AN EMPIRICAL ANALYSIS OF RISK PREMIA IN EQUITY FUTURES : THE CASE OF BORSA ISTANBUL

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To my family …

DECLARATION OF ORIGINALITY

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ABSTRACT

This study investigates the futures risk premia in Türkiye's equity futures market, focusing on spot and term premiums. By applying concepts traditionally used in commodity futures to equity futures, the study captures spot premiums through nearest maturity contracts and captures term premiums through a long-short strategy. Utilizing factor pricing models and portfolio sorting methodology, it examines the explanatory power of basis, momentum and the recently introduced basis-momentum characteristics. After determining the significant risk premiums, the study examines the interaction between the risk premia and main macro financial variables that have a profound effect on the macro economy via Newey West OLS and Vector Autoregressive modelling methods. The study aims to provide new insights into the term structure of equity futures and contribute significantly to the literature on futures risk premia and their application to financial markets.

Keywords**:** Spot Risk Premium, Term Premium, Futures Basis, Basis-Momentum, Momentum, Cost-of-Carry, Newey West Standard Errors, Vector Autoregressive Models, Variance Decomposition Analysis

ÖZET

Bu çalışma, Türkiye'de vadeli işlemler piyasasında, dayanak varlığı hisse senedi olan vadeli işlem kontratlarında risk primi mevcudiyetini spot ve vade risk primi özelinde incelemektedir. Çalışma, geleneksel olarak emtia vadeli işlem kontratlarında kullanılan metotların hisse senedi dayanaklı vadeli işlem sözleşmelerinde uygulanması ile en yakın vadeli sözleşmeler aracılığıyla spot risk primini ve kontratlar arası uzun-kısa stratejisi ile vade risk primini ele almaktadır. Aynı zamanda literatürde yaygın olarak kullanılan faktör fiyatlandırma modelleri ve portföy sıralama yöntemlerini kullanarak Basis, Momentum ve literatüre yakın zamanda tanıtılan Basis-Momentum faktörlerinin risk primlerini açıklama kabiliyetini incelemektedir. Çalışma, istatistiksel olarak anlamlı risk primlerini belirledikten sonra, ilgili risk primlerinin ana makro finansal değişkenler ile olan etkileşimini Newey West OLS ve Vektör Otoregresif modeller ile incelemektedir. Çalışma, hisse senedi dayanıklı vadeli işlem kontratlarının vade yapısına ilişkin yeni içgörüler sunarak, vadeli işlem risk primleri ve finansal piyasalardaki uygulamalarına ilişkin literatüre katkı sağlamayı amaçlamaktadır.

Anahtar Kelimeler: Spot Risk Primi, Vade Risk Primi, Vadeli Baz Farkı, Baz Momentumu, Momentum, Taşıma Maliyeti, Newey West Standart Hataları, Vektör Otoregresif Modeller, Varyans Ayrıştırma Analizi

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LIST OF ACRONYMS AND ABBREVIATIONS

FX: Foreign Exchange

SR: Short Roll Return

EH: Excess Holding Return

EW: Equally Weighted

HML: High Minus Low

Q3: Quartile 3

Q2: Quartile 2

BM: Basis Momentum

PACF: Partial Autocorrelation Function

ADF: Augmented Dickey-Fuller

VAR: Vector Autoregressive Model

VIF: Variance Inflation Factor Tests

EHR: Excess Holding Return

CDS: Credit Default Swap

VECM: Vector Error Correction Model

VIOP: Vadeli İşlem ve Opsiyon Piyasası

AIC: Akaike Information Criterion

HQ: Hannan-Quinn Criterion

NW: Newey-West

TRY: Turkish Lira

OLS: Ordinary Least Squares

TLREF: Turkish Lira Reference Rate

EW: Equally-Weighted

TRLIBOR: Turkish Lira Interbank Offered Rate

YC: Yield Curve

FPE: Final Prediction Error

USDTRY: US Dollar-Turkish Lira Exchange Rate

SC: Schwarz Criterion

BIST: Borsa Istanbul

1. INTRODUCTION

The futures market has its roots from the trade of agricultural products in which farmers and merchants sought to hedge themselves against volatilities in the price movements. Over time, line of available futures contracts have diversified to include other types of commodities and underlying assets such as equities, interest rates and foreign exchange to mention a few. Futures market gains its importance from its role in price discovery and risk management in addition to its role in enhancing market liquidity and providing a mechanism for speculation which can lead to more efficient markets. As stated by [1], futures contracts are zero cost securities since only an initial collateral is required for investment. Thus, returns on futures contracts consist only of risk premium. According to [2], there are two main theories to understand the pricing of futures contracts. One is the hypothesis of cost-of-carry also known as the theory of storage, the other is the risk premium hypothesis. [3], finds that the forward exchange rates have time-varying components which are premium component and expected spot rate component. Also, [4] tries to find evidence to explain futures risk premium with hedging pressure and systematic risk. Time varying risk premia have been examined also for bonds in a study by [5] who find that a single factor, a tent shaped linear function of forward rates predict excess returns. Unlike previous literature on futures risk premia, we build on literature that divides the futures risk premia into two components which are spot premium and term premium. Thus, aim of our work is to characterize and capture spot and term premiums in the equity futures market. The equity futures risk premia has two main dimensions. First, just like the term structure of interest rates, there is a term structure in the prices of futures contracts and these contracts differ on the extent of their exposure to different economic determinants. The term structure of the futures prices takes different forms for different commodity and equity futures contracts as a result of cross-sectional and time-series characteristics of the contracts. As stated by [1], the reason for the changing term structure of futures prices is because for a single underlying equity or commodity, there are different contracts with different times to maturity and different underlying stocks and commodities differ on their exposure to characteristics like basis and momentum. [6] also related commodity futures excess returns to characteristics like basis/carry and momentum. Differences of underlyings to characteristics like Basis, Momentum and Basis-Momentum lead to both time-series variation and cross-sectional variation in the risk premiums. We extend the works of [1] to cover additionally the Basis-Momentum characteristic which is a characteristic recently introduced to the literature by [7] and find significant explanatory power on spot and term premiums. In addition to building on previous literature by determining the significant premia and then explaining them via characteristics which are Basis, Basis-Momentum and Momentum, our study aims at explaining the significant premiums and capturing the interdependencies and interrelations between macro financial variables that constitute significance to Türkiye's economy which are TLREF (overnight borrowing rate in Turkish Lira), Tahvil 2Y (2 Year Turkish Treasury Yield), Tahvil 5Y (5 Year Turkish Treasury Yield), and USDTRY (return on the exchange rate between United States Dollar and Turkish Lira) with the help of Newey West standard errors in OLS modelling and vector autoregressive models. For the Newey West OLS, we introduce one more independent variable in addition to the macro financial variables mentioned above which is a dummy variable that takes the value of one if the Yield Curve on the observation date is inverted and takes the value of zero otherwise. Before using the independent variables in our analysis, we conduct VIF tests to check for any multicollinearity between the variables and drop the variable with high multicollinearity. We detected a multicollinearity between Tahvil 2Y and Tahvil 5Y and in order to address the issue we drop Tahvil 2Y variable and continue with Tahvil 5Y. 5 Year yields are more suitable for our analysis since they represent mid-term rates and can be used together with 5Y CDS for further analysis which is the most commonly used CDS term.

The contribution of this thesis to the literature is threefold. First, we apply the concepts of futures risk premia, which is mostly concentrated on commodity futures literature, to Türkiye's equity futures market via Borsa Istanbul. Spot premiums are captured by going long in the nearby (closest maturity) futures contract and the term premiums are captured by going long in a contract with far maturity while at the same time going short in the nearby contract as [1] did. Secondly, we make use of factor pricing models by sorting futures contracts into portfolios based on their exposure to basis, momentum and basis-momentum characteristics and find significant explanatory power in different portfolio sorts. In a similar paper, [8] create loadings of a "slope" factor and explain international currency returns by relating the factor to high and low interest rate currencies. Portfolio sorting is a widely adopted approach in futures market literature. Finally, combining and comparing the explanatory power of the basis and momentum factors, which have been extensively used in commodity futures literature, with the basis-momentum factor recently introduced to the futures market literature by [7], on the equity futures term structure is one of the main purposes of our study. As stated by [7], the ability of basis-momentum to predict returns in many asset classes including currencies, commodities and equities, makes the basis-momentum characteristic an area of interest in asset pricing. While it is important to separate between different calculations of basis depending on whether it is a commodity or equity futures, we follow [7] in the calculation of basis, momentum and basis-momentum characteristics. Besides their use in academia, Basis and Momentum characteristics have a profound usage in the financial services industry. As stated by [9], the basis and momentum are one of the characteristics that many commodity index products take positions conditionally on.

2. LITERATURE REVIEW

The literature which focuses on explaining and making a prediction from the term structure of the futures contracts regarding the underlying assets is varied depending on the underlying asset in question. While the literature is mostly focued on foreign exchange, literature expanded on mostly commodity futures with the development of the cost of carry models. When we look at the earlier studies, which focuse on forward and spot exchange rates in [3], we can see the focus on forwards which are over the counter products resulting from the fact that the dominance was on the forwards contracts for foreign exchange transactions instead of organized markets. In [3], Fama aims at measuring the relation between the expected future spot rate component of forward rates and the variation in the risk premium.

We can see this movement towards commodity futures in [2], in which, they try to explain the variation between commodity spot and future prices with the changes in interest rates and seasonal changes in the convenience yield which is basically defined as the income generated from holding excess inventory.

