short-term rate is unknown and the market is risk-averse, the speculative opportunity remains underexploited. Non-financial companies, especially large and unconstrained firms, can fill this gap by acting as cross-market arbitrageurs in their debt securities when expected excess returns on debt are low. Consequently, net debt issuance (and net equity repurchases) increases (Ma, 2019).

Therefore, if the difference between the United States Fed Funds Rate and the rate predicted by the Taylor rule is negative, the expected future short-term rate increases more than the long-term rate, which brings some predictability in bond returns that managers can exploit. Hence, this difference has a negative impact on $E[r2]$, and as has been demonstrated $E[r2]$ has a positive effect on debt maturity. This implies that when a tight monetary policy is expected (United States Fed Funds Rate − Taylor rule rate < 0), Equation 2 yields a lower result since $E[r2]$ increases more than P^{-1}, incentivizing firms to increase their issuance of long-term bonds.

However, it is important to note that there are multiple interest rate forecasting models besides the Taylor rule, and one rule may predict better monetary policies than other monetary policy rules for each period. For this reason, Benchimol and Fourçans (2019) tested for the period from 1955 to 2017 twelve different monetary policy rules, including four Taylor-type, and eight nominal income targeting types (NGDP), to analyze which monetary rule best aligns with the historical data. These sub-periods were selected to capture the impact of policy rules under different economic conditions. Their results demonstrate that the objectives of central banks are better predictable using more monetary rules than using a single rule of thumb. Moreover, Cochrane et al. (2019) find that during the early 2000s, there was a high level of discretion with all the rules reported by the Fed, while in the 1990s it was really low. Therefore, they demonstrate that the monetary policy rules, especially the Taylor rule, forecast the monetary policy better from 1985 to 2000 than in the following periods. They find that in the last two decades, the Fed transitioned from a Taylor-type framework to a nominal income targeting framework and adopted a more discretionary approach.

Considering all these findings, future researchers can implement this research using different monetary policy rules for different periods, distinguishing when the monetary policy is driven by one of the rule-driven or discretionary.

2.5 Hypothesis formulation

Drawing from the demonstrations carried out by Mokhova and Zinecker (2014), Bhamra et al. (2011), and Abaidoo and Kwenin (2013) which establish that macroeconomic conditions influence the capital structure choice, this thesis aims to test a specific aspect of this choice: to determine whether and how expected future changes in monetary policy impact corporate debt maturity decisions.

In light of the literature review, it was found that the sensitivity of short-term bond yields to an increase in central bank interest rates exceeds that of long-term bond yields, as established by Estrella and Mishkin (1997) and Taylor (1995). Short-term instruments employed by the central bank significantly impact the short end of the yield curve, while factors such as long-term inflation and real activity expectations influence the long end. For this reason, expected effective monetary policy tightening leads to differing effects on short-term and long-term interest rates. The short end experiences a credit supply tightening that results in rising interest rates, while the long end is influenced by changes in expected inflation and real long-term rates. If tightening is perceived as credible, reduced long-term inflation expectations can mitigate the effect of tighter credit conditions effects consequently, long-term rates tend to rise less than short-term rates, resulting in a flatter yield curve (Estrella & Mishkin, 1997).

Given this, when a tightening monetary policy is expected the difference between the long-term rate and the product of the current short-term rate and the expected future short-term, derived from Greenwood et al. (2010), decreases. A smaller difference indicates that long-term financing would be cheaper, encouraging firms to issue more long-term bonds.

The hypothesis can now be formulated as follows:

H1: Companies increase their debt maturity when a tighter monetary policy is expected.

The hypothesis states that companies tend to issue more long-term bonds when the difference between the United States Fed Funds rate and the rate determined by the Taylor rule is negative, and vice versa. Therefore, accounting for extreme values of this difference I expect to have stronger results.

Despite the numerous capital structure theories, there remains a significant gap in the literature regarding the influence of macroeconomic variables on corporate financing strategies reveals and corporate debt maturity decisions. The lack of comprehensive analysis concerning how macro factors affect corporate choices across different bond maturities makes this thesis essential. In an attempt to bridge this gap, this research seeks to enhance the theoretical understanding of corporate finance. While this study employs a straightforward model based on the general Taylor rule for the U.S.; future research could delve deeper, examining additional countries like those in the Eurozone and applying different types of monetary policy rules, as Benchimol and Fourçans (2019) state that a specific rule performs better than other monetary policy rules in forecasting monetary policies for each distinct period.

3 Data and Methodology

3.1 Data

The Mergent dataset, retrieved from WRDS, is used to identify the universe of bonds. One of the control explanatory variables, *TSY20*, is available at a quarterly frequency for the period 1999 to 2022. In this study, it is referred to as the quarterly dataset. An alternative proxy is available at a monthly frequency but only for a shorter period, from 2001 to 2022. Following Badoer and James (2016), I exclude "asset- or mortgage-backed debt, secured debt, pass-through securities, equipment trust certificates, lease obligations, convertible debt, the preferred stock that has been misclassified as debt, equity linked certificates, and perpetual debt". I also exclude securities issued by financial corporations (SIC codes 6000-6999)[1]. After these preliminary filters, the quarterly dataset consists of 14,232 observations, and the monthly dataset contains 11,670 observations. The quarterly dataset is primarily used in this analysis, while the monthly dataset serves as a robustness check.

The quarterly dataset consists of a sample of 1,986 different companies that issued bonds during the considered timeframe. The issuance of bonds is spread out over the years, with the highest concentration of issuance in 2020, likely due to the macroeconomic situation during and after the Covid-19 crisis. Over half of the issuances occurred after 2011. In the appendix, the distribution of observations over time and their graphical representation are presented in Table A and Figure A.

The monthly dataset includes a sample of 1,526 different companies that issued bonds over the time considered. Here again, the issuance is distributed across years, with the highest concentration of issuance in 2020. More than half of these issuances occurred after 2013. The distribution of observations over time and their graphical representation are detailed in Table B and Figure B in the appendix.

3.2 Dependent and main explanatory variables

The key dependent variable of interest is the maturity at issuance in days of each bond issued by companies (referred to as *maturity*). For the quarterly dataset there are 14,232 observations, while in the monthly dataset there are 11,670.

