Learning From History: Examining Yield Spreads as a Predictor of Real Economic Activity

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Abstract

Economists often use complicated models in an attempt to predict economic activity; however, in recent years, attention has shifted toward more simplistic forecasting methods that have the potential to yield equally useful results. One such method involves examining the predictive power of interest rate yield spreads. The spread in interest rates offered for different debt securities with identical maturities reflects the required compensation investors demand for bearing extra risk. Within the market forces driving yield spreads lies tacit information of market expectations. The goal of this study is to examine yield spreads of various debt securities and compare changes in those spreads to changes in economic activity across the past 50 years. By using statistical methods to compare the relationships of various yield spreads to real economic activity, this paper will show the value of using interest rate yield spreads to forecast economic activity and determine which spreads are most valuable as predictors.

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I. Introduction

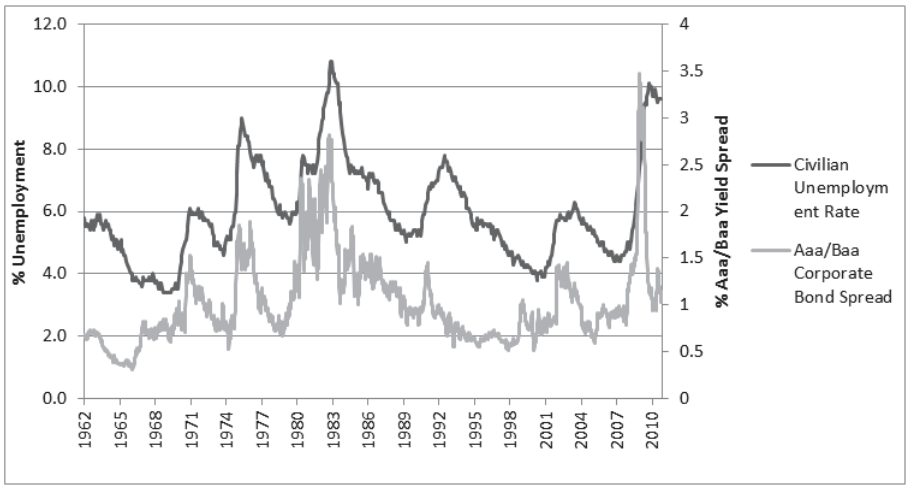
Varying theories of market efficiency revolve around the amount of information that is contained in asset prices. In an efficient market, prices contain all information that is available to the sea of investors that comprise the market population. This means that, aside from past information, market prices also reflect information about collective future expectations. These market expectations would then be influential in determining the required return for individual assets. This thesis hopes to build upon the fundamental idea that asset prices reflect information about future economic climates by examining the relationship between changes in yield spreads of various debt securities and changes in real economic activity.

Intuitively, trying to extract information held in market-driven interest rates to predict economic activity makes sense. The price of a financial asset is determined by the return that the market of investors requires on the asset. These prices are stated in terms of an interest rate, or required return, on the asset. The information contained in that required return includes the real rate of interest and premiums for expected inflation, default risk, liquidity, and other price determinates. It stands to reason that required returns may also contain information about collective expectations for future economic activity.

This research considers this possibility by examining how one specific measure of changing asset prices, yield spreads, relates to changes in real economic activity. Yield spreads, here defined as the difference between interest rates of debt securities with the same maturity and different levels of default risk, are a potentially important predictor of future economic activity. The difference in interest rates offered for debt securities with different levels of default risk vary based on the market's collective risk tolerance and varying requirements for compensation to bear that risk. In times of economic volatility, yield spreads often increase as decreases in demand for high-risk assets drive up the required return on those assets. In contrast, stable economic conditions often correspond to a contraction in yield spreads as investors become more comfortable holding risky securities.

A brief examination of historical yield spreads will serve to further this argument. Figure 1.1 shows a graph of the yield spread between Aaa/Baa corporate bonds compared to U.S. civilian unemployment over the past 50 years.

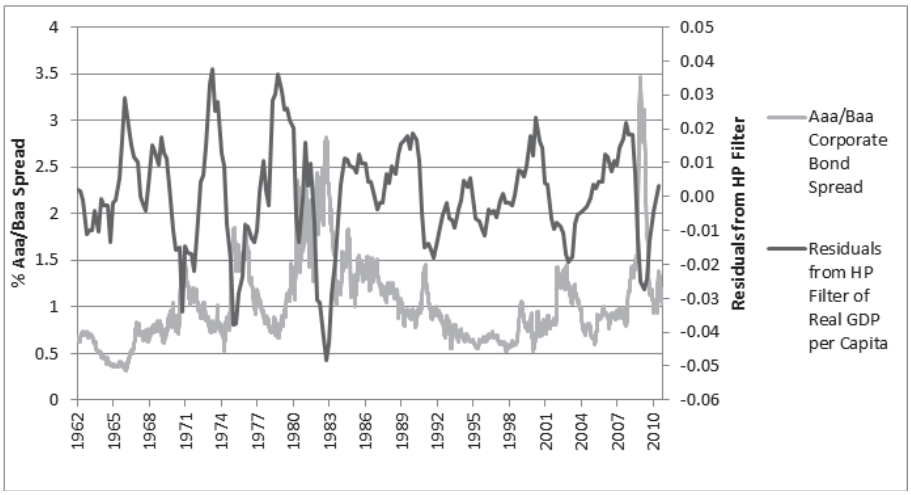
Figure 1.1: Aaa/Baa Corporate Bond Spread vs. Civilian Unemployment 1962-2010



This graph shows a clear relationship between changes in the Aaa/Baa corporate bond yield spread and civilian unemployment, a common indicator of real economic activity. The graph indicates a positive relationship between the two, which could be predicted using financial theory. An increase in the yield spread of Aaa/Baa corporate bonds would indicate that investors are demanding a higher return for bearing the increased risk of Baa bonds. Investors often require increased compensation for risk during times of economic uncertainty; increasing unemployment rates often coincide with declining economic conditions.

Figure 1.2 shows a graph of the same Aaa/Baa corporate bond spread plotted against a filtered measure of real GDP per capita over the past 50 years (details of the filter applied to the data are discussed in the methodology section).

Figure 1.2: Aaa/Baa Corporate Bond Spread vs. Real GDP per Capita 1962-2010



Here we see evidence of a negative relationship between the Aaa/Baa yield spread and economic activity measured by real per capita GDP. Contrary to the positive relationship seen with unemployment, one would expect a negative relationship here. Increasing yield spreads commonly occur during times of economic contraction, which would be marked by decreasing per capita GDP levels.

The graphs above help illustrate why interest rates have been an increasingly attractive method of predicting economic activity. Economists often include details of asset prices in combination with other economic indicators to predict economic trends (King and Watson 1996). These complex models often vary in their relative success in predicting real economic output. In contrast, this research takes a simpler, fact-based approach by analyzing patterns in interest rate data to determine key trends and relationships between changes in the prices of debt securities and real economic activity.

By showing the relationship between the chosen yield spreads and common measures of real economic activity, this study adds to a growing library of economic research that has important implications for future models with the goal of predicting economic activity. The increasingly apparent potential of using simplistic predictive models based on changing asset prices continues to gain support in the economic community. Advancing research in this area has important implications for the broad society of stakeholders influenced by economic activity. From policy makers in government office to corporate

executives to individual investors, increasing the accuracy of predictive economic models holds broad potential influence.

The next section of this thesis focuses on literature that examines existing research on the predictive power of asset prices, namely interest rate term structure and yield spreads. A thorough examination of existing research builds a foundation for the rest of this research. Following the literature review is an outline of the methodology used. A presentation and summary of the study results then leads to a discussion and conclusion of the thesis.

II. Literature Review

Existing research in this area can best be divided into two broad categories. The first being research examining the predictive value of term structure/yield curve (the difference in price of the same security across different maturities) and the second including research that examines the predictive value of yield spreads (the difference in price of different securities with the same maturity). Existing research using term structure/yield curves is much more prominent and the relative value of using term structure to predict economic activity is well-documented. Examining the predictive value of yield spreads is considerably less common in research focused on interest rate information. This thesis adds to this existing body of research by statistically examining the relationship between three common yield spreads and three common measures of economic activity to see if any of the spreads show potential predictive value. The following is an examination of some of the most prominent research on the use of interest rates as predictors of economic activity.

2.1 The predictive value of interest rate term structure

Historically, most of the research done on the value of interest rates as economic predictors has focused on considering interest rate term structure. Harvey (1988) was an early proponent of the value of term structure as a predictor of economic activity, showing that elaborate econometric models were unable to deliver predictions as accurate as simple term structure models. Stock and Watson (1989) contributed early to the popularity of using term structure as a predictor of economic activity by comparing the term structure of U.S. Treasury securities against multiple leading economic indicators at that time. The yield curve proved to be a far more valuable predictor of business cycle activity.