[4], aims at examining the risk pricing in futures contracts by utilizing a comprehensive sample of futures with different underlyings ranging from foreign exchange, agricultural products and precious metals and finds that returns to FX and agricultural futures change with the hedging pressure resulting from the holdings of hedgers. Hedging pressure is one of the alternative risk premiums mentioned both in [1] and [7]. Several other theories aim at explaining the pricing mechanism of futures prices not based on risk premiums but on the shape of the commodity futures term structure. Two main shapes of the commodity futures term structure is the backwardation and contango. In the normal backwardation, futures price is lower than the spot price which

is mostly driven by the hedging pressure. In the contango, futures prices are higher than the spot prices, which is mostly caused of storage costs. [10] aims at analyzing the long term properties of commodity futures prices by constructing an equally weighted portfolio of commodity futures and tries to capture risk pricing by looking at the term structure. [5] utilize the excess returns on forward interest rates to analyze the risk premia in US treasury bonds. In order to isolate the term premia and remove the effects from inflation and the level of interest rates, they make use of excess returns. [8], adopts the portfolio sorting methodology which is a commonly used factor in the literature and commonly known as the slope factor. With the help of the slope factor, they capture most of the cross sectional variation in the excess return differential between high-low interest rate currencies. Slope factor is derived from the term structure of the futures prices and is a commonly used pricing factor in the literature. The articles that constitute the basis of our study are [1] and [7]. [1] builts on the two main types of risk encountered in the futures prices which are spot risk premia and term premia. They sort commodity futures on several variables which are basis, return momentum, hedging pressure, inlation and liquidity and find that a single HML portfolio factor can be used to explain spot premia in the cross section. [7] on the other hand, take the work further by sorting commodities into portfolios based on their Basis, Basis-Momentum and Momentum values and capture spot risk premium and term premiums in both the time series and in the cross section. They utilize the newly introduced Basis-Momentum factor next to Basis and Momentum.

3. CONCEPTS

3.1 Decomposition of Returns

We start our analysis by decomposing expected returns into different premia which are spot premium and the term premium. We follow [1] and define spot premium as the expected return in excess of one period basis and define term premium as the expected deviation from the term structure of the basis. The definitions for spot premium ($\pi_{s,t}$) and term premium (${\pi^{(n)}}_{y,t}$) are provided below where $E_t[r_{s,t+1}]$ is the expected one period log spot return, s_t is the underlying log spot price at time t and ${y^{(1)}}_t$ is the one-period basis at time t.

$$E_t[r_{s,t+1}] = E_t[s_{t+1} - s_t] = {y^{(1)}}_t + \pi_{s,t} \tag{1}$$

$$n{y^{(n)}}_t = {y^{(1)}}_t + (\text{n-1})E_t\,[{y^{(n-1)}}_{t+1}] - {\pi^{(n)}}_{y,t} \tag{2}$$

In order to measure the degree to which these different risk premiums exist, we first aim at capturing these returns via different return types. As mentioned before, spot risk premium is captured by the return of the first nearby futures contract. First nearby contracts are also defined as one period contracts. The return of a one period futures contract invested at time t and maturing at time t+1 gives the spot risk premium at time t which is the spot premium that contains all of the information available at time t in an efficient market. Derivation of the spot risk premium from the return of a nearby contract is provided below where ${f^{(1)}}_t$ is the price of the futures contract at time t maturing in one period.

$$E_t[r^{(1)}{}_{fut,t+1}] = E_t[s_{t+1} - f^{(1)}{}_t] = E_t[s_{t+1} - s_t - y^{(1)}{}_t] = \pi_{s,t} \quad (3)$$

Spot risk premium is also a part of futures contracts whose maturity is longer than one period. As an example, if we decompose the return of the second nearby futures contract invested at time t which matures at time t+2 which is one period later than the first nearby contract, we can see that it is composed of the sum of expected spot and term premia for all maturities up to t+2 as stated by [1]. This return is called holding return in which futures contract invested at time t is held until maturity which is time t+n. Definition of the Holding return is provided below where $f^{(n)}{}_t$ is the price of the futures contract at time t and maturing in n-periods and s_{t+n} is the spot price at the maturity time t+n.

$$E_t\ [\ r^{(n)}{}_{fut,t\rightarrow t+n}\ ] = E_t\ [\ s_{t+n} - f^{(n)}{}_t\ ] \quad (4)$$

Now let's consider an investment strategy in which instead of holding a futures contract until maturity, we invest in one period futures contracts and roll them over until n consecutive periods. This return is called "short-roll" return and gives us the sum of all expected spot premia until period n. Definition of the Short Roll return is provided below.

$$E_t\ [\ \sum_{j=1}^{n} r^{(1)}{}_{fut,t+j}\ ] = \sum_{j=0}^{n-1} E_t\ [\pi_{s,t+j}] \quad (5)$$

Now let's consider the return in which we go long in a far from nearby maturity futures contract and go short in the first nearby contract. From the decompositions of returns of the mentioned contracts, we can find that the expected return from the mentioned return captures only the term premium at time t. Definition of the Spreading return is provided below.

$$E_t\ [\ r^{(k)}{}_{fut,t+1} - r^{(1)}{}_{fut,t+1}\ ] = \pi^{(k)}{}_{y,t} \quad (6)$$

Finally, let's consider another return which includes going long in the holding return and going short in the short roll return for n periods. This return is called the excess holding return and gives the sum of expected term premia for all maturities up to n. Definition of the Excess Holding return is provided below.

$$E_t \left[\, {r^{(n)}}_{fut,\, t\to t+n} - \sum_{j=1}^{n} {r^{(1)}}_{fut,t+j} \, \right] = \sum_{j=0}^{n-1} E_t \left[{\pi^{(n-j)}}_{y,t+j} \right] \tag{7}$$

In our analysis with daily data for pooled OLS regressions (multivariate tests), we will utilize the nearby return (equal to Short Roll Return for maturity n=1) and spreading returns (equal to Excess Holding Return for maturity n=1) in order to capture spot risk premiums and term premiums since in daily data contracts are not held until maturity so a different return from excess holding return must be utilized.

3.2 Characteristics to Capture Risk Premiums

In order to capture the main risk premiums mentioned which are spot premium and term premium, we make use of three characteristics which can be calculated from futures prices and which are important components of the term structure of futures prices. These characteristics are also oftenly utilized in finance academia and financial services industry for management of commodity index products. The characteristics of interest are : Basis, Momentum and Basis-Momentum. Basis, in its simplest terms, can be defined as the divergence between spot and futures prices of an underlying asset. Basis (B_t) can be positive if futures price has a premium over spot price. It can also be negative, if futures price has a discount over the spot price. Basis, in its most comprehensive form, is also commonly known as the cost-of-carry and is comprised of the risk-free interest rate with maturity equal to that of the respective futures contract and other components such as the storage costs if the contract has a commodity as underlying. However, for our study, we will stick with the definition made by [7] also with the definition of Momentum and Basis-Momentum characteristics. Definition of the Basis (B_t) characteristic used in our study is provided below :

$$B_t = (F^{T2}{}_t \,/\, F^{T1}{}_t) - 1 \tag{8}$$

The characteristic of momentum also has varying definitions throughout the finance literature and industry applications. In basic terms it can defined as persistency in the returns of an asset for a certain consecutive time period. The definition momentum (M_t) used in our study can be found below :

$$M_t = \prod_{s=t-11}^{t}(1 + R^{T1}{}_{fut,s}) - 1 \tag{9}$$

Among the three of the characteristics employed in our study, Basis-Momentum characteristic will be used as a benchmark to Basis and Momentum since it is recently introduced to the literature by [7] and provides important implications for the literature. The novelty and difference of the Basis-Momentum characteristic come from the fact that it is calculated as the difference between the momentum of the first nearby contract and the momentum of the second nearby contract, as a result of which, basis-momentum characteristic has an explanatory power on the short-end of the term structure of futures prices. The definition of the basis-momentum (BM_t) characteristic is provided as below :

$$BM_t = \prod_{s=t-1}^{t} (1 + R^{T1}{}_{fut,s}) - \prod_{s=t-1}^{t} (1 + R^{T2}{}_{fut,s}) \tag{10}$$

4. DATA

Our data is extracted from BIST Data Store, which is the main data storage of Borsa Istanbul. Our equity futures data is comprised of 20 liquid and high-volume contracts from BIST VIOP (Futures and Options Market) and covers the period from March-2016 until September-2023. In order to maintain the price data necessary for construction of a number of a portfolio that will enable us to minimize return variance which can be achieved by putting a certain number of underlyings per portfolio, we stopped adding data on March 2016, going backwards from which date, the number of underlyings in equity futures drops below 20 which is the least amount of underlyings necessary for portfolio formation. Different from but similar to [1], at the beginning of month “t” , we choose the nearby contract as the contract which matures at the end of month “t+1” , while [1] chooses the nearby contract as the one maturing at the end of month “t+2” in order to avoid contracts with high volatility and less liquidity observed in contract prices at the month of maturity. We finally add second nearby contracts as the contract maturing on month “t+3” which is just after the maturity of the first nearby contract. Due to the availability of data, we limit the futures contract maturity with second nearby contracts since contract expiration dates become uneven while going backwards in history. We conduct our analyses with monthly data and use daily data only for multivariate tests (pooled ols). An advantage of using BIST Data Store to extract our futures and spot price data, is the fact that it enables us to control and check for any adjustments for corporate actions and other events such as splits that can change the nominal prices. Table 1 below shows the Name and Ticker data of the futures contract used in our study.