The first key explanatory variable, referred to as *difference*, is the difference between the United States Fed Funds rate[2], as observed the day before a bond is issued, and the Taylor rule rate[3]. The Taylor rule is calculated in the following way: "The output gap as the difference between potential output (published by the Congressional Budget Office) and real GDP. Inflation is measured by changes in the CPI, and we use a target inflation rate of 2%. We also assume a

[1] Compustat code for securities issued by financial corporations.
[2] Taken from the U.S. central bank's database.
[3] Taken from FRED Economic Data, St. Louis Fed.

steady-state real interest rate of 2%"[4], which follows the Taylor rule described in the literature review with Equation 4. The Taylor rule data are available only quarterly, then, the same value will be considered for 3 months, in order to have the variable *difference* daily. In the quarterly dataset, the minimum value is -11.59, and the maximum is 4.32, while in the monthly dataset, the minimum is -11.59, and the maximum is 3.22. The minimum extreme value is the same for both datasets and it was registered at the begging of 2022 when the policy rate had not yet been raised, but inflation was already much higher than the target. On the other hand, the maximum was registered in 1996 for the quarterly dataset, and in 2020 for the monthly dataset. A negative (positive) value of *difference* indicates that the policy rate is lower (higher) than what the Taylor rate would suggest; as such, a tight (loose) monetary policy is expected, then short-term rates are expected to increase (decrease) in the future.

The second key explanatory variable is *short-term rate*. It is the U.S. 3 Month Treasury Bill[5] as observed the day before a bond is issued. In the quarterly dataset, the minimum value is -0.05 and the maximum is 6.39, while in the monthly dataset, the minimum is -0.05 and the maximum is 5.17. The minimum extreme value of this variable is the same for both the dataset and it was registered after the Covid19 crisis in 2020. Meanwhile, the maximum value was recorded at the end of 2000 for the quarterly dataset, and in 2022 in the monthly dataset.

The last key variable is *termstructure*, which is the difference between the long-term rate and the short-term rate, taken by Badoer and James (2016). *Termstructure* is the difference between the percentage yields of 10-year and 6-month treasury securities[6] observed the day before a bond is issued, differently from Badoer and James (2016) who take monthly. In the quarterly dataset, the minimum value is -0.78 and the maximum is 3.73, while in the monthly dataset, the minimum is -0.63, and the maximum is 3.73. The maximum was registered in 2010 for both datasets. Meanwhile, the minimum was registered at the end of 2000 for the quarterly dataset when there was an inverted yield curve, which predicts an upcoming economic slowdown, as it happened in 2001. The minimum of the monthly dataset was registered at the end of 2022, indicating a possible recession in 2023.

The choice of different rates represents the short-term rates in the different variables, hence, the U.S. 3 Month Treasury Bill as *short-term rate*, the U.S. Fed Funds Rate in the variable *difference*, and the 6 Month Treasury Bill in the *termstructure*, is made to avoid data collinearity problems. As undelighted in Lindner et al. (2020) collinearity is a current and recurring problem in quantitative research, consequently, in my framework I choose the variables to avoid this issue. For this reason, different short-term rates are considered.

[4] As defined in FRED Economic Data, St. Louis Fed.
[5] Taken directly from the U.S. central bank's database.
[6] Taken directly from the U.S. central bank's database.

3.3 Control variables

Following Badoer and James (2016) the issuance dataset is supplemented with firm-level financial data from Compustat for the fiscal year ending immediately prior to the date of debt issuance, with the supply of Long-Term Treasury security and the credit market conditions data from the Federal Reserve Board's website.

In order to measure the supply of Long-Term Treasury security the variable called *TSY20* is used, which is the fraction of outstanding long-term treasury debt, with maturity over 20 years, on total outstanding treasury debt. I have two datasets with two different periods as described in a previous subsection, the monthly dataset follows the methodology by Badoer and James (2016) since from 2001 to 2022[7] the monthly data for the variable are available. On the other hand, for the quarterly dataset, with a period from 1993 to 2022[8], the data are quarterly; differently from the methodology by Badoer and James (2016). Following the reasoning of Badoer and James (2016), I expect this variable to be negative.

The primary measure of credit market conditions is *Moody's BBB-AAA 30Y*, which is the difference between the percentage yields of Moody's 30-year BBB and AAA-rated corporate bond indices, measured monthly. I expect this variable to be negative. Moreover, Badoer and James (2016) consider the country's growth rate as a macroeconomic control variable to see how quarterly U.S. GDP growth affects the choice of maturity for bond issuance, but due to collinearity issues, I do not compute it.

For the quarterly data, the data of the quarter before the bond issuance are considered, while for the monthly data, the data of the first day of the same month in which the bond is issued are considered.

The firm-level financial data are considered in order to minimize the error effect and they are taken from the fiscal year end immediately prior to the date of debt issuance.

The market value of equity is calculated as the closing shares' price of the prior fiscal year multiplied by the number of common shares outstanding. Then, its natural logarithm is taken to create the variable *Ln(MV of Equity)*, I expect its coefficient to be positive. Differently, the logarithm of sales is not considered for the same reason as the country's growth rate.

Then, different financial ratios are taken into consideration: *Market to book ratio*, *Market-Debt ratio*, and *EBIT to Total Assets*. Where the first is a metric that compares the business's book value to its market value, the second one compares the proportion of the book value of a company's debt with the total assets, and the last one compares the company's earnings before interest and taxes (EBIT) and their total assets. *Market to book ratio* is calculated as (total liabilities - deferred taxes and investment tax credit + Market Value of Equity + total preferred stock) / total assets). While *Market-Debt ratio* is computed

[7]Taken from the U.S. Treasury Monthly Statement of the Public Debt (MSPD), found on the fiscaldata.treasury.gov website.

[8]Taken from Fred Economics Data St. Louis Fed database.

as (total long-term debt + total debt in current liabilities) / (total long-term debt + total debt in current liabilities + Market Value of Equity). Last, but not least *EBIT to Total Assets* is calculated as (Income before extraordinary items + total interest and related expense + total income taxes) / total assets. I expect the *Market to book ratio* and *Market-Debt ratio* to have a negative effect on the maturity of the new bond issued, in contrast with the *EBIT to Total Assets*, which I expect to have a positive effect.

Therefore, two dummy variables are considered: *Dividend Dummy*, which has a value of one if the firm declared dividends on common stock the prior fiscal year, and *IG Rating Dummy*, which takes on a value of one if the firm has a long-term credit rating by S&P of "BBB-" or higher. Both should have a positive effect on maturity.

As already mentioned, the collinearity between the independent variables is one significant problem (Lindner et al., 2020), therefore, some of the variables taken into consideration by Badoer and James (2016) are not considered in this research.

In the Appendix, Table C presents a description of all the variables with all the Compustat formulas, while Table D reports a summary of the variables for the quarterly dataset, lastly Table E presents a summary of the variables of the monthly dataset.

3.4 Methodology

In the current methodology, I employ a linear regression with multiple fixed effects for the maturity of newly issued corporate bonds by U.S. nonfinancial corporations. The variables employed as controll variables are derived from the framework of Badoer and James (2016).