Early evidence in support of using the yield curve as an economic predictor led to an increasing amount of studies in this area during the 1990s. Studies continually showed the value of using the term structure of U.S. government bonds as a stand-alone predictor by comparing the yield curve against indexes

of other leading indicators (Bernanke 1990; Estrella and Mishkin 1997; Dueker 1997). Estrella and Hardouvelis (1991) showed the yield curve to have a strong association with changes in real economic output, consumption, and inflation levels. The term structure of government securities was also shown to be a valuable predictor of economic output and inflation throughout western Europe, in addition to the United States (Estrella and Mishkin 1996).

Eventually, research began to expand to look at other characteristics of interest rates beyond term structure of government securities. In the 2000s, research into predictive value of interest rate yield spreads gained increasing attention.

2.2 The predictive value of interest rate yield spreads

In the same paper where Stock and Watson (1989) popularized the use of U.S. Treasury term structure as a predictor of activity, they also showed the value of including the commercial paper-Treasury Bill yield spread in an index of leading economic indicators. Stock and Watson posed that the predictive value inherent in the paper-bill spread comes from changes in investor expectations of default risk, which in turn are dependent upon future economic conditions. Despite an early foundation, research in this area is relatively recent and considerably more scarce than research regarding term structure.

In the early 2000s, examinations of the yield spread as a predictor of activity gained popularity due to the decreasing statistical accuracy of models that incorporated term structure as a predictor. Whereas term structure had shown to be a strong predictor of economic activity throughout most of the 20th century, Mody and Taylor (2003) found that the high-yield corporate bond to U.S. Treasury yield spread was statistically a better predictor of real economic activity than the term structure of U.S. Treasury securities during the 1990s. The idea that changing economic structure in the late-20th/early-21st century could diminish the effectiveness of term structure as a predictor has spurred increased interest in research examining yield spreads.

Aslanidis and Cipollini (2009) also showed the predictive value of the high-yield corporate bond to 10-year Treasury spread. The study showed corporate bond to government bond yield spreads to be valuable predictors of real activity in aggregate in addition to showing the value of using sector-specific yield spreads as predictors of industry activity. Bianco and Pasaogullari (2009) examined the usefulness of the high-yield corporate bond spread as a predictor as well, and using a simple model predicted real U.S. GDP growth of 2.7% for 2010. Actual GDP growth for 2010 was 2.6%.

While these recent studies have shown potential value in using high-yield corporate spreads as predictors of economic activity, there is inherent diffi-

culty when using spreads of high-yield corporate bonds to predict economic activity. Commonly referred to as junk bonds, the market for high-yield corporate debt securities in the United States was not fully developed until the 1980s. As a result, there is a small sample size present when comparing junk bond data to real economic activity. Due to this small sample size, Stock and Watson (2003) suggest using the Aaa/Baa corporate bond spread as a more reasonable predictor due to its existence over a longer time frame. This same logic is the reason why this thesis considers the Aaa/Baa spread instead of using junk market interest rate data.

While the body of empirical evidence showing the value of using interest rate term structure as a predictor of real economic activity is fairly expansive, that of research focusing on interest rate yield spreads is considerably less available. However, the two concepts share many of the same ideas regarding why interest rates are useful in practical applications as predictors of activity. Although there is no standard theory to support the predictive value of interest rate term structure, most empirical papers advance informal explanations as to why relationships between term structure and real activity exist (Estrella 2005). One frequently cited reason relates to the influence of monetary policy over term structure. For example, a rise in the short-term interest rate will flatten the yield curve and theoretically lead to a lagged decrease in real economic growth. This is often posed as an important reason why the yield curve proves to be such a successful predictor of future output. However, as stated above, expectations of future inflation and real interest rates contained in the yield curve also seem to play an important role in increasing its value as a predictor.

The fundamental similarity to be considered here is the idea that all interest rates contain inherent information. Whereas the term structure of interest rates has been consistently shown to contain information regarding real future economic activity, the comparative value of using yield spreads is less conclusive.

By using statistical techniques to show the relationship between spreads and future output, this thesis lays a basic foundation for future research and understanding into possible relationships between the two. The following section describes in detail the statistical methodology used to examine the relationship between the aforementioned yield spreads and selected measures of real economic activity, as well as inherent assumptions and limitations of the methodology used. After the description of methodology is a presentation and discussion of results found.

III. Methodology

3. 1 Data Summary and Collection

This analysis uses historical U.S. economic and interest rate data. There are numerous government organizations that maintain online databases of historical economic information for the United States. To calculate the target yield spreads, historical interest rate data for Aaa/Baa corporate bonds, AA commercial paper, and various U.S. Treasuries was collected from multiple online databases. Table 3.1 summarizes the yield spread data sets used in the statistical analyses, as well as the respective data sources.

Table 3.1: Interest Rate Data[2]

Descriptive Statistics: Interest Rate Spreads							
	Dates	Mean	Median	Min	Max	Range	Source
3-Mth AA Commercial Paper/3-Mth U.S. Treasury	4/01/1971 - 10/01/2010	0.60%	0.44%	0.06%	4.38%	4.32%	U.S. Federal Reserve Economic Database (FRED)
Aaa/Baa Corporate Bond Yield Spread	1/01/1960 - 10/01/2010	1.02%	0.89%	0.32%	3.38%	3.06%	
Aaa Corporate Bond/10-Yr U.S. Treasury	1/01/1960 - 10/01/2010	0.89%	0.82%	-0.17%	2.68%	2.85%	

Data selected to measure real economic activity include the historical U.S. civilian unemployment rate, real per capita GDP, and real per capita consumption. Table 3.2 summarizes the data sets for real economic activity along with relevant sources.

2 research.stlouisfed.org/fred2

Table 3.2: Economic Data[3]

Descriptive Statistics: Economic Activity							
	Dates	Mean	Median	Min	Max	Range	Source
Civilian Unemployment Rate	1/01/1960 - 10/01/2010	5.71%	5.6%	2.5%	10.8%	8.3%	U.S. Bureau of Labor Statistics (BLS)
Real per Capita GDP (Chained 2005 Dollars)	1/01/1960 - 10/01/2010	$26,243	$25,313	$12,239	$44,080	$31,841	U.S. Bureau of Economic Analysis (BEA)
Real per Capita Consumption (Chained 2005 Dollars)	1/01/1960 - 10/01/2010	$17,366	$16,497	$7,904	$30,816	$22,912	

All data used in the analysis is calculated at quarterly intervals. The per capita economic data collected from the BEA was cleaned by applying the Hodrick-Prescott Filter (HP Filter) to the natural logarithm of the initial data. Filtering the data in this way eliminates the effects of over-differencing and provides for a more valuable comparison to changes in yield spreads. The HP Filter attempts to fit a line to the data series while accounting for effects of seasonality. The generic form of the HP Filter can be written:

$$Y_t = \tau_t + c_t,$$

where Yt equals the observation, τt equals the trend, and ct equals the effect of seasonality, all measured at time t. The residual observations in relation to the HP line are then used in the statistical analyses comparing per capita output and consumption to changes in yield spreads.

3.2 Methods for Analysis

To examine the relationship between yield spreads and real economic activity the data was compared using two common statistical techniques used for examining relationships among data: cross-correlation and regression.

A cross-correlation analysis was run comparing all three spreads to each measure of real economic activity. This analysis outlines the relationship between each spread and corresponding measure of economic activity across multiple positive and negative time lags. The output from the cross-correlation analysis consists of individual correlation coefficients calculated at all speci-

3 bls.gov; bea.gov

fied time lags. Correlation coefficients near zero indicate the presence of a random relationship between the two variables. Strong non-zero coefficients indicate a non-random relationship. If the yield spreads have value as predictors of economic activity, they should show strong non-zero correlations with the selected measure of economic output at one or more time lags.

The regressions show the effect the independent variable, the selected yield spread, has on the dependent variable, real economic activity, at eight quarterly time lags to determine the value the spread has as a predictor of economic activity. Nine total regressions were run to analyze each spread in relation to each measure of economic activity while incorporating the eight quarterly time lags to find which lags show the strongest relationship. The generic formula for the regression follows:

$$Y_t = \alpha_0 + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \ldots + \beta_8 x_{t-8} + \varepsilon_t,$$

where Yt represents the dependent economic variable at time t and x represents the independent yield spread variable at each respective time lag.

The regressions serve to illustrate the strength and nature of the relationship between yield spreads and economic activity and to show the value of predictive information inherent in yield spread fluctuations. Also, by comparing the relative strength of each yield spread, the regression shows which spreads hold the most predictive value. The relative value of the regression models is determined by comparing R2 values and numbers of significant regressors.

3.3 Appropriateness of Methodology

The statistical analyses listed above are appropriate for this thesis given the nature of the research question and data being examined. The primary purpose of this thesis is to examine the relationship between interest rate yield spreads and real economic activity. A cross-correlation analysis demonstrates the nature of the relationship present between the selected variables. Regression analysis is an effective way to analyze and show relationships between quantitative dependent and independent variables.

The selected methods for analysis allow for a clear presentation of a large amount of historical data, as well as any inherent relationships within that data. The primary goal of this thesis is to compile and present valuable relationships in historical economic data in a format that is useful to others who might read it. The statistical methods used here represent a level-one analysis designed to clearly demonstrate any relationship present among the selected spreads and economic data. Compiling interest rate and economic data and using regression and cross-correlation analyses across multiple time lags to examine and present the relationship between the two categories of data satisfies the pri-

mary purpose of this research.