Table 4.1 : Futures Data

Data Name	Ticker	Data Name	Ticker
Akbank	F_AKBNK	Pegasus Hava Taşımacılığı	F_PGSUS
Arçelik	F_ARCLK	Sabancı Holding	F_SAHOL
Emlak Konut GYO	F_EKGYO	Türkiye Şişe ve Cam Fabrikaları	F_SISE
Ereğli Demir Çelik Fabrikaları	F_EREGL	Turkcell İletişim Hizmetleri	F_TCELL
Türkiye Garanti Bankası	F_GARAN	Türk Hava Yolları	F_THYAO
Türkiye Halk Bankası	F_HALKB	Tofaş Türk Otomobil Fabrikası	F_TOASO
Türkiye İş Bankası C	F_ISCTR	Türk Telekomünikasyon	F_TTKOM
Koç Holding	F_KCHOL	Türkiye Petrol Rafinerileri	F_TUPRS
Kardemir Karabük	F_KRDMD	Türkiye Vakıflar Bankası	F_VAKBN
PETKİM Petrokimya Holding	F_PETKM	Yapı Kredi Bankası	F_YKBNK

The data for the macrofinancial variables that are utilized in our regressions with newey-west standard errors and vector autoregressive models which are TLREF (Overnight Turkish Lira borrowing rate quoted annually), Tahvil 2Y (Yield on the 2-year Türkiye Treasury Bond quoted annually), Tahvil 5Y (Yield on the 5-year Türkiye Treasury Bond quoted annually), USDTRY (Exchange rate between USD and TRY on the observation date), are extracted from the Bloomberg terminal for the observation dates that consist our sample period. In creating the necessary time series for the TLREF variable representing the overnight Turkish Lira borrowing rate, a derivation is done to calculate the rates for the period before the TLREF publication date which is 17th June 2019. The derivation is made by taking the average of the bid and ask rates for the overnight TRLIBOR. Verification calculations for the period after the TLREF publication shows that the average of the bid-ask rates of overnight TRLIBOR is quite close to TLREF.

In the table 2 below, provided are the summary statistics of the Momentum, Basis and Basis-Momentum values for each of the 20 equity futures contracts used in our study for the whole sample. Mentioned 20 equity futures contracts are sorted into different portfolios by ranking them based on their values of Momentum, Basis and Basis-Momentum.

Table 4.2 Panel A : Summary Statistics – Momentum

AKBNK		*ARCLK*		*EKGYO*		*EREGL*		*GARAN*	
Mean	0.053973676	Mean	0.250492921	Mean	0.088727646	Mean	0.495306977	Mean	0.128423
Standard Error	0.052812087	Standard Error	0.056112265	Standard Erro	0.065331278	Standard Erro	0.059554991	Standard Error	0.050977
Median	0.011153454	Median	0.148043815	Median	0.00791528	Median	0.475652436	Median	0.085014
Standard Deviation	0.503795203	Standard Deviati	0.535276891	Standard Devi	0.623220672	Standard Devi	0.568118401	Standard Devia	0.486294
Sample Variance	0.253809606	Sample Variance	0.286521351	Sample Varian	0.388404005	Sample Varian	0.322758518	Sample Varian	0.236482
Kurtosis	1.937436922	Kurtosis	-0.164896051	Kurtosis	2.743567808	Kurtosis	-0.698342973	Kurtosis	1.760311
Skewness	1.508579165	Skewness	0.629960577	Skewness	1.47564253	Skewness	0.262936335	Skewness	1.371107
Range	2.219548406	Range	2.241767448	Range	3.072221313	Range	2.316359345	Range	2.147445
Minimum	-0.502021146	Minimum	-0.556027322	Minimum	-0.680896545	Minimum	-0.432245327	Minimum	-0.42776
Maximum	1.71752726	Maximum	1.685740126	Maximum	2.391324768	Maximum	1.884114018	Maximum	1.719687
Sum	4.911604503	Sum	22.79485584	Sum	8.074215787	Sum	45.07293495	Sum	11.68654
Count	91	Count	91	Count	91	Count	91	Count	91

HALKB		*ISCTR*		*KCHOL*		*KRDMD*		*PETKM*	
Mean	-0.150447199	Mean	0.24845471	Mean	0.299645007	Mean	0.659359616	Mean	0.25015
Standard Error	0.041115779	Standard Error	0.080372228	Standard Erro	0.053915724	Standard Erro	0.089361163	Standard Error	0.048739
Median	-0.290441057	Median	0.03893085	Median	0.188810749	Median	0.40116511	Median	0.27696
Standard Deviation	0.392219529	Standard Deviati	0.766702191	Standard Devi	0.514323228	Standard Devi	0.85245116	Standard Devia	0.464942
Sample Variance	0.153836159	Sample Variance	0.587832249	Sample Varian	0.264528383	Sample Varian	0.726672981	Sample Varian	0.216171
Kurtosis	0.586023025	Kurtosis	2.568346491	Kurtosis	1.800960999	Kurtosis	-0.688163393	Kurtosis	-0.37627
Skewness	1.124917734	Skewness	1.800607646	Skewness	1.486776824	Skewness	0.559258656	Skewness	0.067965
Range	1.583750914	Range	3.346816009	Range	2.42945634	Range	3.332837521	Range	2.261121
Minimum	-0.633189631	Minimum	-0.538581571	Minimum	-0.296129897	Minimum	-0.632551101	Minimum	-0.60034
Maximum	0.950561282	Maximum	2.808234438	Maximum	2.133326443	Maximum	2.70028642	Maximum	1.660782
Sum	-13.6906951	Sum	22.60937864	Sum	27.26769565	Sum	60.00172506	Sum	22.76361
Count	91	Count	91	Count	91	Count	91	Count	91

PGSUS		*SAHOL*		*SISE*		*TCELL*		*THYAO*	
Mean	0.673030509	Mean	0.223614261	Mean	0.447161877	Mean	0.044753449	Mean	0.890973
Standard Error	0.129615211	Standard Error	0.065736811	Standard Erro	0.07537021	Standard Erro	0.030012877	Standard Error	0.186643
Median	0.333927373	Median	0.054496131	Median	0.221351722	Median	-0.001731832	Median	0.049176
Standard Deviation	1.236450305	Standard Deviati	0.627089211	Standard Devi	0.718985978	Standard Devi	0.286304603	Standard Devia	1.780456
Sample Variance	1.528809358	Sample Variance	0.393240879	Sample Varian	0.516940837	Sample Varian	0.081970326	Sample Varian	3.170024
Kurtosis	3.085939168	Kurtosis	3.240376903	Kurtosis	2.928761186	Kurtosis	2.380249281	Kurtosis	2.368725
Skewness	1.920408258	Skewness	1.767138152	Skewness	1.684680221	Skewness	1.285932501	Skewness	1.715594
Range	5.499232549	Range	3.112259225	Range	3.503244035	Range	1.500610458	Range	7.568093
Minimum	-0.401179553	Minimum	-0.469751019	Minimum	-0.426149382	Minimum	-0.433890983	Minimum	-0.59964
Maximum	5.098052996	Maximum	2.642508206	Maximum	3.077094652	Maximum	1.066719474	Maximum	6.96845
Sum	61.2457763	Sum	20.34889776	Sum	40.69173077	Sum	4.072563832	Sum	81.0785
Count	91	Count	91	Count	91	Count	91	Count	91

TOASO		*TTKOM*		*TUPRS*		*VAKBN*		*YKBNK*	
Mean	0.402722239	Mean	0.032434051	Mean	0.389164714	Mean	0.054966011	Mean	0.131308
Standard Error	0.080441094	Standard Error	0.043500244	Standard Erro	0.088067934	Standard Erro	0.049748675	Standard Error	0.076929
Median	0.190598264	Median	-0.043152178	Median	0.06320576	Median	0.051800749	Median	-0.03792
Standard Deviation	0.767359129	Standard Deviati	0.414965885	Standard Devi	0.840114542	Standard Devi	0.474572118	Standard Devia	0.733853
Sample Variance	0.588840033	Sample Variance	0.172196686	Sample Varian	0.705792443	Sample Varian	0.225218695	Sample Varian	0.538541
Kurtosis	0.802758266	Kurtosis	4.744513082	Kurtosis	1.594306012	Kurtosis	-0.32331657	Kurtosis	2.868951
Skewness	1.03050185	Skewness	1.500632521	Skewness	1.33203947	Skewness	0.680296749	Skewness	1.701781
Range	3.64379847	Range	2.629825651	Range	3.743846273	Range	1.968073142	Range	3.466849
Minimum	-0.611374141	Minimum	-0.630096621	Minimum	-0.606379355	Minimum	-0.564668162	Minimum	-0.72752
Maximum	3.032424329	Maximum	1.99972903	Maximum	3.137466917	Maximum	1.40340498	Maximum	2.739328
Sum	36.64772372	Sum	2.951498644	Sum	35.41398896	Sum	5.00190699	Sum	11.94906
Count	91	Count	91	Count	91	Count	91	Count	91

Table 4.2 Panel B : Summary Statistics – Basis

AKBNK		*ARCLK*		*EKGYO*		*EREGL*		*GARAN*	
Mean	0.014889044	Mean	0.015273944	Mean	0.015723866	Mean	0.007069603	Mean	0.01480
Standard Error	0.00136182	Standard Error	0.001873786	Standard Erroı	0.002338669	Standard Erroı	0.002867938	Standard Error	0.001
Median	0.013095238	Median	0.015407855	Median	0.016949153	Median	0.011477762	Median	0.01553
Mode	#N/A	Mode	#N/A	Mode	0	Mode	-0.008346858	Mode	0.04231
Standard Deviation	0.012990937	Standard Deviatic	0.017874777	Standard Devi	0.022309481	Standard Devi	0.027358381	Standard Devia	0.0152
Sample Variance	0.000168764	Sample Variance	0.000319508	Sample Varian	0.000497713	Sample Varian	0.000748481	Sample Varian	0.00023
Kurtosis	4.037460158	Kurtosis	2.610010697	Kurtosis	4.682111383	Kurtosis	11.06313708	Kurtosis	9.23114
Skewness	-0.19616239	Skewness	0.177153436	Skewness	-0.505523829	Skewness	-2.157442329	Skewness	-1.6330
Range	0.098556844	Range	0.118643589	Range	0.164383562	Range	0.225847599	Range	0.11935
Minimum	-0.038899431	Minimum	-0.039215686	Minimum	-0.061643836	Minimum	-0.148584906	Minimum	-0.0687
Maximum	0.059657413	Maximum	0.079427903	Maximum	0.102739726	Maximum	0.077262693	Maximum	0.05064
Sum	1.354903025	Sum	1.389928922	Sum	1.430871761	Sum	0.643333853	Sum	1.34739
Count	91	Count	91	Count	91	Count	91	Count	9