The fixed effects in the regression model account for individual or temporal unobserved heterogeneity. Given that my key explanatory variable of interest varies over time I cannot apply a time-fixed effect. Therefore, paralleling Badoer and James (2016), I include a decade-fixed effect to isolate long-cycle differences in maturity choices. In this thesis, the controlled fixed effects are the issuer identifier and the 10-year fixed effect. Specifically, the 10-year fixed effect controls for general variations during the investigated period in average bond maturity. Consequently, the issuer identifier fixed effect controls for general variations in bond maturity across different companies. Thus, a linear model with fixed effects permits us to account for unobserved and time-invariant characteristics across different entities and unobserved characteristics common to all entities but varying over time. The advantage of this approach is that the issuer identifier fixed effect accounts for issuer-specific attributes that could be correlated with the dependent variable and potentially bias the estimates of the regression coefficients. Similarly, the 10-year fixed effects control for time-specific shocks or trends affecting all issuers simultaneously for the time window considered, thus avoiding bias in the estimates. Consequently, this method assists in uncovering causal relationships in observational data, assuming that the only endogeneity source comes from unobserved time-invariant or entity-invariant characteristics.

However, its disadvantages include computational complexity and the assumption of no correlation between the fixed effects and the independent variables.

The regression's standard errors are clustered over the years. The use of clustered standard errors aids in correcting for heteroskedasticity, preventing the underestimation of standard errors, which would lead to inefficient, inconsistent, and spurious results.

The model is estimated using a quarterly dataset controlling only for the 10-year fixed effect. A subsequent regression incorporates the issuer identifier fixed effect. To check for robustness, a similar is applied to the monthly dataset and for a dataset including only the 1990s.

Consequently, the first model is defined as follows:

$$\begin{aligned} \textit{maturity}_i = \; & \beta_{0i} + \beta_1 \cdot (\textit{short-term rate})_i + \beta_2 \cdot (\textit{difference})_i \\ & + \beta_3 \cdot (\textit{termstrucuture})_i + \beta_4 \cdot (\textit{TSY20})_i \\ & + \beta_5 \cdot (\textit{EBIT to Total Assets})_i + \beta_6 \cdot (\textit{Market to book ratio})_i \\ & + \beta_7 \cdot (\textit{Market-Debt ratio})_i + \beta_8 \cdot (\textit{Ln(MV of Equity)})_i \\ & + \beta_9 \cdot (\textit{STD EBIT Growth 2DSIC})_i + \beta_{10} \cdot (\textit{Dividend Dummy})_i \\ & + \beta_{11} \cdot (\textit{IG Rating Dummy})_i + \beta_{12} \cdot (\textit{Moodys BBB-AAA 30Y})_i + \varepsilon_i \end{aligned}$$

H1 predicts an increase in debt maturity for companies when a tighter monetary policy is expected. Thus β_2 is expected to be negative. Meanwhile, when the short-term rate is positive, companies are inclined to issue more long-term bonds, implying a positive β_1. In contrast, β_3 should be negative, as a larger difference between long-term rate and short-term rates indicates expensive long-term debt, leading corporations to issue less of such debt (Greenwood et al., 2010).

The quarterly and monthly datasets are also used to conduct a robustness check by analyzing the impact of the main variable *difference* when values exceed the 95th percentile or fall below the 5th percentile. For this analysis, two dummy variables—*dummy_max* and *dummy_min*— are created, accounting for the impact of extreme values (both positive and negative) of the main variable. *Dummy_max* is assigned a value of 1 if *difference* exceeds 2.43 in the quarterly dataset or 1.17 in the monthly dataset (95th percentile). Conversely, *dummy_min* equals 1 when its value falls below -6.99 in the quarterly dataset or -7.00 in the monthly dataset (5th percentile). For example, if the U.S. Fed Funds surpasses the Taylor rule rate, expectations of future loose monetary policy rise, as the Fed considerably deviates from the rate suggested by the Taylor rule.

Consequently, the second model is defined as follows:

$$
\begin{aligned}
\mathit{maturity}_i = \; & \beta_{0i} + \beta_1 \cdot (\mathit{short\text{-}term\ rate})_i + \beta_2 \cdot (\mathit{Dummy\_max})_i + \beta_3 \cdot (\mathit{Dummy\_min})_i \\
& + \beta_4 \cdot (\mathit{termstrucuture})_i + \beta_5 \cdot (\mathit{TSY20})_i + \beta_6 \cdot (\mathit{EBIT\ to\ Total\ Assets})_i \\
& + \beta_7 \cdot (\mathit{Market\ to\ book\ ratio})_i + \beta_8 \cdot (\mathit{Market\text{-}Debt\ ratio})_i \\
& + \beta_9 \cdot (\mathit{Ln(MV\ of\ Equity)})_i + \beta_{10} \cdot (\mathit{STD\ EBIT\ Growth\ 2DSIC})_i \\
& + \beta_{11} \cdot (\mathit{Dividend\ Dummy})_i + \beta_{12} \cdot (\mathit{IG\ Rating\ Dummy})_i \\
& + \beta_{13} \cdot (\mathit{Moodys\ BBB\text{-}AAA\ 30Y})_i + \varepsilon_i
\end{aligned}
$$

Following the previous reasoning, β_2 is expected to be negative, in contrast, β_3 should be positive. Unfortunately, the statistical distribution of the observations for the 1990s dataset does not allow the application of this methodology, as approximately only 2% of the variable *difference* has a negative value, with the remainder being positive. Thus, even if the 1st percentile is used, the regression would contain only 63 number of observations.

4 Results

This section is organized into four subsections. The first subsection presents the results derived from the quarterly dataset, the second shows the results from the monthly dataset, the third discusses the robustness check performed for extreme values for both datasets, and the final subsection examines the variable *difference* for the period from 1993 to 1999.

4.1 Quarterly Dataset

This subsection discusses the results obtained from the quarterly dataset. Two models are considered here: one includes issuer identifier fixed effects, and the other excludes it. In the first case, the estimated coefficients reflect the effect of macro conditions changing over time on the variation in firms' maturity decisions. This specification is consistent with the model proposed by Greenwood et al. (2010), which predicts how a representative firm would change its financing over time as macro conditions change. However, in practice, changes over time in the maturity of newly issued bonds at the macro level may be driven more by changes in the identity of firms raising debt capital, rather than by changes in the maturity of choice for individual firms. The issuer identifier fixed effect would absorb these differences across firms, hence models without this fixed effect are also examined. The effect of one standard deviation change on *maturity* for each variable is analyzed, with results rounded to two decimal places. The model featuring solely the 10-year fixed effect accounts for 6% of the variance in *maturity*. When the issuer identifier fixed effect is included, the model accounts for 14% of the variance in *maturity*.

Table 1 presents the regression results, comparing the model with only the 10-year fixed effect (column 1) to the model incorporating the issuer identifier fixed effect (column 2), with standard errors clustered by years.