3.4 Assumptions and Limitations

The stated methodology relies on a number of assumptions. First, there are a number of assumptions present when using regression analysis as a statistical tool. These include the assumption of a linear relationship, representative sample, etc. The assumptions present with regression analysis represent a main limitation of my thesis, but given the data being used, this form of analysis is still the most appropriate methodology.

The other key assumption of this thesis is the assumption that interest rate spreads hold information about market demand. The risk premium present between debt securities with different levels of inherent risk is driven by investors' willingness to bear that risk. Changes in risk preferences will in turn cause changes in the various yield spreads between securities. This paper assumes that investors' collective expectations about the future economic environment affect the compensation they require for bearing risk. Therefore, changes in yield spreads of debt securities result from changes in market expectations of future economic activity. The statistical analysis presented in this research attempt to determine whether or not there is a relationship between yield spreads and economic activity, but it will not be able to define why that relationship exists. The notion that yield spreads contain inherent information must then be assumed, and that assumption is one of the key motivators of this research.

As stated previously, the inherent assumptions present with any regression analysis limit the effectiveness of regression as an analytical tool. Fundamentally, using regression models to analyze the relationship between spreads and output will illustrate a relationship but will not define a causal relationship. Therefore, a main limitation of this analysis stems from the assumption that interest rate yield spreads hold information about activity. There could be numerous other causal factors that affect both yield spreads and economic activity that might cause an apparent relationship. It is also possible that yield spreads change as a reaction to changes in real economic activity, which would imply a reactionary market rather than a predictive one.

The stated limitations will decrease the usefulness of the statistical analysis as a predictor of economic activity. However, the main goal of this thesis is not to create a comprehensive model for predicting economic activity, but instead to plainly document a relationship with potentially important economic implications.

IV. Results

Cross-correlation analyses were run as a precursor to the regression analysis. Results of the cross-correlation tests serve mainly as a graphic illustration of the nature of relationships among the data. These results can be found in Appendix 1. The remainder of this section focuses summarizing the results of the nine regressions. As stated previously, each regression was run using eight time lags. Each lag represents a one quarter time lag, so each regression contains two years of data leading up to the measured independent variable at time t.

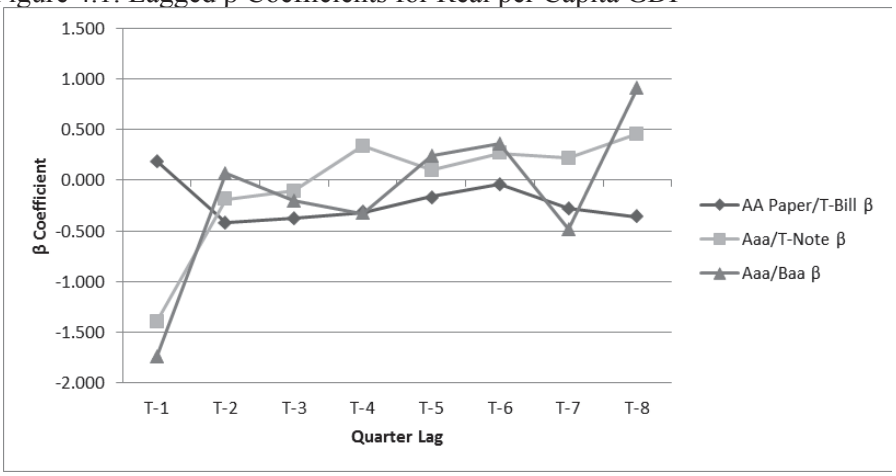
The results of the regressions were largely mixed in nature. Table 4.1 summarizes the regression model statistics drawn from the appropriate analyses of variance (more detailed summaries of regression statistics can be found in Appendix 2). Overall, regression models predicting real per capita measures of economic activity were largely insignificant as predictors. Both regressions were run using actual quarterly interest rate spreads lagged as independent variables, with the dependent variable being the natural log of the appropriate measure of per capita output filtered using the HP Filter (as discussed in the methodology section).

Table 4.1: Comparative Measures of Model Significance

Indicator	Spread	R^2	# of significant regressors
Unemployment	Commercial Paper/T-Bill	0.325	4
	Aaa/T-Note	0.083	1
	Aaa/Baa	0.709	3
Real per capita GDP	Commercial Paper/T-Bill	0.122	0
	Aaa/T-Note	0.143	1
	Aaa/Baa	0.250	1
Real per capita consumption	Commercial Paper/T-Bill	0.179	0
	Aaa/T-Note	0.052	1
	Aaa/Baa	0.207	2
Note: Each regression uses 8 quarterly time lags			

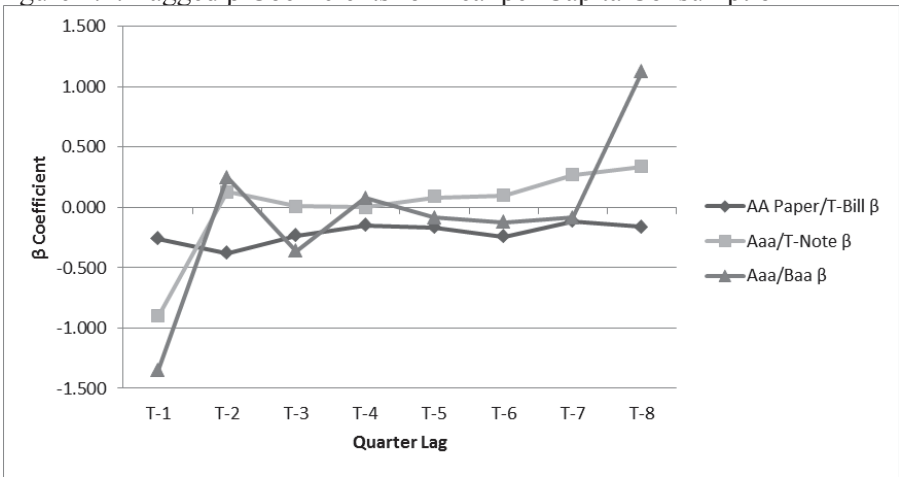
Figures 4.1 and 4.2 show the beta coefficients for each respective time lag in the regression models for real per capita GDP and consumption. Out of 48 tested time lags, only five showed statistically significant p-values.

Figure 4.1: Lagged β Coefficients for Real per Capita GDP



In predicting real per capita GDP, the AA paper/Treasury Bill spread showed no significant regressors. Given the earlier graph of Aaa/Baa to real GDP per capita shown in the introduction section (Figure 1.2), I would have expected the Aaa/Baa spread to show some significance as a predictor. The Aaa/Baa and Aaa/Treasury spreads showed strong significance at the one-quarter time lag but none in the later quarters.

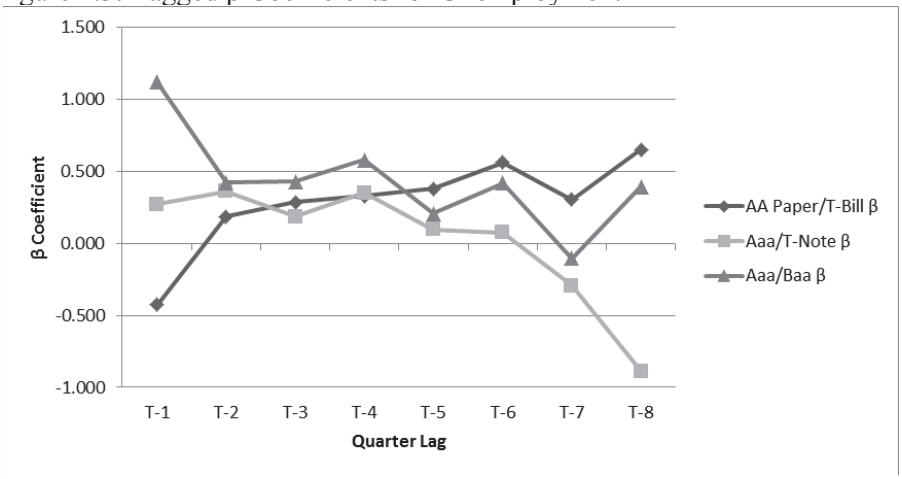
Figure 4.2: Lagged β Coefficients for Real per Capita Consumption



The Aaa/Baa corporate bond spread showed statistical significance in predicting real per capita consumption at time lags T-1 and T-8, which does not represent a rational pattern. The large negative coefficient at time T-1 and the large positive coefficient at time T-8 also represent an irrational predictive pattern. If the spreads were useful in predicting real consumption we would expect to see multiple negative coefficients. The paper/bill and Aaa/Treasury spreads show no significance as predictors of real per capita consumption.

The regressions of the three interest rate spreads against an unfiltered measure of civilian unemployment showed the most value as potential predictors of activity. The AA commercial paper/Treasury Bill spread may have some value as a predictor of future unemployment. Even with a relatively low overall R2 value of .33, it still shows higher potential value than a majority of the other models with three statistically significant predictors in the 5 to 8-quarter range. Using the Aaa/Baa corporate bond spread to predict civilian unemployment shows the highest potential as a predictive model, with an overall R2 of .71 and a number of statistically significant independent variables. Even though the Aaa/Baa model has fewer statistically significant regressors than the paper/bill spread overall, the number of consistently high β coefficients result in a much more valuable model. Figure 4.3 shows the relative beta coefficients of the unemployment regressions.