HALKB		*ISCTR*		*KCHOL*		*KRDMD*		*PETKM*	
Mean	0.018664358	Mean	0.015326377	Mean	0.014841921	Mean	0.016031548	Mean	0.01620
Standard Error	0.001393628	Standard Error	0.001316055	Standard Erroı	0.001947219	Standard Erroı	0.001820093	Standard Error	0.00152
Median	0.01875	Median	0.015037594	Median	0.016711834	Median	0.014869888	Median	0.017
Mode	0.020618557	Mode	0.000727273	Mode	0.028481013	Mode	0.042345277	Mode	0.0177
Standard Deviation	0.013294368	Standard Deviatic	0.012554367	Standard Devi	0.018575281	Standard Devi	0.017362585	Standard Devia	0.01451
Sample Variance	0.00017674	Sample Variance	0.000157612	Sample Varian	0.000345041	Sample Varian	0.000301459	Sample Varian	0.00021
Kurtosis	5.956040484	Kurtosis	1.24096969	Kurtosis	3.242055552	Kurtosis	5.129814111	Kurtosis	3.44583
Skewness	-1.246982676	Skewness	-0.129014383	Skewness	-0.48782883	Skewness	-0.402135331	Skewness	-1.0856
Range	0.095894291	Range	0.075153628	Range	0.126700046	Range	0.129317728	Range	0.09298
Minimum	-0.042216359	Minimum	-0.022033898	Minimum	-0.053041018	Minimum	-0.048672566	Minimum	-0.0412
Maximum	0.053677932	Maximum	0.05311973	Maximum	0.073659028	Maximum	0.080645161	Maximum	0.05177
Sum	1.698456615	Sum	1.394700301	Sum	1.350614822	Sum	1.458870878	Sum	1.47446
Count	91	Count	91	Count	91	Count	91	Count	9

PGSUS		*SAHOL*		*SISE*		*TCELL*		*THYAO*	
Mean	0.015180594	Mean	0.015679564	Mean	0.014224445	Mean	0.015469127	Mean	0.0190
Standard Error	0.001957077	Standard Error	0.002047113	Standard Erroı	0.001674428	Standard Erroı	0.001591831	Standard Error	0.0009
Median	0.013173005	Median	0.016434039	Median	0.015625	Median	0.015616586	Median	0.018
Mode	0.016649088	Mode	0.025697342	Mode	0.003211562	Mode	0.017594462	Mode	0.0205
Standard Deviation	0.018669323	Standard Deviatic	0.019528217	Standard Devi	0.015973026	Standard Devi	0.015185102	Standard Devia	0.0089
Sample Variance	0.000348544	Sample Variance	0.000381351	Sample Varian	0.000255138	Sample Varian	0.000230587	Sample Varian	7.98E-
Kurtosis	4.448595768	Kurtosis	7.847219427	Kurtosis	0.970832612	Kurtosis	3.166592431	Kurtosis	1.3382
Skewness	-0.082135767	Skewness	-1.452948727	Skewness	-0.816622763	Skewness	-0.033042404	Skewness	0.4942
Range	0.135718228	Range	0.151269408	Range	0.080284916	Range	0.113867766	Range	0.0554
Minimum	-0.057452123	Minimum	-0.086866598	Minimum	-0.036328872	Minimum	-0.042394015	Minimum	-0.006
Maximum	0.078266105	Maximum	0.06440281	Maximum	0.043956044	Maximum	0.071473751	Maximum	0.0488
Sum	1.381434099	Sum	1.42684032	Sum	1.294424503	Sum	1.407690593	Sum	1.7307
Count	91	Count	91	Count	91	Count	91	Count	

TOASO		*TTKOM*		*TUPRS*		*VAKBN*		*YKBNK*	
Mean	0.014525056	Mean	0.016509922	Mean	0.014420753	Mean	0.020114083	Mean	0.0144
Standard Error	0.002014117	Standard Error	0.001724492	Standard Erroı	0.001963547	Standard Erroı	0.001805968	Standard Error	0.0017
Median	0.015146178	Median	0.016483516	Median	0.015538994	Median	0.020179372	Median	0.0173
Mode	0.013907383	Mode	0.024440978	Mode	0.016595682	Mode	0.025	Mode	0.0125
Standard Deviation	0.019213451	Standard Deviatic	0.016450605	Standard Devi	0.018731042	Standard Devi	0.017227836	Standard Devia	0.0168
Sample Variance	0.000369157	Sample Variance	0.000270622	Sample Varian	0.000350852	Sample Varian	0.000296798	Sample Varian	0.0002
Kurtosis	9.772302595	Kurtosis	1.619019191	Kurtosis	7.362003993	Kurtosis	10.75859155	Kurtosis	11.307
Skewness	-1.233603229	Skewness	0.391067918	Skewness	-1.715602033	Skewness	-1.935781448	Skewness	-2.65
Range	0.163830255	Range	0.095278643	Range	0.125902076	Range	0.138309353	Range	0.1199
Minimum	-0.088830255	Minimum	-0.025185185	Minimum	-0.061122544	Minimum	-0.075	Minimum	-0.078
Maximum	0.075	Maximum	0.070093458	Maximum	0.064779532	Maximum	0.063309353	Maximum	0.0411
Sum	1.321780054	Sum	1.502402869	Sum	1.312288517	Sum	1.830381524	Sum	1.3150
Count	91	Count	91	Count	91	Count	91	Count	

Table 4.2 Panel C : Summary Statistics – Basis-Momentum

AKBNK		ARCLK		EKGYO		EREGL		GARAN	
Mean	0.114829136	Mean	0.08439241	Mean	0.181373762	Mean	0.109196892	Mean	0.12725
Standard Error	0.012414354	Standard Error	0.018153052	Standard Erro	0.022034036	Standard Erro	0.020163475	Standard Error	0.01073
Median	0.085656068	Median	0.034121851	Median	0.174625783	Median	0.094798395	Median	0.10964
Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	0.14568
Standard Deviation	0.118425392	Standard Deviatic	0.173169076	Standard Devi	0.210191307	Standard Devi	0.192347297	Standard Devia	0.10239
Sample Variance	0.014024573	Sample Variance	0.029987529	Sample Varian	0.044180385	Sample Varian	0.036997483	Sample Varianc	0.01048
Kurtosis	2.220247123	Kurtosis	-0.463925797	Kurtosis	0.244592367	Kurtosis	-0.643918462	Kurtosis	-0.4572
Skewness	1.469053307	Skewness	0.204873646	Skewness	0.680019161	Skewness	0.089581661	Skewness	0.43817
Range	0.585627143	Range	0.858429929	Range	0.963180439	Range	0.784940271	Range	0.43840
Minimum	-0.05096948	Minimum	-0.404455285	Minimum	-0.179567439	Minimum	-0.290142213	Minimum	-0.0455
Maximum	0.534657664	Maximum	0.453974643	Maximum	0.783613	Maximum	0.494798058	Maximum	0.39285
Sum	10.44945134	Sum	7.679709317	Sum	16.50501238	Sum	9.936917196	Sum	11.5803
Count	91	Count	91	Count	91	Count	91	Count	9

HALKB		ISCTR		KCHOL		KRDMD		PETKM	
Mean	0.026101182	Mean	0.100503844	Mean	0.265836279	Mean	0.344954411	Mean	0.20905
Standard Error	0.007499135	Standard Error	0.019914269	Standard Erro	0.015801115	Standard Erro	0.038067853	Standard Error	0.01564
Median	0.0064326	Median	0.05862222	Median	0.269242453	Median	0.242704734	Median	0.17691
Mode	0.018770579	Mode	0.05862222	Mode	0.121735194	Mode	0.080113821	Mode	0.24225
Standard Deviation	0.071537186	Standard Deviatic	0.189970016	Standard Devi	0.150733034	Standard Devi	0.363144174	Standard Devia	0.14920
Sample Variance	0.005117569	Sample Variance	0.036088607	Sample Varian	0.022720448	Sample Varian	0.131873691	Sample Varianc	0.02226
Kurtosis	0.250881992	Kurtosis	2.733985622	Kurtosis	1.169835303	Kurtosis	-0.440033457	Kurtosis	-0.3434
Skewness	0.889490483	Skewness	1.419668081	Skewness	-0.560166569	Skewness	0.806292217	Skewness	0.69663
Range	0.31431976	Range	1.010183222	Range	0.852742204	Range	1.455582401	Range	0.57624
Minimum	-0.087483552	Minimum	-0.2141642	Minimum	-0.207497118	Minimum	-0.236854258	Minimum	-0.0093
Maximum	0.226836208	Maximum	0.796019022	Maximum	0.645245086	Maximum	1.218728143	Maximum	0.56689
Sum	2.375207535	Sum	9.145849839	Sum	24.19110137	Sum	31.39085145	Sum	19.023
Count	91	Count	91	Count	91	Count	91	Count	9

PGSUS		SAHOL		SISE		TCELL		THYAO	
Mean	0.023414762	Mean	0.143999392	Mean	0.251283041	Mean	0.146881964	Mean	0.30383
Standard Error	0.061225221	Standard Error	0.01608124	Standard Erro	0.023187453	Standard Erro	0.019492656	Standard Error	0.05260
Median	0.055649312	Median	0.118437012	Median	0.217593951	Median	0.11928689	Median	0.07253
Mode	-0.241141008	Mode	0.390347859	Mode	0.25559615	Mode	-0.014639424	Mode	-0.0452
Standard Deviation	0.584051388	Standard Deviatic	0.153405256	Standard Devi	0.221194205	Standard Devi	0.185948086	Standard Devia	0.50180
Sample Variance	0.341116024	Sample Variance	0.023533173	Sample Varian	0.048926876	Sample Varian	0.034576691	Sample Varianc	0.25180
Kurtosis	0.750121926	Kurtosis	-0.128149725	Kurtosis	-0.533087381	Kurtosis	0.345578096	Kurtosis	3.72988
Skewness	-0.233201778	Skewness	0.618293065	Skewness	0.487691164	Skewness	1.04482927	Skewness	1.97787
Range	3.147346379	Range	0.670595535	Range	0.930826263	Range	0.742138556	Range	2.32348
Minimum	-1.690994007	Minimum	-0.173834786	Minimum	-0.120293974	Minimum	-0.077347408	Minimum	-0.1699
Maximum	1.456352372	Maximum	0.496760748	Maximum	0.810532289	Maximum	0.664791148	Maximum	2.15350
Sum	2.130743356	Sum	13.10394467	Sum	22.86675669	Sum	13.36625869	Sum	27.648
Count	91	Count	91	Count	91	Count	91	Count	9