Table 1: Regression Results for the Quarterly Dataset

Dependent Variable:	Maturity	
Variable	**(1)**	**(2)**
Short-term rate	-23.64	-189.17***
	[60.61]	[53.24]
Difference	-18.79	-13.93
	[11.29]	[16.30]
Termstrucure	-159.68*	-321.29***
	[65.52]	[58.42]
EBIT to Total Assets	915.75**	714.20**
	[287.15]	[264.72]
Ln(MV of Equity)	11.34	52.53*
	[25.07]	[24.61]
Market to book ratio	-156.18**	0.91
	[48.41]	[68.95]
Market-Debt ratio	-612.49**	-1,281.38***
	[187.73]	[282.27]
Dividend Dummy	210.07*	-154.57
	[85.43]	[125.69]
IG Rating Dummy	1,484.71***	723.72***
	[113.56]	[192.74]
STD EBIT Growth 2DSIC	2.47	-4.58**
	[1.46]	[1.81]
Moody's BBB-AAA 30Y	-493.46**	-692.96***
	[140.73]	[131.43]
TSY20	-1,296.34	-3,310.77**
	[1,595.73]	[1,169.89]
cons	5,216.81**	8,213.09***
	[1,422.81]	[1,070.55]
10-year fixed effect	YES	YES
ID-issuer fixed effect	NO	YES
Clustered standard errors	YES	YES
Observations	14,232	13,788
Adjusted R-squared	0.06	0.14

Note: This table reports coefficients with their corresponding standard errors in square brackets for two regressions. The columns (1) and (2) are regression results where only time_period is absorbed and id_issuer and time_period are absorbed respectively. All specifications include fixed effects. Standard errors are clustered at the year level. Significance levels: *10%, **5%, ***1%.

4.1.1 Quarterly Dataset Results with 10-Year Fixed Effect

In this subsection, the results of the linear model based solely on the 10-year fixed effect within the quarterly dataset are analyzed.

The main variable *difference* negatively impacts *maturity* as predicted, but its effect is statistically insignificant. Therefore, *difference* does not statistically affect maturity decisions, indicating that expected changes in monetary policy do not influence firms' debt maturity decisions. Also *short-term rate* is statistically insignificant, with a p-value higher than 0.10.

On the contrary, the third main variable, *termstructure* is statistically significant and conforms to expectations, with a coefficient of -159.68. This means that an increase of 1.03 percentage points in *termstructure* results in a decrease of 164.47 days (about 7 months) in *maturity*.

Next, the control variables drawn from Badoer and James (2016) are discussed. The first of these is the Fraction of Treasury debt maturing in over 20 years (*TSY20*) measured quarterly. They demonstrated that this variable negatively impacts the maturity of the bonds issued, but its effect is significant only for the longest and shortest maturities. My results align with the expectations, as the coefficient is -1,296.34, although it is statistically insignificant.

Moody's BBB-AAA 30Y has a coefficient of -493.46, implying a negative impact on the maturity of newly issued bonds, consistent with the findings of Badoer and James (2016). This means that if the yield difference between Moody's 30-year BBB and AAA-rated corporate bond indices increases by 0.36 percentage points, *maturity* decreases by 177.65 days (about 6 months).

Market to book ratio negatively impacts the dependent variable, corresponding with the results of Badoer and James (2016). If it increases by 1.27 units, *maturity* decreases by 198.35 days (about 6 months). Similarly, *Market-Debt Ratio* also negatively impacts *maturity*, with a coefficient of -612.49, implying that if the ratio increases by 0.22 units the firms will decrease the maturity of the new bond issued by 134.75 days (about 3 months). In contrast, *EBIT to Total Assets* positively affects *maturity* as expected. If this financial ratio increases by 0.11 units, *maturity* increases by 100.73 days (about 3 months).

The two dummy variables, *Dividend Dummy* and *IG Rating Dummy* both positively affect *maturity* as predicted by Badoer and James (2016). If a firm has paid dividends in the prior fiscal year, the maturity of the newly issued bond increases by 210.07 days (about 9 months), and if it has an S&P rating higher than "BBB-", *maturity* increases by 1,484.71 days (about 4 years).

Ln(MV of Equity) aligns with the expectations but is also statistically insignificant. The only variable that deviates from Badoer and James (2016) is *STD EBIT Growth 2DSIC* which has a positive coefficient of 2.47, although is statistically insignificant.

4.1.2 Quarterly Dataset with 10-Year Fixed Effect and Issuer Identifier Fixed Effect

This subsection incorporates the issuer identifier fixed effect. With this adjustment, the estimated coefficients represent the impact of macroeconomic fluctuations over time on the changes in individual firms' maturity decisions. The estimates of the regression coefficients; hence, are evaluated again to see if, at parity of companies, the results have changed.

The variable *difference* is in line with the results of Section 4.1.1. Although it has a negative coefficient as expected, its effect is statistically insignificant and therefore does not statistically influence maturity decisions. This means that expected changes in monetary policy predicted by the Taylor Rule do not affect firms' debt maturity decisions. This could be due to the application of a monetary policy rule that is not adapted to the prevailing economic context. Consistent with Benchimol and Fourçans (2019), a specific rule tends to forecast monetary policies more accurately for each distinct period. Therefore, to study the impact of expected changes in monetary policies for different economic periods, alternative forecasting rules must be used, selecting the one that best predicts the Fed's behavior. Another reason for the statistical insignificance could be due to the lack of daily data for the Taylor Rule, meaning some values of *difference* might not accurately represent the exact disparity between the U.S. Fed Funds rate and the Taylor rule rate.

Conversely, the effect of the variable *short-term rate* is statistically significant, indicating that the U.S. 3 Month Treasury Bill negatively impacts *maturity*, holding a coefficient of -189.17. However, this result deviates from expectations, as a rise in *short-term rate* by 1.98 percentage points corresponds to a decrease in *maturity* by 374.56 days (about 1 year). This deviation from my predictions can be explained by several factors. For instance, if the managers believe that the interest rate will keep increasing in the future, the long rate will increase more than the short (Taylor, 1993), causing firms to issue more short-term bonds. Alternatively, managers might believe that current long-term rates already reflect higher future expected short-term rates. These decisions on capital structure choices heavily depend on personal expectations, the current financial situation and the economic environment. If managers expect these factors to change in the near future, they might opt for short-term debt in order to maintain flexibility instead of long-term debt. Additionally, firms may choose to issue more short-term debt to manage their exposure to interest rate risks, or they might have liquidity needs and be willing to accept a higher interest rate.

In contrast, the variable *termstructure* remains statistically significant and aligns with the predictions. Hence, if it increases by 1.03 percentage points, *maturity* decreases by 330.93 days (about 11 months).

As a result, *short-term rate* negatively impacts *maturity*, similar to *termstructure*. However, there is no correlation between the expected changes in monetary policy predicted by the Taylor rule and the firms' debt maturity decision.

The *TSY20* variable is statistically significant and aligns with the results of Badoer and James (2016), with a coefficient of -3,310.77. This implies that if the fraction of Treasury debt maturing in over 20 years relative to total debt changes by 0.03, *maturity* decreases by 99.32 days (about 3 months).