Figure 4.3: Lagged β Coefficients for Unemployment



As was discussed in the introduction, unemployment rates and yield spreads seem to have a natural relationship and correspondingly have moved together over time. These regression results support that conclusion. The fol-

lowing section goes deeper into the discussion of these results.

V. Discussion and Conclusion

In comparing the results seen here to existing research in this area, three main conclusions may be drawn:

1. The AA Commercial Paper/Treasury Bill spread appears to be decreasing in benefit as a predictor of real activity.
2. The relationship between yield spreads and Real per capita GDP and Consumption has been inconsistent.
3. The relationship between the Aaa/Baa spread and unemployment has been predictably strong over the past 50 years.

5.1 AA Commercial Paper/Treasury Bill spread

Initially, the forecast accuracy of the Commercial Paper/Treasury Bill spread is what attracted economic researchers to the idea of including yield spreads in economic forecasting models (Stock and Watson 1989; Friedman and Kuttner 1992, 1993, 1994). However, the Stock/Watson and Friedman/Kuttner papers both used data sets from similar economic time periods (1960-1990). In the decades since these results were first published, there have been multiple studies showing the decline of the paper/bill spread's forecast accuracy (Stock and Watson 2003; Gilchrist and Zakrajšek, 2008). Gilchrist and Zakrajšek (2008) suggest that this change may be due to the fact that as financial markets evolve, the information content of specific financial asset prices may change as well. Stock and Watson (2003) provide empirical support to this conclusion by examining a multitude of different asset prices as economic predictors over multiple time periods in multiple economies. Ultimately, they conclude that the effectiveness of any single asset price as a predictor of real economic activity appears to fluctuate and has not shown to be constant in one country over multiple decades. In the case of the paper/bill spread, it is possible that the maturation of the commercial paper market over the past 30 years has reduced the effectiveness the spread once had for predicting economic activity.

Another possible explanation for the decreased significance of the paper/bill spread as a predictor could be the minimal price effect of yield spreads on short-term securities. Yields of debt securities are calculated from dollar prices determined by market demand for any particular security. Due to the short maturity of commercial paper and Treasury Bills, the discounted effect the yield

spread has on the price is minimal. In contrast, applying the yield spread to the Aaa/Baa corporate bond spread over a term of 10 years creates a much larger price impact. The economic significance of this dollar price difference could influence the relative significance of each respective spread as a predictor of activity. The yield/price relationship is demonstrated in Table 5.1.

Table 5.1:

Security	Yield Spread	Maturity	Coupon	Price	Price Difference
T-Bill	0.00%	3 months	-	$ 999.377	$ -
AA Paper	0.45%	3 months	-	$ 998.267	$ 1.110
Treasury Note	0.00%	10 years	3.00%	$ 1,217.760	$ -
Aaa Corporate Bond	0.82%	10 years	3.00%	$ 1,145.227	$ 72.533
Baa Corporate Bond	1.71%	10 years	3.00%	$ 1,072.703	$ 145.057

Note: Assumes $1,000 Par

The table uses the current 10-year yield curve found using implied yields of Treasury securities. The yield spreads are median yield spreads of the relevant securities over the matched-maturity Treasury security. The coupon rate of 3% assigned to the 10-year bonds was randomly chosen for the purpose of calculating the prices. Because of the depressed interest rate environment, using a 3% coupon results in a 10-year Treasury Note priced at a large premium. The table clearly shows the effect yield spreads have on the price of long-term maturities when compared to short-term maturities and demonstrates the economic significance of yield spreads over longer maturities.

5.2 Real per capita GDP and Consumption

The lack of relationship between the selected spreads and real per capita consumption is not surprising. Intuitively, it is clear why there would be a more direct relationship between yield spreads and unemployment or production than personal consumption spending. Previous studies have arrived at this same conclusion as well. Gilchrist, Yankov, and Zakrajšek (2009) showed that credit spreads have essentially no information content for future consumption spending on either durable or nondurable goods. Using corporate debt interest rates to predict activity has the potential to work well when predicting unemployment or production, but the information does not translate to household spending.

5.3 Aaa/Baa spread and Unemployment

The most promising results of this study relate to the strong relationship seen between the Aaa/Baa corporate bond spread and U.S. civilian unemployment. As discussed with the presentation of Figure 1 at the beginning of this thesis, there seems to be a strong intuitive foundation for the presence of this relationship. Additionally, the Aaa/Baa spread has gained attention as providing more predictive benefit than the paper/bill spread or other corporate credit spreads including the high-yield spread. Gilchrist and Zakrajšek (2008) conducted a comprehensive study to compare the predictive effectiveness of multiple commonly-used yield spreads. They conclude that the forecast ability of yield spreads is well captured by a single index that measures credit spreads of long maturity bonds issued by firms with low-to-medium probability of default. The Aaa/Baa spread used here satisfies those requirements.

A possible explanation for this relates to the close relationship between the financial economic environment and the large companies whose debt comprises the Aaa/Baa spread. As conditions in the financial sector deteriorate in advance of economic downturns, the availability of credit in the marketplace declines and increases the premium associated with default risk on debt securities. This results in a decline in investment spending and a contraction in economic activity. Disturbances emanating from the financial sector cause a rise in the cost of credit for nonfinancial firms (Gilchrist and Zakrajšek 2008).

Another possible explanation for the close relationship between yield spreads and unemployment could be the fact that spreads share a more similar risk profile with unemployment than the other two economic indicators used here. Yield spreads and unemployment are both negative indicators. Unemployment has a minimum value and yield spreads can only narrow to a point, so neither measure experiences the full benefits of an economic boom. However, during a recessionary environment both spreads and unemployment can deteriorate unchecked along with the economy. On the other hand, per capita measures of GDP and consumption are positive indicators and have no maximum growth level, which allows them to increase without any upper boundary during periods of economic expansion.

5.4 Conclusion

Because interest rates are forward looking, using them in an attempt to predict economic activity has long been common in the world of economic research. What separates the information held in yield spreads from that of the underlying rates used to calculate the spreads is that the way in which the spreads vary provides us with information beyond the presence or absence of a simple time trend (Friedman and Kuttner 1994). When controlling for the

effect of the yield spread, it has been empirically shown that interest rates themselves have little predictive content for real output (Bernanke and Blinder 1992).

Multiple theories have been put forth as to why the variation in yield spreads over time may hold predictive information about future economic activity. Stock and Watson (1989) suggested that the predictive content arises from expectations of default risk inherent in yield spreads. Friedman and Kuttner (1994) pose that varying levels of liquidity among debt securities of different default risk affect supply and demand for individual securities based on expected economic conditions; these changes in supply and demand then affect the yield spread. The responsiveness of varying debt securities to changes in monetary policy preceding changes in economic conditions also may contribute to the predictive power of yield spreads (Bernanke 1990; Bernanke and Blinder 1992). Ultimately, these conclusions are not mutually exclusive and all may contribute to the predictive power of interest rate yield spreads. While the relative value of using certain yield spreads to predict economic activity may change over time, it continues to be shown that spreads have the potential to contribute information to models predicting economic activity.

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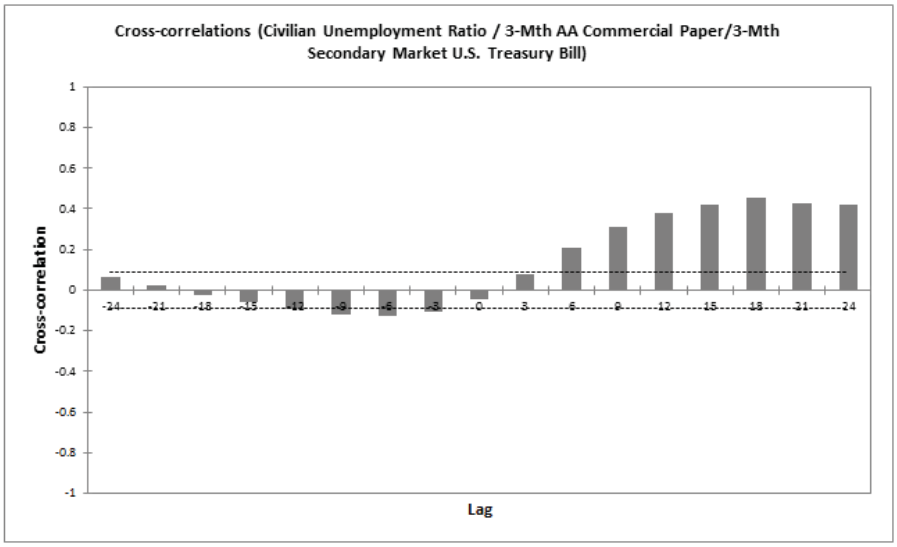
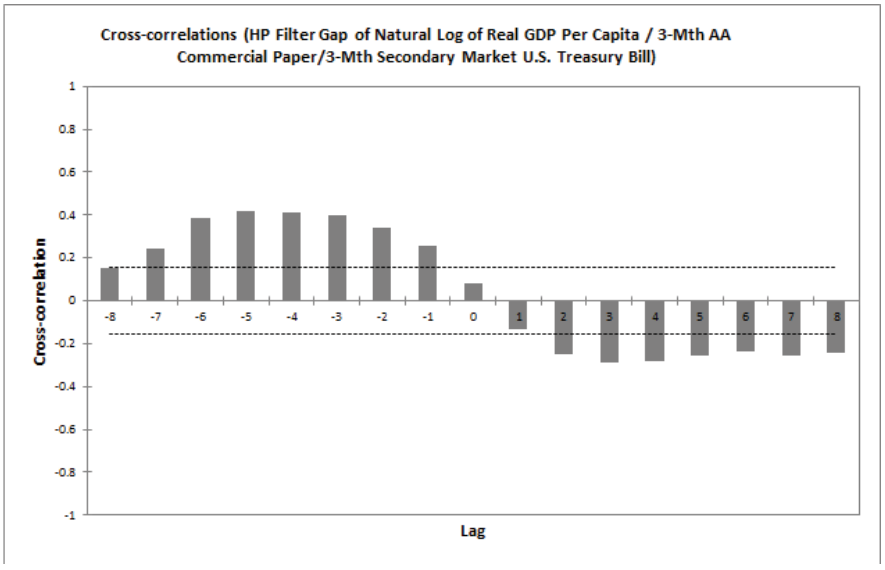
Appendix