TOASO		TTKOM		TUPRS		VAKBN		YKBNK	
Mean	0.091735058	Mean	0.028096138	Mean	0.348076286	Mean	0.211891717	Mean	0.12713
Standard Error	0.018977561	Standard Error	0.01703855	Standard Erro	0.03876691	Standard Erro	0.01515629	Standard Error	0.02388
Median	0.089214451	Median	0.02573182	Median	0.197217584	Median	0.193288797	Median	0.03985
Mode	-0.119247479	Mode	-0.259010691	Mode	0.073322329	Mode	0.252012597	Mode	0.01205
Standard Deviation	0.181034393	Standard Deviatic	0.162537409	Standard Devi	0.369812749	Standard Devi	0.144581796	Standard Devia	0.22788
Sample Variance	0.032773451	Sample Variance	0.026418409	Sample Varian	0.136761469	Sample Varian	0.020903896	Sample Varianc	0.05193
Kurtosis	0.608522236	Kurtosis	2.815037166	Kurtosis	-0.075585655	Kurtosis	1.304050723	Kurtosis	-0.0139
Skewness	0.290149051	Skewness	1.118601482	Skewness	0.87010202	Skewness	1.040234437	Skewness	0.71331
Range	0.969834909	Range	0.902718882	Range	1.487278637	Range	0.720067161	Range	1.00908
Minimum	-0.321210734	Minimum	-0.259010691	Minimum	-0.048960638	Minimum	0.00801169	Minimum	-0.2819
Maximum	0.648624174	Maximum	0.643708191	Maximum	1.438317998	Maximum	0.72807885	Maximum	0.72713
Sum	8.347890293	Sum	2.556748532	Sum	31.67494205	Sum	19.28214628	Sum	11.5694
Count	91	Count	91	Count	91	Count	91	Count	9

5. METHODOLOGY

5.1 Unconditional Returns

In this stage of our study, we aim to find whether spot and term premiums represented by Short Roll and Excess Holding returns, in the cross-section of equity futures that make up our sample, is significant or not. In this stage, futures contracts are not sorted on Basis, Momentum and Basis-Momentum characteristics but are taken as whole. To conduct our analysis, we follow [1] and start by calculating the Short Roll N1 (maturing in 1 month), Short Roll N2 (2 month roll) and Excess Holding N2 (2 month) returns for each of the twenty contracts in our sample and then we create equally-weighted (represented as EW) portfolios of the mentioned returns. Finally, we conduct a constant-only regression model with the below estimate to test for mean values, standard deviations and significance. Mean values and standard deviations are annualized for comparison. Our data is in monthly frequency.

$$\{ EH_{EW,t+1} , SR_{EW,t+1} \} = \beta_{0,t} + e_t \tag{11}$$

With $EH_{EW,t+1}$ representing the Excess Holding return of the EW portfolio, $SR_{EW,t+1}$ representing the Short Roll return of the EW portflio and $\beta_{0,t}$ is the intercept.

5.2 Conditional Returns

As mentioned in the introduction section of the study, different underlying assets are exposed differently to different economic determinants and characteristics and this fact changes the explanatory power of those characteristics in the mentioned assets whether they are commodities or equities. This fact makes it necessary to use our test assets in combination with portfolio sorting approach which is a common method in asset pricing literature. Again, the data is in monthly frequency. We start by sorting our twenty equity futures contracts into portfolios based on the extent of their exposure to the three characteristics that are at the center of our analysis which are basis-momentum, basis and momentum. In our analysis, we use one and two period short roll returns that capture, respectively, one period spot premium and sum of spot premiums for two consecutive periods and two period excess holding returns which is the minimum maturity required to capture term premiums. We sort our contracts into following portfolios : High, Q3, Q2, Low and HML. High portfolio contains, for each observation date, arithmetic average of the Short Roll or Excess Holding returns of the five contracts with the highest sorting characteristic (Basis, Momentum or BM). Q3 contains the arithmetic average of the Short Roll or Excess Holding returns of the five contracts within the third and second quartile ranking based on the respective characteristic. Q2 portfolio contains the returns of the five contracts within the second and first quartile ranking, Low portfolio contains the returns of the five contracts with the lowest sorting characteristic. HML portfolio, on the other hand, is calculated by taking the difference of High and Low portfolios for the respective return.

After formation of the portfolios, we conduct a constant-only regression model with the below estimate to test for mean values, standard deviations and significance. Mean values and standard deviations are annualized for comparison with our other analysis results. Our data is in monthly frequency.

$$\{ EH_{\{BM,M,B\},i,t+1} , SR_{\{BM,M,B\},i,t+1} \} = \beta_{0,t} + e_t \tag{12}$$

$EH_{\{BM,M,B\},i,t+1}$ represents the Excess Holding return of the contracts sorted on either Basis-Momentum, Momentum or Basis, i represents one of the portfolios High, Q3, Q2, Low or HML at time t+1. $SR_{\{BM,M,B\},i,t+1}$ represents the Short Roll return of the contracts sorted on either Basis-Momentum, Momentum or Basis and $\beta_{0,t}$ is the intercept.

5.3 Multivariate Tests

In this part of our analysis, we join Basis, Momentum and Basis-Momentum characteristics together in a panel (Pooled OLS) regression in order to test the robustness of the characteristics against the inclusion of each other. [2] and [11] find that basis and momentum have predictive power for commodity returns in the time series. We also make use of time fixed effects and equity (underlying) fixed effects in order to capture the passive and dynamic components of the three characteristics' explanatory power. Daily data is utilized for this part of our study in order have enough observation to have more accurate estimates. Since daily data is used, types of returns utilized are nearby and spreading returns instead of short roll and excess holding returns. Nearby returns are basically the same with one period short roll returns, the difference is that the contract is not rolled over. In our analysis, thirteen different regressions are conducted for both nearby returns and spreading returns making a total of twenty-six regressions. Our regression model is provided as below :

$$\{ R^{nb}{}_{fut,i,t+1}, R^{spr}{}_{fut,i,t+1} \} = \lambda'_C \, C_{i,t} + a_{t+1} + \mu_i + e_{i,t+1} \tag{13}$$

Where $R^{nb}{}_{fut,i,t+1}$ and $R^{spr}{}_{fut,i,t+1}$ represent daily nearby and spreading returns and i is the respective underlying contract. λ'_C is the regression estimate/coefficient of the characteristics used in the regression where $C_{i,t} = \{ BM_{i,t} , B_{i,t}, M_{i,t} \}$ represents the characteristics used in the respective regression. a_{t+1} is the time fixed effect and μ_i is the equity (underlying) fixed effect.

Before moving on to the regressions, we conduct a VIF test with the Basis, Basis-Momentum and Momentum variables to see if there is any multicollinearity among them which may affect the robustness of our regressions. Results of the VIF test can be seen in the table below.

Table 5.1 : VIF Test, Multivariate Tests

Variables	VIF Value	Multicollinearity
Basis-Momentum	1.92	No
Momentum	1.93	No
Basis	1.01	No

We start our regressions with only single characteristics included without any fixed effect. After that, we test the accuracy of the characteristics individually by including different fixed effects one-by-one and also jointly. Finally, we test characteristics jointly with all of the fixed effects present. Without the fixed effects, regression betas of individual characteristics represent the total return predictability from the characteristic itself. Inclusion of underlying fixed effects, eliminates the passive component coming from the variation in unconditional average equity futures returns and as a result controls for the systematic differences across different underlyings while including time fixed effects eliminates the passive component coming from time variation in average equity futures returns.

5.4 Regression With Newey West Standard Errors

5.4.1 Model Definition

In the previous sections of our study, equity futures are sorted into portfolios based on their extent of exposure to Basis, Momentum and Basis-Momentum characteristics to form explanatory factors for spot premiums and term premiums. As a result of constant-only regressions, factors determined as significant are : EH Return of the Momentum Sorted HML Portfolio, EH Return of the BM Sorted HML Portfolio, EH Return of the Basis Sorted HML Portfolio which represent term premium. In this part of our study, our aim is to examine the driving factors behind these mentioned term premiums represented by the respective excess holding returns during our sample period. In order to do that, the HML excess holding returns are regressed separately as three sets of data on the following macroeconomic variables and a dummy variable used as independent variables : TLREF (Overnight Turkish Lira borrowing rate quoted annually), Tahvil 2Y (Yield on the 2-year Türkiye Treasury Bond quoted annually), Tahvil 5Y (Yield on the 5-year Türkiye Treasury Bond quoted annually), USDTRY (Return on the exchange rate between USD and TRY on the observation date), and finally YieldCurveInverted (Dummy variable taking the value of 1 if the YC is inverted on the respective date). The yield curve at the center of our analysis is the curve calculated for the Türkiye Government Bonds in Turkish Lira denomination and issued domestically. For each dataset, regressions are conducted with three different time frames, two of which are the sub samples and finally for the whole sample. Thus, our analysis consists of nine regressions in total. In order to choose cut-off dates to form our sub-samples, we conducted a Zivot-Andrews test [12] for structural breaks with our dependent variables to see the time points with structural breaks. Structural break for Basis sorted term premium occurs in 26.02.2021, for Basis-Momentum sorted term premium, occurs in 30.06.2020 and finally for the Momentum sorted term premium the break occurs in 29.05.2020. Since the cut-off dates are close to each other and close to the start of the middle point of our data, which is 2019 end and 2020 beginning, we divide our sample in half for convenience. 2020 beginning also corresponds to the beginning of the Covid-19 pandemic. Zivot-Andrews test [12] results for structural breaks can be seen below.