Moody's BBB-AAA 30Y, with a coefficient of -692.96, is consistent with the results of Badoer and James (2016). This means that if the difference between the percentage yields of Moody's 30-year BBB and AAA-rated corporate bond indices increases by 0.36 percentage points, *maturity* decreases by 249.47 days (about 8 months).

Moreover, the effect of *Market to book ratio* is statistically insignificant, whereas the *Market-Debt Ratio* and *EBIT to Total Assets* are significant and in line with expectations. *Market-Debt Ratio* has a negative impact on *maturity*, with a coefficient of -1,281.38, suggesting that if the ratio increases by one standard deviation, firms will decrease the maturity of the newly issued bonds by 281.90 days (about 9 months). In contrast, *EBIT to Total Assets* has a positive effect, increasing *maturity* by 78.56 days (about 3 months), for one standard deviation increase.

As *Market to book ratio*, *Dividend Dummy* also is statistically insignificant. On the other hand, the *IG Rating Dummy* aligns with the prediction of Badoer and James (2016). If a firm has an S&P rating higher than "BBB-", *maturity* increases by 723.72 days (about 1 year and 11 months).

Both *STD EBIT Growth 2DSIC* and *Ln(MV of Equity)* are consistent with the results of Badoer and James (2016), and their effect are both statistically significant.

4.2 Robustness Check with Monthly Dataset

This subsection presents the results obtained from the first model presented in Section 3.4 for the monthly dataset. The main differences from the quarterly dataset include a shorter period and the fact that the variable *TSY20* is analyzed monthly rather than quarterly, consistent with the framework of Badoer and James (2016). This is done to see if the results follow the same path also analyzing a more recent time period. As before, the model is analyzed both with and without the issuer identifier fixed effect. The effect of a standard deviation change on *maturity* for each variable is evaluated, with results rounded to two decimal places. The model employed only the 10-year fixed effect accounts for 6.21% of the variance of *maturity*. However, including the issuer identifier fixed effect increases the model's variance of *maturity* to 13.69%.

Table 2 presents the regression results, comparing the model with only the 10-year fixed effect (column 1) to the model that incorporates the issuer identifier fixed effect (column 2), with standard errors clustered by years.

Table 2: Regression Results for the Monthly Dataset

Dependent Variable:	Maturity	
Variable	**(1)**	**(2)**
Short-term rate	-24.76	-212.11**
	[43.50]	[62.41]
Difference	-24.84***	-16.33
	[6.99]	[20.49]
Termstrucure	-228.45***	-434.98***
	[35.29]	[75.91]
EBIT to Total Assets	857.26**	807.83**
	[355.71]	[314.36]
Ln(MV of Equity)	-28.26	17.87
	[21.29]	[25.18]
Market to book ratio	-141.70**	83.60
	[49.28]	[65.26]
Market-Debt ratio	-665.92***	-681.13*
	[210.47]	[312.03]
Dividend Dummy	287.94***	-157.79
	[79.53]	[144.68]
IG Rating Dummy	1,459.83***	633.36**
	[96.80]	[248.90]
STD EBIT Growth 2DSIC	3.93*	-3.40
	[1.58]	[2.11]
Moody's BBB-AAA 30Y	-352.65***	-578.31***
	[97.74]	[111.37]
TSY20	-11,767.13	-15,976.58*
	[10,504.86]	[8,609.62]
cons	4,694.32***	5,933.07***
	[431.77]	[357.65]
10-year fixed effect	YES	YES
ID-issuer fixed effect	NO	YES
Clustered standard errors	YES	YES
Observations	11,670	11,361
Adjusted R-squared	0.0621	0.1369

Note: This table reports coefficients with their corresponding standard errors in square brackets for two regressions. The columns (1) and (2) are regression results where only time_period is absorbed and id_issuer and time_period are absorbed respectively. All specifications include fixed effects. Standard errors are clustered at the year level. Significance levels: *10%, **5%, ***1%.

When considering only the 10-year fixed effect in the monthly dataset, *difference* and *termstructure* are statistically significant among the three main variables, whereas *short-term rate* is not. The main variable *difference* has a coefficient of -24.84, implying that an increase of 2.33 percentage points leads *maturity* to decrease by 57.87 days (about two months), which aligns with predictions. Following Estrella and Mishkin (1997), an increase in *difference* reduces the expectation of the future short-term rate. This means that if the expected short-term rate decreases more than the long-term rate, higher Δ results from Equation 2 in Section 2.1, indicating that long-term debt becomes more expensive, encouraging firms to deviate from their target debt mix and issue more short-term debt. However, this regression does not account for the issuer identifier fixed effect, which can account for unobserved and time-invariant characteristics across different entities. Therefore, this result could be influenced by specific firms' attributes that could affect their debt maturity decisions. Consequently, the inclusion of the issuer identifier fixed effect results in *difference* being statistically insignificant; hence, it does not statistically influence maturity decisions. This implies that the expected changes in monetary policy predicted by the Taylor Rule do not affect firms' debt maturity decisions, aligning with the results of Section 4.1.2

Contrarily, the effect of *short-term rate* is statistically insignificant when only the decade fixed effect is considered. However, when the issuer identifier fixed effect is included, its effect becomes statistically significant, indicating that the U.S. 3 Month Treasury Bill impacts *maturity.* However, the outcome does not align with expectations, as *short-term rate* has a negative impact on *maturity.* If *short-term rate* increases by 1.35 percentage points, *maturity* decreases by 286.34 days (about 9 months). *Short-term rate* follows the same trend as Section 4.1.1 and Section 4.1.2.

The third main variable, *termstructure* is statistically significant and aligns with expectations with and without the issuer identifier fixed effect. Excluding the issuer identifier fixed effect, it holds a coefficient of -228.45, suggesting that a 1.03 percentage points increase in *termstructure* results in a decrease in *maturity* by 235.30 days (about 7 months). However, with the inclusion of the issuer identifier fixed effect, a 1.03 percentage points increase in the yield difference between 10-year and 6-month treasuries leads to a decrease of *maturity* by 448.03 days (about 1 year and 2 months).

4.3 Robustness Checks for Extreme Values

As previously discussed in Section 3.4, both the quarterly and the monthly datasets are also employed to perform robustness checks by analyzing the impact of the main variable *difference* when its values are either above the 95th percentile or below the 5th percentile. The new dummy variables—*dummy_max* and *dummy_min*— take into account the impact of extreme values (positive and negative) of the main dependent variable. For instance, if the U.S. Fed Funds surpasses the Taylor rule rate, expectations of future loose monetary policy rise, as the Fed considerably deviates from the rate suggested by the Taylor rule. The model for the quarterly dataset accounts for 14.21% of the variance of *maturity*, while the model for the monthly dataset accounts for 13.68% of the variance of *maturity*. Table 3 presents the regression results, with standard errors clustered by year.