Appendix 1: Cross-Correlation Results & Graphs

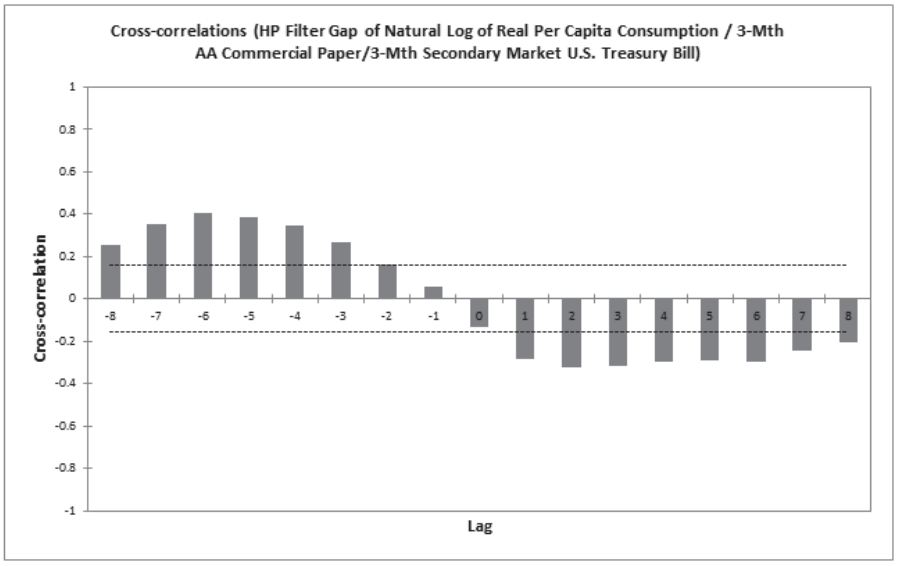
Cross-correlations (Civilian Unemployment Ratio / 3-Mth AA Commercial Paper/3-Mth Secondary Market U.S. Treasury Bill):				
Month Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-24	0.066	0.046	-0.090	0.090
-21	0.025	0.046	-0.090	0.090
-18	-0.024	0.046	-0.090	0.090
-15	-0.058	0.046	-0.090	0.090
-12	-0.094	0.046	-0.090	0.090
-9	-0.123	0.046	-0.090	0.090
-6	-0.126	0.046	-0.090	0.090
-3	-0.107	0.046	-0.090	0.090
0	-0.047	0.046	-0.090	0.090
3	0.078	0.046	-0.090	0.090
6	0.210	0.046	-0.090	0.090
9	0.313	0.046	-0.090	0.090
12	0.376	0.046	-0.090	0.090
15	0.418	0.046	-0.090	0.090
18	0.454	0.046	-0.090	0.090
21	0.430	0.046	-0.090	0.090
24	0.421	0.046	-0.090	0.090



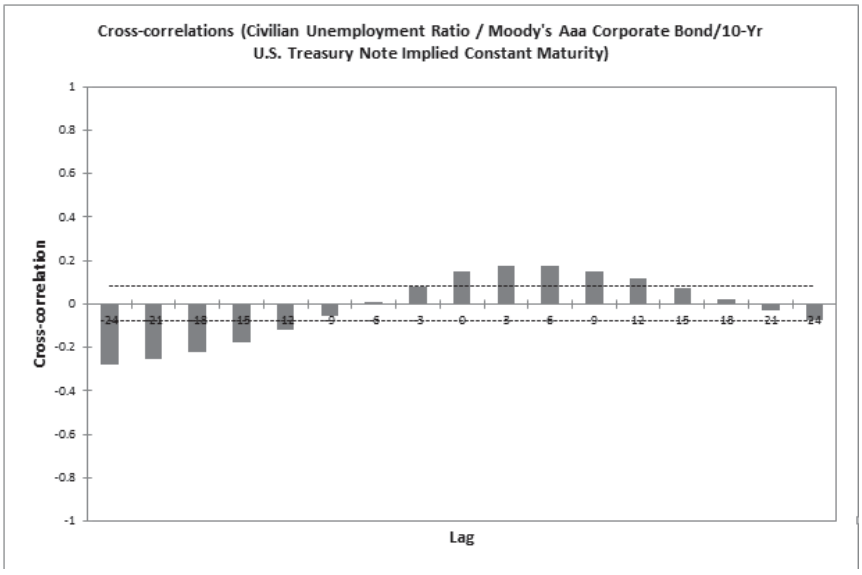
Cross-correlations (HP Filter Gap of Natural Log of Real GDP Per Capita / 3-Mth AA Commercial Paper/3-Mth Secondary Market U.S. Treasury Bill):				
Quarter Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-8	0.155	0.080	-0.156	0.156
-7	0.244	0.080	-0.156	0.156
-6	0.385	0.080	-0.156	0.156
-5	0.416	0.080	-0.156	0.156
-4	0.410	0.080	-0.156	0.156
-3	0.397	0.080	-0.156	0.156
-2	0.338	0.080	-0.156	0.156
-1	0.254	0.080	-0.156	0.156
0	0.080	0.080	-0.156	0.156
1	-0.130	0.080	-0.156	0.156
2	-0.249	0.080	-0.156	0.156
3	-0.287	0.080	-0.156	0.156
4	-0.285	0.080	-0.156	0.156
5	-0.259	0.080	-0.156	0.156
6	-0.238	0.080	-0.156	0.156
7	-0.257	0.080	-0.156	0.156
8	-0.242	0.080	-0.156	0.156



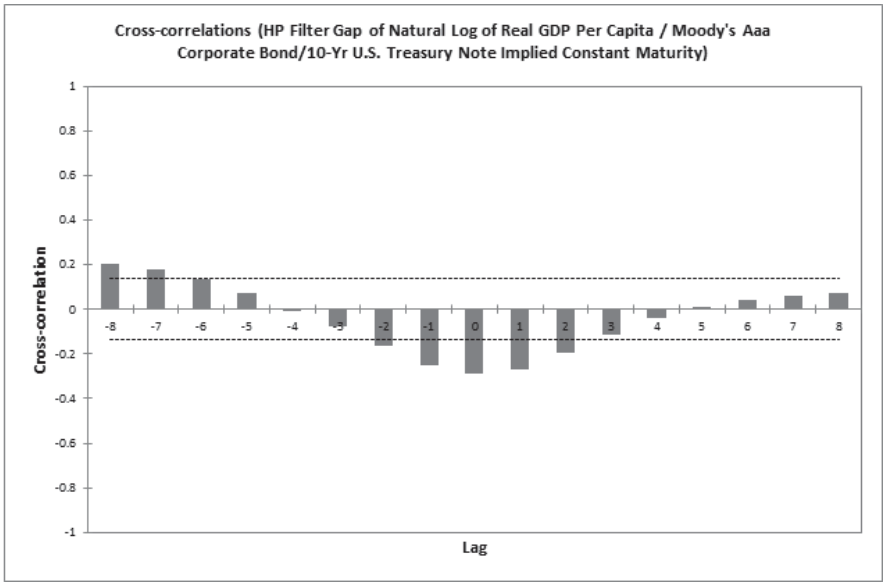
Cross-correlations (HP Filter Gap of Natural Log of Real Per Capita Consumption / 3-Mth AA Commercial Paper/3-Mth Secondary Market U.S. Treasury Bill):				
Quarter Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-8	0.255	0.080	-0.156	0.156
-7	0.349	0.080	-0.156	0.156
-6	0.405	0.080	-0.156	0.156
-5	0.388	0.080	-0.156	0.156
-4	0.347	0.080	-0.156	0.156
-3	0.269	0.080	-0.156	0.156
-2	0.163	0.080	-0.156	0.156
-1	0.054	0.080	-0.156	0.156
0	-0.132	0.080	-0.156	0.156
1	-0.283	0.080	-0.156	0.156
2	-0.322	0.080	-0.156	0.156
3	-0.319	0.080	-0.156	0.156
4	-0.300	0.080	-0.156	0.156
5	-0.290	0.080	-0.156	0.156
6	-0.297	0.080	-0.156	0.156
7	-0.243	0.080	-0.156	0.156
8	-0.208	0.080	-0.156	0.156