Table 5.2 : Zivot-Andrews Test for Structural Break

Variables	Break Point Position Index	Date (Decreasing Order)
HML EHR BM	39	30.06.2020
HML EHR Momentum	40	29.05.2020
HML EHR Basis	31	26.02.2021

The segmentation of the sample allows us to observe the time varying interaction between the mentioned independent variables and the dependent variables. Our whole sample and the formation of the sub-samples are as follows :

Whole sample : from 31.03.2016 to 31.07.2023

Sub-sample 1 : from 31.03.2016 to 31.10.2019

Sub-sample 2 : from 29.11.2019 to 31.07.2023

The time points chosen as cut-offs are especially important to observe the structural changes in Türkiye's and Global economy. While the sub-sample 1 represents a more stabilized economic environment, sub-sample 2 is a period characterized by global events such as the pandemic and structural changes in the Türkiye's and World economy. Again, before proceeding with the regressions, we check for multicollinearity among independent variables via VIF tests, and find that there is significant multicollinearity between Tahvil 2Y and Tahvil 5Y. As a result, we drop the Tahvil 2Y variable and continue with Tahvil 5Y. Tahvil 5Y is more suitable for our analysis since it represents mid-term rates and can be used hand-in-hand with 5Y CDS for further analysis which is the most commonly used CDS term. TLREF already accounts for short-term rates which decreases dependency on Tahvil 2Y also.

Table 5.3 : VIF Test, NW OLS Regressions

Variables	VIF Value	Multicollinearity
TLREF	2.76	No
Tahvil 2Y	16.28	Yes
Tahvil 5Y	12.48	Yes
USDTRY	1.04	No
Inverted YC	1.64	No

Regressions 1-2-3 are conducted with the EH Return of the Momentum Sorted HML Portfolio as the dependent variable with 3 different samples with the below equation.

$$EH\ Return^{HML\ M} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY\ Return + \beta_5 dummyINVERTED\ YC \quad (14)$$

Regressions 4-5-6 are conducted with the EH Return of the BM Sorted HML Portfolio as the dependent variable with 3 different samples with the below equation.

$$EH\ Return^{HML\ BM} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY\ Return + \beta_5 dummyINVERTED\ YC \quad (15)$$

Regressions 7-8-9 are conducted with the EH Return of the Basis Sorted HML Portfolio as the dependent variable with 3 different samples with the below equation.

$$EH\ Return^{HML\ B} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY\ Return + \beta_5 dummyINVERTED\ YC \quad (16)$$

As described in the Data section. Inversion of the yield curve at each of our observation date is controlled from the Bloomberg terminal. In Table 2 provided below, the information regarding the shape of the mentioned yield curve is given for each of the observation date of our model.

Table 5.4 : Yield Curve Inversion Presence

Observation Date	Yield Curve Inverted ?	Observation Date	Yield Curve Inverted ?	Observation Date	Yield Curve Inverted ?
31.07.2023	0	29.01.2021	1	31.07.2018	1
27.06.2023	1	31.12.2020	1	29.06.2018	1
31.05.2023	1	30.11.2020	0	31.05.2018	1
28.04.2023	1	30.10.2020	0	30.04.2018	1
31.03.2023	0	30.09.2020	0	30.03.2018	1
28.02.2023	0	31.08.2020	0	28.02.2018	1
31.01.2023	0	30.07.2020	0	31.01.2018	1
30.12.2022	0	30.06.2020	0	29.12.2017	1
30.11.2022	1	29.05.2020	0	30.11.2017	1
31.10.2022	1	30.04.2020	0	31.10.2017	1
30.09.2022	1	31.03.2020	0	29.09.2017	1
31.08.2022	1	28.02.2020	1	31.08.2017	1
29.07.2022	1	31.01.2020	0	31.07.2017	1
30.06.2022	1	31.12.2019	0	30.06.2017	1
31.05.2022	1	29.11.2019	0	31.05.2017	1
29.04.2022	0	31.10.2019	1	28.04.2017	1
31.03.2022	0	30.09.2019	1	31.03.2017	0
28.02.2022	0	29.08.2019	1	28.02.2017	0
31.01.2022	0	31.07.2019	1	31.01.2017	0
31.12.2021	0	28.06.2019	1	30.12.2016	0
30.11.2021	0	31.05.2019	1	30.11.2016	0
28.10.2021	0	30.04.2019	1	31.10.2016	0
30.09.2021	1	29.03.2019	1	30.09.2016	0
31.08.2021	1	28.02.2019	1	31.08.2016	0
30.07.2021	1	31.01.2019	1	29.07.2016	0
30.06.2021	1	31.12.2018	1	30.06.2016	0
31.05.2021	0	30.11.2018	1	31.05.2016	0
30.04.2021	1	31.10.2018	1	29.04.2016	1
31.03.2021	1	28.09.2018	1	31.03.2016	1
26.02.2021	1	31.08.2018	1		

5.4.2 Estimation of The Model and Newey West Standard Errors

The mentioned independent variables that we utilize in our regressions are among the major macroeconomic variables providing an important outlook for an economy. In order to be used as explanatory factors for the significant term premiums, we must take into account also the effect of their past values which is a common concern in the finance and economics literature. So in order to adjust for the effect of past values of our independent variables, we calculate Newey-West standard errors of the regression estimates to better mitigate the effects of autocorrelations. We follow a two-step approach to determine the appropriate lag length to calculate our Newey West standard errors. We first start by calculating and plotting the PACF values for each dependent and independent variable to identify the significant lags in the individual series in order not to miss any important autocorrelations. Taking into account significant autocorrelations in the individual series, we then calculate Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ), Schwarz Information Criterion (SC), Final Prediction Error (FPE) values for each of our regression models where dependent and independent variables are taken together. The benefit of this two-step approach is that the lags chosen for each regression model take into account both individual dynamics and dynamics resulting from the interaction of variables. PACF graphs for each variable are provided in the Appendix section.

5.5 Vector Autoregressive Model

5.5.1 Unit Root Tests

After our regressions with Newey-West standard errors, we continue our analysis by setting up a VAR model to bring an explanation to the interaction between our HML returns representing term premiums and major macroeconomic variables and their past values. We first start by controlling our variables for stationarity via Augmented Dickey-Fuller unit root tests. In order to fulfill the condition of stationarity, we take the first difference of the non-stationary variables and again conduct the unit root tests to ensure that stationarity of the variables. Only for the independent variable of TLREF, we transform the series into log base before taking the difference in order to make the variable stationary. In our ADF tests, the ADF statistics and the respective p-values are calculated and decisions of stationarity are made on the condition that the ADF test statistics exceeded the critical values at 5% significance levels. Before proceeding with the lag selection, we check for multicollinearity between the variables via VIF test. We detect multicollinearity between Tahvil 2Y and Tahvil 5Y again, similar to the previous section. We proceed with setting up our model after dropping Tahvil 2Y and continue with Tahvil 5Y again because of the convenience of using Tahvil 5Y. Results of the VIF test can be seen in the table below.

Table 5.5 : VIF Test, VAR Model

Variables	VIF Value	Multicollinearity
HML EHR BM	1.42	No
HML EHR Momentum	1.50	No
HML EHR Basis	1.38	No
TLREF	2.53	No
Tahvil 2Y	11.68	Yes
Tahvil 5Y	8.52	Yes
USDTRY	1.06	No

5.5.2 Optimal Lag Selection

After taking the first difference of our variables and controlling for stationarity with the ADF tests, we then proceed with the selection of the most suitable lag length for our VAR model by calculating the Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ), Schwarz Information Criterion (SC), Final Prediction Error (FPE) values for a maximum of 4 lags considering the fact that our data is monthly, and in order not to lose important information in our data by using long lags. After calculation of the information criterion values, we compare the results of each information criterion and decide based on the AIC values which is the common approach in the literature. PACF graphs for each of our variables can be found in the Appendix section. After taking the first difference of our variables, we do not proceed with co-integration tests since [13] supports the use of unrestricted VAR since it performs better than VECM in the short run data. [14] and [15] also provide evidence in favor of using unrestricted VAR instead of VECM for short time periods in terms of conducting forecast variance decomposition.

5.5.3 Residual Autocorrelation Tests

After determination of the most appropriate lag order for our model which is the 1^{st} lag based on AIC values, we conduct Portmanteu Tests to ensure that the residuals of the estimated VAR model do not contain serial autocorrelation which is an important requirement for a robust VAR model. Results of the Portmanteu tests are reported with the respective Chi-squared test statistics and p-values in the Results section. Significance level used in our test is 5%, meaning that a p-value below 0.05 shows that serial autocorrelation remains and the model needs to be refined.

5.5.4 Estimation of the Model

After determination of the lag order and ensuring no serial autocorrelation is present in our VAR model with 1 lag, we proceed on estimating the VAR (1) model. As indicated in the previous sections for unit root tests, our VAR model is estimated with the first-differenced series to satify the stationarity condition. Endogenous variables included in our model are as follows : EH Return of the Momentum Sorted HML Portfolio, EH Return of the BM Sorted HML Portfolio, EH Return of the Basis Sorted HML Portfolio which represent term premium and TLREF (Overnight Turkish Lira borrowing rate quoted annually), Tahvil 5Y (Yield on the 5-year Türkiye Treasury Bond quoted annually), USDTRY (Return on the exchange rate between USD and TRY on the observation date). Our sample covers the period between 03/2016 and 07/2023 with monthly frequency data. The deterministic component of our model is set as “constant” since our financial and macro data revolve around a mean. This is especially true for our TLREF and Tahvil 5Y variables. It would also be more appropriate to use it also with our USDTRY variable since it is used after taking the first difference in our model. The VAR (1) model constitutes the essence of our following analysis, the variance decomposition analysis.