Table 3: Robustness Checks Results for Extreme Values

Dependent Variable:	Maturity	
Variable	**Quarterly**	**Monthly**
Short-term rate	-97.02*	-190.53***
	[53.21]	[62.11]
Dummy_max	195.69	122.45
	[259.40]	[97.74]
Dummy_min	166.43	243.69
	[185.65]	[185.29]
Termstrucure	-262.73***	-409.61***
	[62.07]	[74.02]
EBIT to Total Assets	679.19**	837.80**
	[265.00]	[318.10]
Ln(MV of Equity)	47.06*	19.53
	[22.98]	[24.99]
Market to book ratio	12.03	77.35
	[66.04]	[65.80]
Market-Debt ratio	-1,291.50***	-719.18**
	[283.94]	[297.14]
Dividend Dummy	-145.27	-160.43
	[126.85]	[143.70]
IG Rating Dummy	747.77***	630.62**
	[192.28]	[248.14]
STD EBIT Growth 2DSIC	-4.59**	-3.41
	[1.80]	[2.11]
Moody's BBB-AAA 30Y	-726.54***	-591.64***
	[127.05]	[107.53]
TSY20	-3,185.66**	-16,915.23**
	[1,286.44]	[8,396.79]
cons	7,896.30***	5,935.71***
	[1,190.06]	[347.35]
10-year fixed effect	YES	YES
ID-issuer fixed effect	YES	YES
Clustered standard errors	YES	YES
Observations	13,788	11,361
Adjusted R-squared	0.1419	0.1369

Note: This table reports coefficients with their corresponding standard errors in square brackets for two regressions. The columns Quarterly and Monthly are regression results where the quarterly dataset and monthly dataset are analyzed respectively. All specifications include fixed effects. Standard errors are clustered at the year level. Significance levels: *10%, **5%, ***1%.

The results from the robustness checks for extreme values are in agreement with the previous subsections. The results for both datasets conclude that there is no statistical evidence indicating an impact of expected future monetary policy predicted by the Taylor rule on corporate debt maturity decisions, even when controlled for extreme cases. This strengthens the results achieved in the previous subsections.

As before, the lack of correlation could be due to the application of a monetary policy rule that is not adapted for the prevailing economic context, or due to the fact that the Taylor rule data are not available daily, which may result in some *difference* values not accurately representing the disparity between the U.S. Fed Funds rate and Taylor Rule rate.

4.4 Robustness Check for the 1990s

This subsection discusses the results from the first model presented in Section 3.4 from the dataset spanning from 1993 to 1999. The model with only the 10-year fixed effect accounts for 9.59% of the *maturity* variance. However, when including the issuer identifier fixed effect, the model account for 27.23% of the variance. This dataset is used to determine whether the expected changes in monetary policy had a significant impact during the 1990s. This is expected because, consistent with Cochrane et al. (2019), the Taylor rule better forecasted monetary policy from 1985 to 2000 than in subsequent periods. Table 4 presents the regression results that include solely the 10-year fixed effect (column 1) and also include the issuer identifier fixed effect (column 2), with standard errors clustered by year are presented.

Table 4: Regression results for the 1990s Dataset

Dependent Variable:	Maturity	
Variable	**(1)**	**(2)**
Short-term rate	-98.72	81.70
	[339.58]	[345.51]
Difference	-167.84	124.18
	[343.21]	[220.27]
Termstrucure	-591.96*	-112.97
	[35.29]	[75.91]
EBIT to Total Assets	583.81	103.21
	[531.81]	[609.11]
Ln(MV of Equity)	216.40**	321.21**
	[78.78]	[119.6758]
Market to book ratio	-294.89*	-232.89**
	[146.09]	[76.16]
Market-Debt ratio	-634.22*	-1,809.16*
	[274.13]	[865.05]
Dividend Dummy	174.19	121.65
	[291.33]	[684.08]
IG Rating Dummy	1,725.53***	-352.5213
	[380.58]	[897.86]
STD EBIT Growth 2DSIC	-5.20**	-10.07
	[1.59]	[6.66]
Moody's BBB-AAA 30Y	-3,888.90**	-1,620.99
	[1,039.97]	[985.48]
TSY20	-36,403.20*	-27,308.90**
	[9,046.45]	[9,096.97]
cons	38,241.09***	28,170.41**
	[8,526.33]	[9,694.56]
10-year fixed effect	YES	YES
ID-issuer fixed effect	NO	YES
Clustered standard errors	YES	YES
Observations	2,228	1,982
Adjusted R-squared	0.0959	0.2723

Note: This table reports coefficients with their corresponding standard errors in square brackets for two regressions. The columns (1) and (2) are regression results where only time_period is absorbed and id_issuer and time_period are absorbed respectively. All specifications include fixed effects. Standard errors are clustered at the year level. Significance levels: *10%, **5%, ***1%.

Although the results are statistically insignificant, this may be due to data distribution issues, as approximately 2% of the variable *difference* has a negative value, whit the remainder being positive. Similarly, the robustness check with the second model from Section 3.4 cannot be conducted, due to an insufficient number of the extreme negative values (only 63), which too low for a comprehensive analysis, as outlined in Table F in the appendix.

To address this issue and expand the dataset, I recommend future research to lengthen the dataset from 1985 to 2000. As supported by Cochrane et al. (2019), during this period the Taylor rule was a superior predictor of the monetary policy implemented by the Fed.

5 Conclusion and Discussion

In light of the literature review, it was found that the sensitivity of short-term bond yields to changes in central bank interest rates is greater than that of long-term bond yields, as established by Estrella and Mishkin (1997) and Taylor (1995). Central bank short-term instruments significantly impact the short end of the yield curve, while the long end is influenced by factors such as long-term inflation and real economy expectations. For this reason, expected monetary policy tightening leads to differing effects on short-term and long-term interest rates. If tightening is seen as credible, long-term rates tend to rise less than short-term rates, resulting in a flatter yield curve (Estrella & Mishkin, 1997). Furthermore, Mokhova and Zinecker (2014), Bhamra et al. (2011) and Abaidoo and Kwenin (2013) demonstrate that macroeconomic conditions affect the capital structure choice. Hence, when the Fed is expected to tighten monetary policy, the difference between the long-term rate and the product of the actual short-term and the expected future short-term, derived from Greenwood et al. (2010), is expected to decrease. A lower difference indicates that long-term financing would be cheaper, encouraging firms to issue more long-term bonds. Therefore, in my thesis, I examined whether expected changes in macro policy decisions predicted by the Taylor rule significantly affect corporate debt maturity decisions.