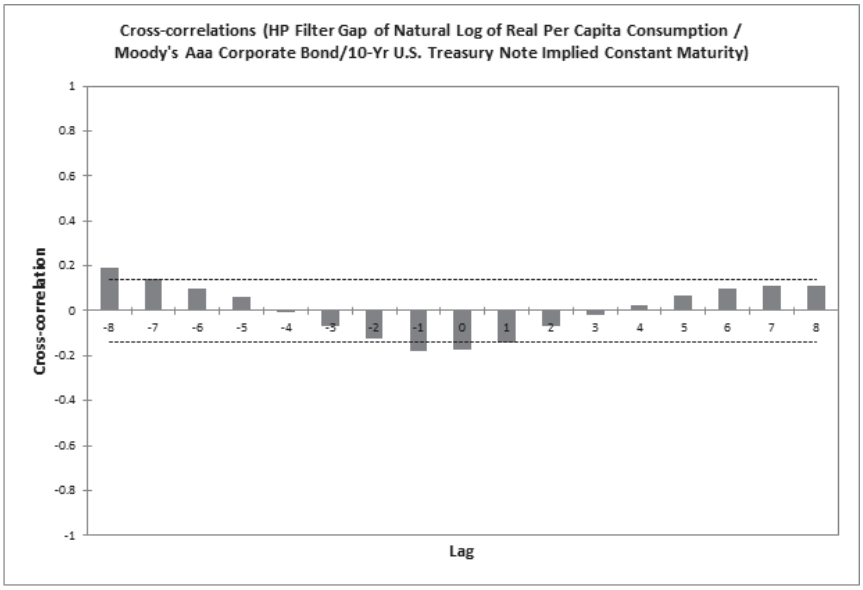
Cross-correlations (Civilian Unemployment Ratio / Moody's Aaa Corporate Bond/10-Yr U.S. Treasury Note Implied Constant Maturity):				
Month Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-24	-0.281	0.041	-0.080	0.080
-21	-0.257	0.041	-0.080	0.080
-18	-0.222	0.041	-0.080	0.080
-15	-0.177	0.041	-0.080	0.080
-12	-0.119	0.041	-0.080	0.080
-9	-0.054	0.041	-0.080	0.080
-6	0.011	0.041	-0.080	0.080
-3	0.080	0.041	-0.080	0.080
0	0.150	0.041	-0.080	0.080
3	0.175	0.041	-0.080	0.080
6	0.174	0.041	-0.080	0.080
9	0.153	0.041	-0.080	0.080
12	0.120	0.041	-0.080	0.080
15	0.073	0.041	-0.080	0.080
18	0.023	0.041	-0.080	0.080
21	-0.033	0.041	-0.080	0.080
24	-0.074	0.041	-0.080	0.080



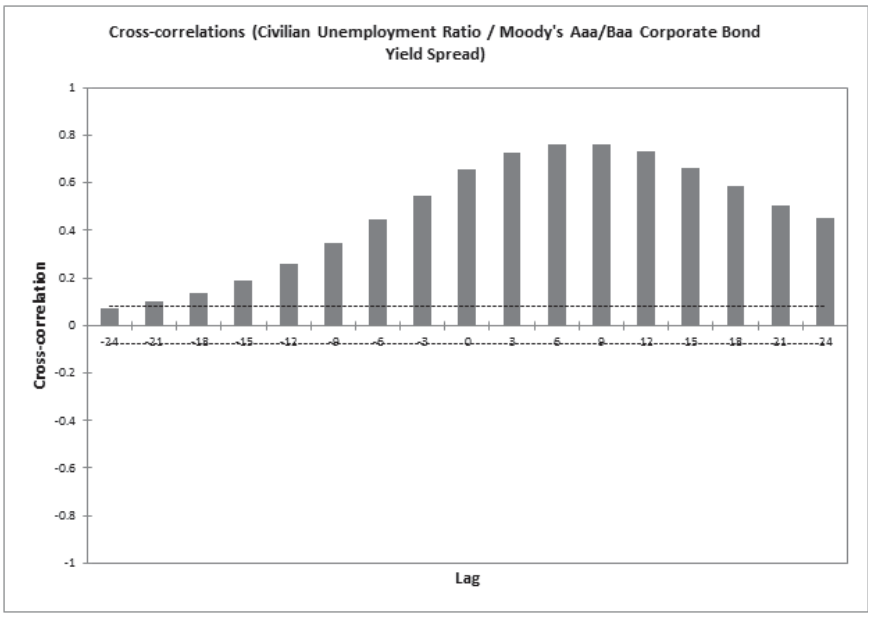
Cross-correlations (HP Filter Gap of Natural Log of Real GDP Per Capita / Moody's Aaa Corporate Bond/10-Yr U.S. Treasury Note Implied Constant Maturity):				
Quarter Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-8	0.204	0.070	-0.138	0.138
-7	0.178	0.070	-0.138	0.138
-6	0.136	0.070	-0.138	0.138
-5	0.074	0.070	-0.138	0.138
-4	-0.001	0.070	-0.138	0.138
-3	-0.079	0.070	-0.138	0.138
-2	-0.162	0.070	-0.138	0.138
-1	-0.248	0.070	-0.138	0.138
0	-0.288	0.070	-0.138	0.138
1	-0.270	0.070	-0.138	0.138
2	-0.197	0.070	-0.138	0.138
3	-0.115	0.070	-0.138	0.138
4	-0.041	0.070	-0.138	0.138
5	0.005	0.070	-0.138	0.138
6	0.042	0.070	-0.138	0.138
7	0.060	0.070	-0.138	0.138
8	0.071	0.070	-0.138	0.138



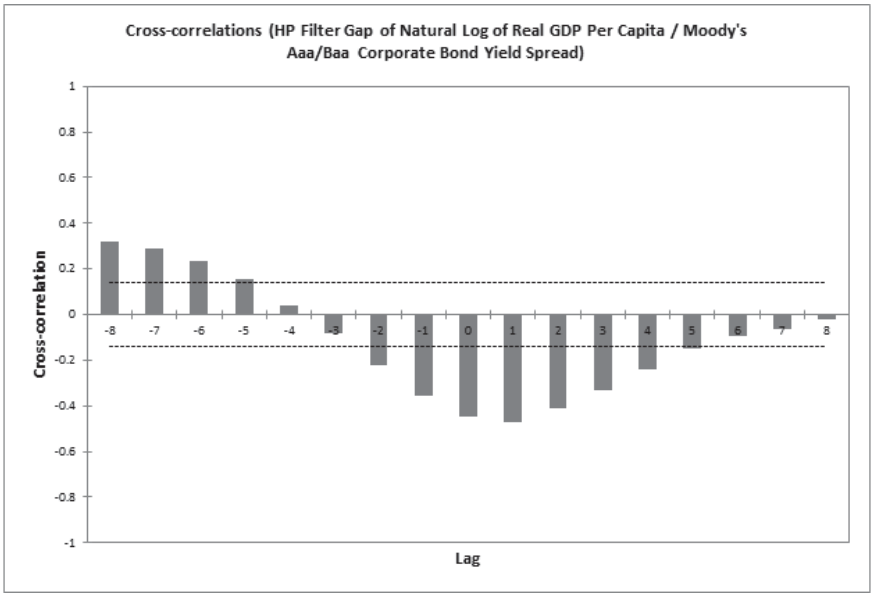
Cross-correlations (HP Filter Gap of Natural Log of Real Per Capita Consumption / Moody's Aaa Corporate Bond/10-Yr U.S. Treasury Note Implied Constant Maturity):				
Quarter Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-8	0.189	0.070	-0.138	0.138
-7	0.144	0.070	-0.138	0.138
-6	0.099	0.070	-0.138	0.138
-5	0.061	0.070	-0.138	0.138
-4	-0.005	0.070	-0.138	0.138
-3	-0.067	0.070	-0.138	0.138
-2	-0.123	0.070	-0.138	0.138
-1	-0.179	0.070	-0.138	0.138
0	-0.176	0.070	-0.138	0.138
1	-0.142	0.070	-0.138	0.138
2	-0.071	0.070	-0.138	0.138
3	-0.020	0.070	-0.138	0.138
4	0.026	0.070	-0.138	0.138
5	0.066	0.070	-0.138	0.138
6	0.097	0.070	-0.138	0.138
7	0.112	0.070	-0.138	0.138
8	0.113	0.070	-0.138	0.138