Our VAR (1) model can be defined as follows :

$$Y_t = \mathrm{c} + A_1 Y_{t-1} + \epsilon_t \tag{17}$$

Where,

Y_t = [$EH\ Return^{HML\ M}, EH\ Return^{HML\ BM}, EH\ Return^{HML\ B}, TLREF, Tahvil\ 5Y, USDTRY$]

Our endogenous variables of interest, “ c “ constants (intercept) vector for each of the equations, A_t where t = {1} represent the 6 X 6 matrices of coefficients for first lags, capturing one variable’s lag’s effect on the other variables in the equation. The estimates provided constitute the baseline of our model, which captures the interdependencies between the variables of the system.

5.5.5 Variance Decomposition Analysis

After setting up our VAR model, we proceed on with making the forecast variance decomposition analysis in order to observe the contribution of each variable in our model to the forecast error variance. The forecast error variance is calculated for the variables which are at the center of our study. These are EH Return of the Momentum Sorted HML Portfolio, EH Return of the BM Sorted HML Portfolio, EH Return of the Basis Sorted HML Portfolio which represent term premium. We aim to provide insights on how the innovations to major macroeconomic variables affect the forecasted values of the mentioned variables that represent the term premium. The variance decomposition is conducted by transforming the residuals of the VAR (1) model via a method known as Cholesky decomposition in order to capture the impact of shocks solely. Our forecast horizon includes one, two and three months horizons. We expect more significant effects for the 3 month horizon since macro and firm economic/financial data is released mostly quarterly. Variance decomposition results are provided in the Results section and are expressed as percentages that show to what extent the forecast error variance is caused by innovations to other variables.

6. RESULTS

6.1 Unconditional Returns

Results of our analysis for the equally-weighted (EW) index of 20 equity futures is provided in Table 3 below which contains the annualized average returns, annualized standard deviations and t-statistic values for the short roll returns that isolate the spot premia and excess holding returns that isolate the term premia.

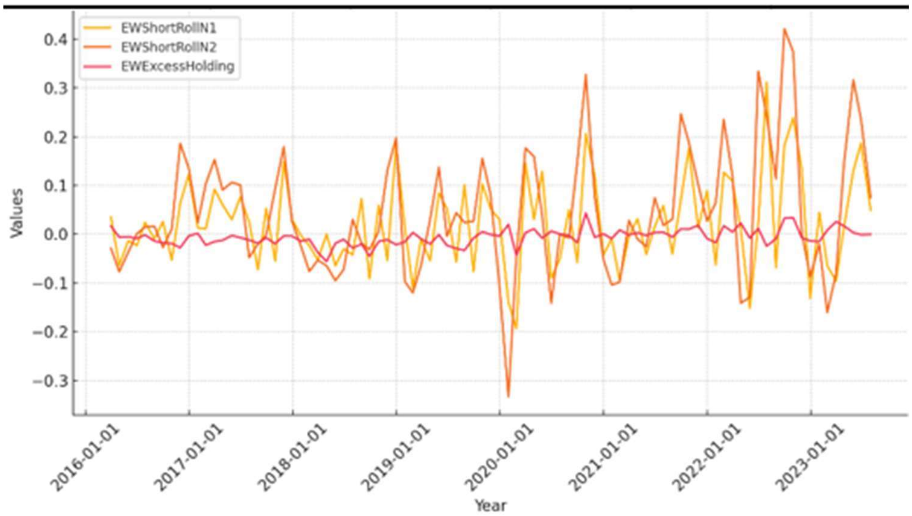
Table 6.1 : Unconditional Expected Returns

		Annualized Mean Returns		Annualized Std. Deviations		t-Statistics	
		n=1	n=2	n=1	n=2	n=1	n=2
Short Roll	EW	0.2645	0.5278	0.3197	0.4493	**2.2804	***3.2201
Excess Holding	EW		-0.0701		0.0585		***-3.2459

*** Significant at 0.01, ** Significant at 0.05

[10] also followed a similar method and constructed an equally weighted portfolio of commodity futures to study the return characteristics. By looking at the average returns and t-statistics, we can see that depending on the maturity of short-roll returns, spot premia are between %26.45 and %52.78 per annum and are significantly different from zero. We can also see that the term premia has an opposite sign with the spot premia with -%7.01 and also significantly different from zero. Looking at the standard deviations of returns, we can see that variance of the spot premia increases with the maturity and ranges between %31.97 and %44.93. Term premia, on the other hand, has the lowest standard deviation with %5.85. Existance of significant short roll and excess holding returns in the equally-weighted portfolios of 20 equities implies that the average spot premiums and term premiums are reliably different from zero in the cross-section of equity futures. In the Figure 1 below, movements of the Short Roll and Excess Holding returns which represent the spot premium and term premium for our sample period is plotted.

Figure 6.1 : Short Roll and Excess Holding Returns of EW Portfolio



6.2 Conditional Returns

Different returns are exposed to spot and term premiums in different ways which makes them suitable to use in combination with portfolio sorting approach. We sort our 20 equity futures contracts into portfolios based on the extent of their exposure to the three characteristics that are at the center of our analysis which are basis-momentum, momentum and basis. Main aim of the portfolio sorting, as stated by [7], is to measure predictability of the mentioned characteristics both in the time series and in the cross section. As in [7], we focus on H4, L4 and HML portfolios. In our analysis, we use one and two period short roll returns that capture, respectively, one period spot premium and sum of spot premiums for two consecutive periods and two period excess holding returns which is the minimum maturity required to capture term premiums. Table 4 presents the short roll and excess holding returns that are captured with different portfolios of basis-moentum, momentum and basis sorts next to t-statistic values and standard deviations. All mean return and standard deviation values are annualized for comparison.

Table 6.2 Panel A : Conditional Expected Returns

		Panel A. Basis Momentum					
		Annualized Mean Returns		Annualized Std. Deviations		t-Statistics	
		n=1	n=2	n=1	n=2	n=1	n=2
Short Roll	Low	0.2417	0.4602	0.3495	0.5010	1.9263	**2.5496
	Q2	0.2314	0.5050	0.3116	0.4224	**2.0257	***3.2479
	Q3	0.2663	0.5467	0.3605	0.5108	**2.0385	***2.9400
	High	0.3186	0.5993	0.3441	0.4894	**2.5346	***3.3330
	HML	-0.0769	-0.1391	0.2287	0.3242	-0.9195	-1.1831
Excess Holding	Low		-0.0279		0.0651		-1.1681
	Q2		-0.0537		0.0704		**-2.0700
	Q3		-0.0804		0.0628		***-3.4729
	High		-0.1186		0.0744		***-4.3150
	HML		0.0907		0.0606		***4.0875

*** Significant at 0.01, ** Significant at 0.05

Panel A of the table shows the average returns, t-statistic and standard deviation values for basis-momentum sorted portfolios. The spread between High and Low portfolios decreases from -%7.69 to -%13.91 but is not statistically significant. For the Low basis-momentum portfolio, the mean returns are between %24.17 and %46.02 and for the High basis-momentum portfolio, mean returns are between %31.85 and %59.93. The excess holding return isolates the term premia. The spread between High and Low portfolios is %9.07 on average and statistically significant. The return of the High and Low portfolios are, on average, -%2.79 and -%11.86 respectively. It can be observed that for basis-momentum sorted portfolios, spot premium and term premium have opposite signs.

Table 6.2 Panel B : Conditional Expected Returns

		Panel B. Basis					
		Annualized Mean Returns		Annualized Std. Deviations		t-Statistics	
		n=1	n=2	n=1	n=2	n=1	n=2
Short Roll	Low	0.2534	0.5483	0.3531	0.4997	1.9832	***3.0022
	Q2	0.3096	0.4924	0.3447	0.4935	**2.4743	***2.7410
	Q3	0.2195	0.5051	0.3312	0.4650	1.8135	***2.9547
	High	0.2755	0.5654	0.3320	0.4638	**2.2814	***3.3332
	HML	-0.0221	-0.0170	0.1677	0.2813	-0.3578	-0.1642
Excess Holding	Low		-0.2274		0.0857		***-7.1966
	Q2		-0.0907		0.0607		***-4.0790
	Q3		-0.0381		0.0572		-1.8044
	High		0.0757		0.0800		**2.5656
	HML		-0.3030		0.0949		***-8.6836

*** Significant at 0.01, ** Significant at 0.05

Panel B of our table shows the results for the basis sorted portfolios. In the basis sorted portfolios, short roll returns increase with the basis as opposed to the findings of [1] with the commodities. The spread between the High and Low portfolios increase from -%2.20 to -%1.70 but is not statistically significant. For the Low basis portfolio, the mean returns are between %25.34 and %54.83 and for the High basis portfolio, mean returns are between %27.55 and %56.54. For excess holding returns, the spread between the High and Low portfolios is -%30.30 on average and statistically significant. The return of the Low and High portfolios are, on average, -%22.74 and %7.57 respectively. Also for basis sorted portfolios, spot premium and term premium have opposite signs as in Basis-Momentum sorted portfolios.