My empirical analysis, however, does not support this hypothesis. After controlling for a large sample of companies, over time periods, and controlling for issuer identifier and decade fixes effects, I find that the expected changes predicted by the original Taylor rule do not influence corporate debt maturity decisions in general. This could be due to the application of a monetary policy rule that is not adapted to the economic context. Consistent with Benchimol and Fourçans (2019) a specific rule performs better than other monetary policy rules in forecasting monetary policies for each distinct period. Therefore, the choice of monetary policy rule should be the one that best predicts the Fed's behavior for each specific economic period. Another reason why results lack statistical significance could be that the data for the Taylor rule are not available daily, meaning some values of *difference* may not accurately represent the exact disparity between the U.S. Fed Funds rate and the Taylor rule rate. Moreover, when the analyses in both datasets are limited to when the variable *difference* exceeds than its 95th or falls below its 5th percentile, the results yield the same conclusion, which makes it more robust. Subsequently, I only consider the dataset with the years ranging from 1993 to 1999, because, as Cochrane et al. (2019) suggest, the Taylor rule forecasts monetary policy better from 1985 to 2000 than in the following periods. Unfortunately, the results are statistically insignificant possibly due to data distribution issues. Approximately 2% (63 observations out of 2,228) of the variable *difference* has a negative value, while the remainder has a positive value, likely causing bias in the results for this key explanatory variable. I direct future research to use a longer time period in order to have more extensive data for this type of analysis, using a time period spanning from 1985 to 2000, consistent with Cochrane et al. (2019).

Regarding the other two main variables tested in the different time periods, only the difference between the percentage yields of the 10-year and 6-month Treasury Bill aligns with the theoretical prediction I have made. This is because it has a statistically significant negative impact on both datasets. However, the short-term rate, proxied by the U.S. 3-month Treasury Bill, does not align with my expectation, negatively impacting the maturity of the new bond issuances. Economically talking this deviance from my predictions can be explained in different ways. For example, if the managers believe that the interest rate will continue to increase, the long rate will increase more than the short (Taylor, 1993), thus, leading them to issue more short-term bonds. Another possibility is that they believe that current long-term rates may already reflect higher expected future short-term rates. Thus, it depends heavily on personal expectations. Furthermore, capital structure choices depend on the current financial situation and the economic environment; if managers expect these to change in the near future, they might choose short-term debt in order to maintain flexibility. Additionally, firms may opt to issue more short-term debt to balance their exposure to interest rate risks, or perhaps they have liquidity needs and are willing to accept a higher interest rate. However, these hypotheses were not tested in this research and could be addressed in future studies.

Future research on expected changes in monetary policies may be directed to use different monetary policy rules, based on which rule better forecasts the Fed's behavior in a specific period. Such improvements could help to determine the real impact of expected macro policy decisions on corporate debt maturity decisions. The lack of statistical significance results could be attributed to the Taylor rule data I use, as it is collected quarterly. Hence, future research may consider calculating the Taylor rule rate directly from Talor's Equation 4 (presented in Section 2.4) on a daily basis.

Appendix

Table A: Distribution of observations over time in the Quarterly Dataset

fyear	Frequency	Percent	Cum.
1993	4	0.03	0.03
1994	164	1.15	1.18
1995	228	1.60	2.78
1996	340	2.39	5.17
1997	419	2.94	8.12
1998	602	4.23	12.35
1999	471	3.31	15.65
2000	306	2.15	17.80
2001	417	2.93	20.73
2002	388	2.73	23.46
2003	550	3.86	27.33
2004	486	3.41	30.74
2005	387	2.72	33.46
2006	340	2.39	35.85
2007	377	2.65	38.50
2008	283	1.99	40.49
2009	414	2.91	43.40
2010	451	3.17	46.56
2011	448	3.15	49.71
2012	547	3.84	53.56
2013	631	4.43	57.99
2014	592	4.16	62.15
2015	673	4.73	66.88
2016	635	4.46	71.34
2017	781	5.49	76.83
2018	566	3.98	80.80
2019	728	5.12	85.92
2020	1,023	7.19	93.11
2021	714	5.02	98.12
2022	267	1.88	100.00
Total	14,232	100.00	

Figure A: Distribution of observations over time in the Quarterly Dataset

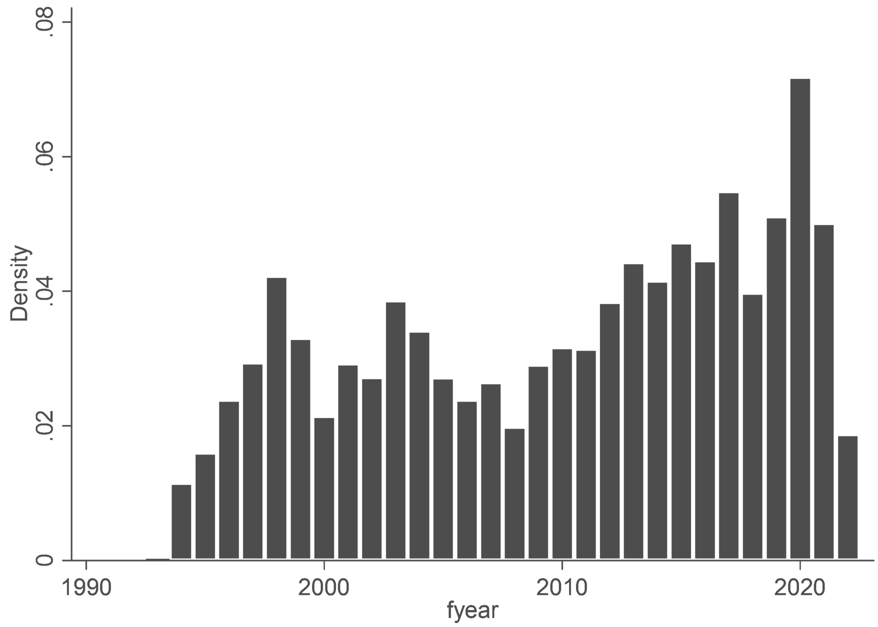

Table B: Distribution of observations over time in the Monthly Dataset

fyear	**Freq.**	**Percent**	**Cum.**
2001	389	3.33	3.33
2002	388	3.32	6.66
2003	550	4.71	11.37
2004	486	4.16	15.54
2005	387	3.32	18.85
2006	340	2.91	21.77
2007	377	3.23	25.00
2008	283	2.43	27.42
2009	414	3.55	30.97
2010	451	3.86	34.83
2011	448	3.84	38.67
2012	547	4.69	43.36
2013	631	5.41	48.77
2014	592	5.07	53.84
2015	673	5.77	59.61
2016	635	5.44	65.05
2017	781	6.69	71.74
2018	566	4.85	76.59
2019	728	6.24	82.83
2020	1,023	8.77	91.59
2021	714	6.12	97.71
2022	267	2.29	100.00
Total	11,670	100.00	