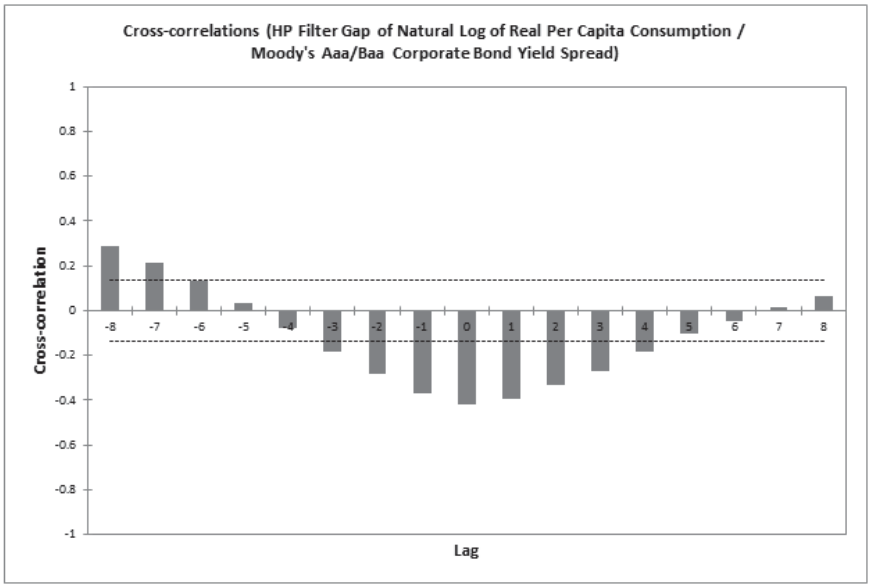
Cross-correlations (Civilian Unemployment Ratio / Moody's Aaa/Baa Corporate Bond Yield Spread):				
Month Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-24	0.070	0.041	-0.080	0.080
-21	0.099	0.041	-0.080	0.080
-18	0.139	0.041	-0.080	0.080
-15	0.191	0.041	-0.080	0.080
-12	0.261	0.041	-0.080	0.080
-9	0.347	0.041	-0.080	0.080
-6	0.444	0.041	-0.080	0.080
-3	0.547	0.041	-0.080	0.080
0	0.656	0.041	-0.080	0.080
3	0.726	0.041	-0.080	0.080
6	0.760	0.041	-0.080	0.080
9	0.761	0.041	-0.080	0.080
12	0.734	0.041	-0.080	0.080
15	0.664	0.041	-0.080	0.080
18	0.588	0.041	-0.080	0.080
21	0.503	0.041	-0.080	0.080
24	0.452	0.041	-0.080	0.080



Cross-correlations (HP Filter Gap of Natural Log of Real GDP Per Capita / Moody's Aaa/Baa Corporate Bond Yield Spread):				
Quarter Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-8	0.317	0.070	-0.138	0.138
-7	0.289	0.070	-0.138	0.138
-6	0.232	0.070	-0.138	0.138
-5	0.153	0.070	-0.138	0.138
-4	0.042	0.070	-0.138	0.138
-3	-0.085	0.070	-0.138	0.138
-2	-0.225	0.070	-0.138	0.138
-1	-0.357	0.070	-0.138	0.138
0	-0.449	0.070	-0.138	0.138
1	-0.470	0.070	-0.138	0.138
2	-0.414	0.070	-0.138	0.138
3	-0.333	0.070	-0.138	0.138
4	-0.244	0.070	-0.138	0.138
5	-0.148	0.070	-0.138	0.138
6	-0.094	0.070	-0.138	0.138
7	-0.064	0.070	-0.138	0.138
8	-0.024	0.070	-0.138	0.138



Cross-correlations (HP Filter Gap of Natural Log of Real Per Capita Consumption / Moody's Aaa/Baa Corporate Bond Yield Spread):				
Quarter Lag	Cross-correlation	Standard error	Lower bound (95%)	Upper bound (95%)
-8	0.290	0.070	-0.138	0.138
-7	0.215	0.070	-0.138	0.138
-6	0.135	0.070	-0.138	0.138
-5	0.035	0.070	-0.138	0.138
-4	-0.076	0.070	-0.138	0.138
-3	-0.185	0.070	-0.138	0.138
-2	-0.280	0.070	-0.138	0.138
-1	-0.367	0.070	-0.138	0.138
0	-0.418	0.070	-0.138	0.138
1	-0.394	0.070	-0.138	0.138
2	-0.333	0.070	-0.138	0.138
3	-0.271	0.070	-0.138	0.138
4	-0.183	0.070	-0.138	0.138
5	-0.106	0.070	-0.138	0.138
6	-0.047	0.070	-0.138	0.138
7	0.013	0.070	-0.138	0.138
8	0.063	0.070	-0.138	0.138



Appendix 2: Summary of Regression Statistics

Regression Summary - Civilian Unemployment			
Spread	Lag	β	P
AA Paper/T.Bill	T-1	-0.425	0.007 **
AA Paper/T.Bill	T-2	0.188	0.285
AA Paper/T.Bill	T-3	0.285	0.104
AA Paper/T.Bill	T-4	0.330	0.060
AA Paper/T.Bill	T-5	0.380	0.030 *
AA Paper/T.Bill	T-6	0.562	0.001 **
AA Paper/T.Bill	T-7	0.304	0.093
AA Paper/T.Bill	T-8	0.653	0.000 **
Aaa/T-Note	T-1	0.270	0.317
Aaa/T-Note	T-2	0.360	0.319
Aaa/T-Note	T-3	0.184	0.608
Aaa/T-Note	T-4	0.350	0.331
Aaa/T-Note	T-5	0.097	0.789
Aaa/T-Note	T-6	0.074	0.838
Aaa/T-Note	T-7	-0.292	0.432
Aaa/T-Note	T-8	-0.889	0.002 **
Aaa/Baa	T-1	1.121	0.000 **
Aaa/Baa	T-2	0.424	0.057
Aaa/Baa	T-3	0.428	0.056
Aaa/Baa	T-4	0.580	0.011 *
Aaa/Baa	T-5	0.208	0.368
Aaa/Baa	T-6	0.419	0.070
Aaa/Baa	T-7	-0.106	0.676
Aaa/Baa	T-8	0.392	0.045 *
*indicates significance at .05; **indicates significance at .01			

Regression Summary - Real per capita GDP			
Spread	Lag	β	P
AA Paper/T.Bill	T-1	0.188	0.523
AA Paper/T.Bill	T-2	-0.421	0.199
AA Paper/T.Bill	T-3	-0.371	0.257
AA Paper/T.Bill	T-4	-0.318	0.328
AA Paper/T.Bill	T-5	-0.164	0.615
AA Paper/T.Bill	T-6	-0.039	0.905
AA Paper/T.Bill	T-7	-0.281	0.415
AA Paper/T.Bill	T-8	-0.363	0.246
Aaa/T-Note	T-1	-1.394	0.002 **
Aaa/T-Note	T-2	-0.188	0.745
Aaa/T-Note	T-3	-0.102	0.860
Aaa/T-Note	T-4	0.338	0.560
Aaa/T-Note	T-5	0.101	0.863
Aaa/T-Note	T-6	0.263	0.651
Aaa/T-Note	T-7	0.221	0.704
Aaa/T-Note	T-8	0.455	0.312
Aaa/Baa	T-1	-1.743	0.000 **
Aaa/Baa	T-2	0.067	0.919
Aaa/Baa	T-3	-0.207	0.752
Aaa/Baa	T-4	-0.327	0.616
Aaa/Baa	T-5	0.243	0.716
Aaa/Baa	T-6	0.364	0.599
Aaa/Baa	T-7	-0.480	0.492
Aaa/Baa	T-8	0.909	0.082
*indicates significance at .05; **indicates significance at .01			

Regression Summary - Real per capita consumption				
Spread	Lag	β	p	
AA Paper/T.Bill	T-1	-0.260	0.253	
AA Paper/T.Bill	T-2	-0.383	0.130	
AA Paper/T.Bill	T-3	-0.236	0.351	
AA Paper/T.Bill	T-4	-0.153	0.541	
AA Paper/T.Bill	T-5	-0.168	0.504	
AA Paper/T.Bill	T-6	-0.247	0.328	
AA Paper/T.Bill	T-7	-0.116	0.662	
AA Paper/T.Bill	T-8	-0.163	0.499	
Aaa/T-Note	T-1	-0.902	0.016	*
Aaa/T-Note	T-2	0.132	0.789	
Aaa/T-Note	T-3	0.011	0.981	
Aaa/T-Note	T-4	0.000	1.000	
Aaa/T-Note	T-5	0.083	0.867	
Aaa/T-Note	T-6	0.099	0.842	
Aaa/T-Note	T-7	0.271	0.586	
Aaa/T-Note	T-8	0.335	0.383	
Aaa/Baa	T-1	-1.344	0.001	**
Aaa/Baa	T-2	0.251	0.647	
Aaa/Baa	T-3	-0.362	0.508	
Aaa/Baa	T-4	0.079	0.885	
Aaa/Baa	T-5	-0.086	0.877	
Aaa/Baa	T-6	-0.123	0.832	
Aaa/Baa	T-7	-0.082	0.888	
Aaa/Baa	T-8	1.118	0.011	*