Figure B: Distribution of observations over time in the Monthly Dataset

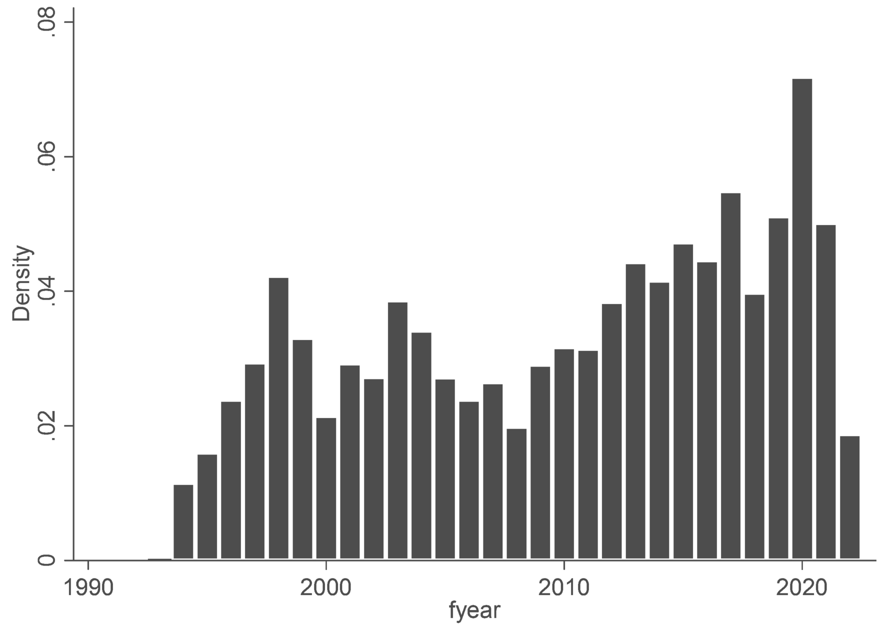

Table C: Description of the variables

Variable Label	**Description**
Dividend Dummy	Indicator variable: it takes value of one if the firm declared dividends on common stock. Measured by the Compustat variable *dvc*.
EBIT to Total Assets	Earnings before interest and taxes, scaled by total assets. Measured by Compustat variables $(ib + xint + txt)/at$.
IG Rating Dummy	Indicator variable: it has value of one if the firm has a long-term credit rating by S&P of *BBB*- or higher. Measured by the Compustat variables *splticrm*.
Ln(MV of Equity)	Natural logarithm of *Market Value of Equity*.
Market-Debt Ratio	Market-debt ratio. Measured by the Compustat variables $((dltt + dlc)/(dltt + dlc + prcc\_f * csho))$.
Market to book ratio	Market to book ratio. Measured by Compustat variables $((lt - txditc + prcc\_f * csho + preferred)/at)$. Where *preferred* is measured by *pstkl* or *pstkrv* or *pstk*.
Maturity in days	The maturity of the new bonds issued in days, independent variable.
Moodys BBB-AAA 30Y	Difference between the percentage yields of Moody's 30-year BBB and AAA rated corporate bond indices - measured monthly.
STD EBIT Growth 2DSIC	Industry earnings volatility measure: Measured as the annual standard deviation of growth in *EBIT to Total Assets* by 2-digit SIC codes.
Taylor rule	The Taylor Rule rate from FRED Economic Data, St. Louis Fed, calculated with their methodology. Measured quarterly.
Termstrucuture	Difference between the percentage yields of 10-year and 6-month treasury bill- measured daily.
TSY20	Fraction of Treasury debt maturing in over 20 years over the total debt - measured quarterly and monthly.
U.S. Fed Funds Rate	The actual interest rate set by the Fed, taken by the official website of the Fed. Measured daily.
U.S. 3 Month Treasury Bill	The U.S. 3 Month Treasury Bill yield taken directly from the U.S. central bank's database, taken daily.

Table D: Summary Statistics of Quarterly Dataset

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Maturity	14,232	4,307.73	3,652.84	60	36,542
Difference	14,232	-1.16	2.52	-11.59	4.32
Dummy_max (0)	14,234	0.95	0.22	0	1
Dummy_max (1)	14,234	0.05	0.22	0	1
Dummy_min (0)	14,234	0.95	0.22	0	1
Dummy_min (1)	14,234	0.05	0.22	0	1
Short-term rate	14,232	1.79	1.98	-0.05	6.39
Termstrucure	14,232	1.42	1.03	-0.78	3.73
EBIT to Total Assets	14,232	.08	0.11	-2.48	2.04
Ln(MV of Equity)	14,232	7.39	4.10	-3.73	14.25
Market to book ratio	14,232	1.41	1.27	0	18.35
Market-Debt ratio	14,232	0.25	0.22	0	1.00
Dividend Dummy (0)	14,234	0.29	0.46	0	1
Dividend Dummy (1)	14,234	0.71	0.46	0	1
IG Rating Dummy (0)	14,234	0.34	0.47	0	1
IG Rating Dummy (1)	14,234	0.66	0.47	0	1
STD EBIT Growth 2DSIC	14,232	12.65	31.06	0	285.43
Moody's BBB-AAA 30Y	14,232	0.95	0.36	0.55	3.38
TSY20	14,232	0.87	0.03	0.80	0.92

Table E: Summary Statistics of Monthly Dataset

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Maturity	11,670	4,261.73	3,535.44	60	36,536
Difference	11,670	-1.79	2.33	-11.59	3.22
Dummy_max (0)	11,670	0.95	0.22	0	1
Dummy_max (1)	11,670	0.05	0.22	0	1
Dummy_min (0)	11,670	0.94	0.23	0	1
Dummy_min (1)	11,670	0.06	0.23	0	1
Short-term yield	11,670	1.06	1.35	-0.046	5.17
Termstrucure	11,670	1.58	1.03	-0.625	3.73
EBIT to Total Assets	11,670	0.08	0.11	-1.78	1.17
Ln(MV of Equity)	11,670	7.85	3.99	-3.73	14.25
Market to book ratio	11,670	1.47	1.25	0	18.35
Market-Debt ratio	11,670	0.25	0.22	0	.99997
Dividend Dummy (0)	11,670	0.27	0.44	0	1
Dividend Dummy (1)	11,670	0.73	0.44	0	1
Rating Dummy (0)	11,670	0.32	0.47	0	1
Rating Dummy (1)	11,670	0.68	0.47	0	1
STD EBIT Growth 2DSIC	11,670	12.38	30.56	0	285.43
Moody's BBB-AAA 30Y	11,670	1.01	0.37	0.55	3.38
TSY20	11,670	0.038	0.006	0.0277	0.0585

Table F: *Diffrence* distribution in the 1990s

Category	**Freq.**	**Percent**	**Cum.**
Difference $>= 0$	2,165	97.17	97.17
Difference < 0	63	2.83	100.00
Total	2,228	100.00	

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