*indicates significance at .05; **indicates significance at .01

Appendix 3: Detailed Regression Statistics

3-mth Paper/Bill Spread to Civilian Unemployment

Regression Statistics	
Multiple R	0.580883805
R Square	0.337425995
Adjusted R Square	0.325324187
Standard Error	0.012617183
Observations	447

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.03550938	0.004438673	27.88227892
Residual	438	0.069726674	0.000159193	*Significance F*
Total	446	0.105236054		5.02995E-35

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.049741	0.001235	40.290841	0.000000
T-1	-0.425207	0.156027	-2.725215	0.006683
T-2	0.187816	0.175609	1.069513	0.285427
T-3	0.284639	0.174815	1.628224	0.104196
T-4	0.330208	0.174922	1.887744	0.059721
T-5	0.379887	0.174970	2.171149	0.030456
T-6	0.561691	0.175122	3.207429	0.001437
T-7	0.303610	0.180305	1.683868	0.092920
T-8	0.652537	0.162093	4.025695	0.000067

3-mth Paper/Bill Spread to Real per capita GDP

Regression Statistics	
Multiple R	0.411552037
R Square	0.169375079
Adjusted R Square	0.121910798
Standard Error	0.014845188
Observations	149

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.006291352	0.000786419	3.568474544
Residual	140	0.030853146	0.00022038	*Significance F*
Total	148	0.037144498		0.000853387

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.010419691	0.002472282	4.214604028	4.46178E-05
T-1	0.188229319	0.29373357	0.640816502	0.522689469
T-2	-0.420695273	0.325906132	-1.290847983	0.198883966
T-3	-0.371374697	0.326345972	-1.137978492	0.257073185
T-4	-0.318245365	0.324055616	-0.982070205	0.327759368
T-5	-0.16359665	0.324433951	-0.504252561	0.614876579
T-6	-0.03886933	0.326373844	-0.1190945	0.905371208
T-7	-0.281028587	0.343653865	-0.817766409	0.414880178
T-8	-0.36255402	0.311531562	-1.16377942	0.246492961

3-mth Paper/Bill Spread to Real per capita Consumption

Regression Statistics	
Multiple R	0.472242852
R Square	0.223013311
Adjusted R Square	0.178614072
Standard Error	0.011460665
Observations	149

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.005277946	0.000659743	5.022908381
Residual	140	0.018388559	0.000131347	*Significance F*
Total	148	0.023666505		1.70987E-05

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.009977159	0.001908632	5.227387761	6.11958E-07
T-1	-0.260401346	0.226765878	-1.148326848	0.252791964
T-2	-0.382838774	0.251603485	-1.521595672	0.13036587
T-3	-0.235629375	0.251943047	-0.935248571	0.351270603
T-4	-0.153323077	0.250174864	-0.612863637	0.540960789
T-5	-0.167853062	0.250466943	-0.670160541	0.503859375
T-6	-0.247309018	0.251964565	-0.981523008	0.328028039
T-7	-0.116363813	0.26530495	-0.438604001	0.661624588
T-8	-0.162978043	0.240506143	-0.677646072	0.499114481

Aaa/10-yr T-Note to Civilian Unemployment

Regression Statistics	
Multiple R	0.308726854
R Square	0.09531227
Adjusted R Square	0.082681377
Standard Error	0.014971897
Observations	582

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.013531888	0.001691486	7.54596437
Residual	573	0.12844236	0.000224158	*Significance F*
Total	581	0.141974247		1.31908E-09

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.057588389	0.001346215	42.77801108	1.6184E-180
T-1	0.270237703	0.269595259	1.002382994	0.31658176
T-2	0.360172278	0.36141127	0.996571797	0.319393055
T-3	0.184442024	0.359843815	0.51256133	0.608455729
T-4	0.350206421	0.359876581	0.973129231	0.330899695
T-5	0.096781192	0.361684475	0.26758459	0.789115382
T-6	0.074420071	0.363804189	0.204560785	0.837987935
T-7	-0.292407126	0.371617309	-0.786850124	0.431694919
T-8	-0.88889566	0.283057558	-3.140335367	0.001774512

Aaa/10-yr T-Note to Real per capita GDP

Regression Statistics	
Multiple R	0.422398353
R Square	0.178420369
Adjusted R Square	0.14308361
Standard Error	0.01418253
Observations	195

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.008124846	0.001015606	5.049143644
Residual	186	0.037412814	0.000201144	*Significance F*
Total	194	0.04553766		1.08865E-05

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.003391689	0.002229316	1.52140365	0.129856772
T-1	-1.394158183	0.434371433	-3.209599152	0.001565765
T-2	-0.188194568	0.578530437	-0.325297609	0.745321464
T-3	-0.10219365	0.578571702	-0.176630916	0.859990485
T-4	0.33774206	0.578665817	0.58365649	0.560158538
T-5	0.100632319	0.581567998	0.173036204	0.862811125
T-6	0.26345878	0.581731064	0.45288759	0.65115752
T-7	0.221470435	0.581833245	0.380642455	0.70390294
T-8	0.455226779	0.449039029	1.013779983	0.312004678

Aaa/10-yr T-Note to Real per capita Consumption

Regression Statistics	
Multiple R	0.302055435
R Square	0.091237486
Adjusted R Square	0.052150926
Standard Error	0.012106662
Observations	195

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.002737062	0.000342133	2.334241908
Residual	186	0.027262257	0.000146571	*Significance F*
Total	194	0.029999319		0.02064665

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.000110894	0.001903016	0.058272757	0.953593924
T-1	-0.902180496	0.370793377	-2.433108445	0.015915788
T-2	0.132253583	0.493852122	0.26779997	0.789150033
T-3	0.011475669	0.493887348	0.023235398	0.98148741
T-4	1.24579E-05	0.493967688	2.52201E-05	0.999979904
T-5	0.08314849	0.496445082	0.16748779	0.867168213
T-6	0.09887745	0.496584281	0.199115144	0.842390169
T-7	0.271239763	0.496671506	0.546115008	0.585641317
T-8	0.335185746	0.383314106	0.874441458	0.383005568

Aaa/Baa to Civilian Unemployment

Regression Statistics	
Multiple R	0.844224705
R Square	0.712715352
Adjusted R Square	0.708704397
Standard Error	0.008436915
Observations	582

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.101187226	0.012648403	177.6921862
Residual	573	0.040787022	7.11815E-05	*Significance F*
Total	581	0.141974247		9.3189E-150

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.0255883	0.001036131	24.69600617	3.00792E-92
T-1	1.121035135	0.158142503	7.088765618	3.99618E-12
T-2	0.423579344	0.222516531	1.90358596	0.057464869
T-3	0.428243118	0.223261137	1.918126566	0.055591627
T-4	0.579875845	0.2286901	2.535640344	0.011488817
T-5	0.208225593	0.230966344	0.901540845	0.367679607
T-6	0.41858609	0.230204489	1.818322879	0.069536748
T-7	-0.105604802	0.252282238	-0.418597848	0.675666912
T-8	0.391698367	0.194532889	2.013532867	0.044525625

Aaa/Baa to Real per capita GDP

Regression Statistics	
Multiple R	0.530057812
R Square	0.280961284
Adjusted R Square	0.250034888
Standard Error	0.013267987
Observations	195

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.01279432	0.00159929	9.084837456
Residual	186	0.032743341	0.000176039	*Significance F*
Total	194	0.04553766		1.63976E-10

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.012065859	0.002811935	4.290944774	2.8578E-05
T-1	-1.742669178	0.45599509	-3.821684086	0.000180618
T-2	0.067087545	0.656770682	0.102147594	0.918749562
T-3	-0.207094729	0.65391467	-0.316699928	0.751826467
T-4	-0.327345832	0.651340192	-0.502572751	0.615859203
T-5	0.243001594	0.666248578	0.364731126	0.715726471
T-6	0.363876217	0.690905907	0.526665373	0.599053491
T-7	-0.480480929	0.697811059	-0.688554478	0.491961592
T-8	0.909415091	0.520063353	1.748662132	0.081999146

Aaa/Baa to Real per capita Consumption

Regression Statistics	
Multiple R	0.489190321
R Square	0.23930717
Adjusted R Square	0.206589199
Standard Error	0.011076534
Observations	195

ANOVA

	df	*SS*	*MS*	*F*
Regression	8	0.007179052	0.000897382	7.31424235
Residual	186	0.022820267	0.00012269	*Significance F*
Total	194	0.029999319		1.94548E-08

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.005819893	0.002347492	2.479195444	0.014057968
T-1	-1.344363733	0.380679098	-3.531488175	0.000521026
T-2	0.251447638	0.548292902	0.458600935	0.647056168
T-3	-0.361999303	0.545908613	-0.663113376	0.508078905
T-4	0.078509337	0.543759357	0.144382504	0.885354753
T-5	-0.086007955	0.556205349	-0.154633455	0.877277959
T-6	-0.12264147	0.576790065	-0.21262757	0.831850312
T-7	-0.081817207	0.582554704	-0.140445536	0.888459959
T-8	1.117747453	0.434165307	2.574474365	0.010817044