Table 6.2 Panel C : Conditional Expected Returns

		Panel C. Momentum					
		Annualized Mean Returns		Annualized Std. Deviations		t-Statistics	
		n=1	n=2	n=1	n=2	n=1	n=2
Short Roll	Low	0.2929	0.6126	0.3467	0.5026	**2.3094	***3.3263
	Q2	0.3038	0.5372	0.3116	0.4418	***2.7041	***3.3431
	Q3	0.2516	0.5246	0.3562	0.4970	1.9560	***2.8923
	High	0.2097	0.4368	0.3674	0.5135	1.5597	**2.3213
	HML	0.0833	0.1758	0.2591	0.3858	0.8703	1.2341
Excess Holding	Low		-0.0631		0.0726		**-2.3536
	Q2		-0.0439		0.0641		-1.8567
	Q3		-0.0601		0.0692		**-2.3516
	High		-0.1135		0.0683		***-4.5035
	HML		0.0504		0.0617		**2.2123

*** Significant at 0.01, ** Significant at 0.05

Panel C of our table shows the results for the momentum sorted portfolios. In the momentum sorted portfolios, spread between High and Low portfolios increases from %8.33 to %17.58 but is not statistically significant. For the Low momentum portfolio, the mean returns are between %29.29 and %61.26. For the High momentum portfolio, the mean returns are between %20.97 and %43.68. The High and Low spread in the excess holding return is on average %5.04 and statistically significant. The return of the High and Low portfolios are, on average, -%6.31 and -%11.35 respectively. Also for basis sorted portfolios, spot premium and term premium have opposite signs as in other sorts.

Results for the second and third quartile portfolios of different sorts can also be viewed in the tables.

6.3 Multivariate Tests

In this section of our study, we provide the results for our pooled regressions conducted with thirteen different set ups for both nearby returns and spreading returns with daily data to test the robustness of each of the three characteristics against the inclusion of each other with and without the presence of fixed effects. Results and the configuration of our regressions can be seen in the Table 5 below which is divided into two panels. Panel A showing the results for Nearby returns and Panel B showing the results for the Spreading returns that respectively represent spot premium and term premium.

Table 6.3 : Multivariate Tests

Model	1	2	3	4	5	6	7	8	9	10	11	12	13
Panel A. Nearby Returns													
λBM	0.0859	-0.2092	-0.3180	0.0519									-0.0766
(t)	0.7094	-1.5239	**-2.2209	0.1679									-0.4149
λB					16.3382	14.4101	14.6367	16.5229					14.4429
(t)					***10.7683	***7.0640	***7.1675	***5.3652					***7.073302
λM									0.0945	-0.0239	-0.1313	0.0580	-0.0816
(t)									**2.2326	-0.3795	-1.9782	0.4219	-0.9507
Time FE	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Equity FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes
R^2	0.0000	0.4366	0.4367	-0.0002	0.0030	0.4384	0.4385	0.0029	0.0001	0.4365	0.4367	-0.0002	0.4386
Panel B. Spreading Returns													
λBM	0.6023	0.6232	0.7535	0.6902									0.1797
(t)	***6.9897	***6.1945	***6.7460	***5.4545									1.3428
λB					-89.1475	-97.1936	-97.8377	-89.6026					-97.8662
(t)					***-90.9001	***-30.3028	***-30.4963	***-29.8372					***-30.43052
λM									0.0658	0.0728	0.0925	0.0741	-0.1522
(t)									**2.1794	**2.3085	**2.5480	1.4682	***-3.3116
Time FE	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Equity FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes
R^2	0.0013	0.1152	0.1150	0.0010	0.1786	0.2867	0.2875	0.1791	0.0001	0.1142	0.1138	-0.0004	0.2876

*** Significant at 0.01, ** Significant at 0.05

As can be seen from the Panel A of the Table 5, in isolation, the coefficient estimate on basis-momentum is positive but insignificant at 0.08 (t= 0.7094) which translate into an increase in annual return of %2.42 for one standard deviation increase in basis-momentum, contrary to the finding of [7] who find positive and significant coefficient for Basis-Momentum in isolation. Inclusion of time fixed effects and equity fixed effects individually still gives an insignificant basis-momentum estimate while including both fixed effects together gives a significant basis-momentum estimate in isolation at -0.31 (t= -2.2209). Basis, in isolation, gives significant cofficients whether fixed effects are included together or individually and gives the greatest average return estimate while momentum, in isolation, gives a coefficient of 0.09 (t= 2.2326) which is significant and translates into an increase in annual return of %7.60 for one standard deviation increase in momentum. Including basis, momentum and basis-momentum characteristics with the presence of both fixed effects gives an insignificant basis-momentum and momentum estimates while Basis estimate is significant with a coefficient of 14.44 (t= 7.0733)

In panel B, which shows the predictability of the characteristics in spreading returns, we can see that the basis-momentum gives a significant return estimate in isolation with a coefficient of 0.60 (t= 6.9897) which translates into an increase in annual return of %16.96 for one standard deviation increase in basis-momentum. The coefficients of basis-mometum are significant in all cases where the time fixed effects and equity fixed effects are present together and individually. Basis, in isolation, also gives a significant coefficent of -89.14 (t= -90.9001) which translate into a decrease in annual spreading return of %200 for one standard deviation increase in basis which is different from the case in nearby returns. The coefficients of basis are also significant in all cases where time fixed effects and equity fixed effects are present together and individually. Momentum, in isolation, gives a significant coefficient of 0.06 (t= 2.1794) which translate into an increase in annual return of %5.29 for one standard deviation increase in momentum. The coefficients of momentum are also significant in all cases except the case in which the time fixed effects are not included but the equity fixed effects are present.

6.4 Regressions With Newey-West Standard Errors

6.4.1 Estimation of The Model and Newey-West Standard Errors

As previously mentioned in the methodology section of our study, our regression models are set up separetely for each of our dependent variables which are EH Return of the Momentum Sorted HML Portfolio, EH Return of the BM Sorted HML Portfolio, EH Return of the Basis Sorted HML Portfolio that represent the term premiums. Our dependent variables are TLREF (Overnight Turkish Lira borrowing rate quoted annually), Tahvil 5Y (Yield on the 5-year Türkiye Treasury Bond quoted annually), USDTRY (Return on the exchange rate between USD and TRY on the observation date), and finally YieldCurveInverted (Dummy variable taking the value of 1 if the YC is inverted). Each of our regression models are visualized in the Table 6 below.

Table 6.4 : Regression Equations

Regressions 1-2-3	
Equation	$EH\ Return^{HML\ M} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY\ Return + \beta_5 dummyINVERTED\ YC$
Sample for (1)	*from 31.03.2016 to 31.10.2019*
Sample for (2)	*from 29.11.2019 to 31.07.2023*
Sample for (3)	*from 31.03.2016 to 31.07.2023*
Regressions 4-5-6	
Equation	$EH\ Return^{HML\ BM} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY\ Return + \beta_5 dummyINVERTED\ YC$
Sample for (4)	*from 31.03.2016 to 31.10.2019*
Sample for (5)	*from 29.11.2019 to 31.07.2023*
Sample for (6)	*from 31.03.2016 to 31.07.2023*
Regressions 7-8-9	
Equation	$EH\ Return^{HML\ B} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY\ Return + \beta_5 dummyINVERTED\ YC$
Sample for (7)	*from 31.03.2016 to 31.10.2019*
Sample for (8)	*from 29.11.2019 to 31.07.2023*
Sample for (9)	*from 31.03.2016 to 31.07.2023*

Each of the regression models with the equations given in Table 6 are conducted for three samples. For our whole sample and for two sub-samples.

The independent variables of our regression models are chosen in a way that captures the major dynamics in an economy. As it is common with most of the macroeconomic and macrofinancial data, autocorrelation structure must also be taken into account in order to build a more robust model. Thus, in order to account for dynamic interdependencies between our variables and their past values, we calculate the newey-west standard errors. First, we need to determine the best lag order in order to capture the most information from the past values and achieve low estimation errors. In determining the appropriate lag order, we embrace two-step approach. We first calculate and plot the PACF values for each of our variables to visualize all significant autocorrelations. Then, we proceed with calculating the Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ), Schwarz Information Criterion (SC), Final Prediction Error (FPE) values for a maximum of 4 lags since our data is monthly and covers a relatively short-period of time. The respective information criterion values for each lag is presented in the Table 7 below. Graphs of the PACF functions for each variable can be seen in the Appendix section.

Table 6.5 : Lag Order Selection for NW Standard Errors Calculation

$EH\ Return^{HML\ M} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY + \beta_5 dummyINVERTED\ YC$				
Lag	**AIC**	**HQ**	**SC**	**FPE**
1	-1.40E+01	-1.36E+01	-1.31E+01	8.59E-07
2	-1.39E+01	-1.32E+01	-1.23E+01	9.49E-07
3	-1.37E+01	-1.27E+01	-1.14E+01	1.19E-06
4	-1.38E+01	-1.25E+01	-1.07E+01	1.12E-06
$EH\ Return^{HML\ BM} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY + \beta_5 dummyINVERTED\ YC$				
Lag	**AIC**	**HQ**	**SC**	**FPE**
1	-1.41E+01	-1.37E+01	-1.32E+01	7.60E-07
2	-1.39E+01	-1.33E+01	-1.24E+01	8.88E-07
3	-1.38E+01	-1.28E+01	-1.15E+01	1.07E-06
4	-1.38E+01	-1.26E+01	-1.07E+01	1.11E-06
$EH\ Return^{HML\ B} = \beta_0 + \beta_1 TLREF + \beta_3 Tahvil\ 5Y + \beta_4 USDTRY + \beta_5 dummyINVERTED\ YC$				
Lag	**AIC**	**HQ**	**SC**	**FPE**
1	-1.34E+01	-1.30E+01	-1.25E+01	1.55E-06
2	-1.33E+01	-1.26E+01	-1.17E+01	1.71E-06
3	-1.30E+01	-1.21E+01	-1.07E+01	2.27E-06
4	-1.32E+01	-1.20E+01	-1.02E+01	1.97E-06

For our model with the EH Return of the Momentum Sorted HML Portfolio as the dependent variable, information criterion values indicate the use of 1^{st} lag. For the model with EH Return of the BM Sorted HML Portfolio as the dependent variable, information criterion values indicate the use of 1st lag again. Also, for the model with EH Return of the Basis Sorted HML Portfolio as the dependent variable, information criterion values indicate the use of 1st lag. Results of our regressions are provided in three separate panels in the Table 8 below. We report the coefficients for each independent variable next to Standard Errors, t-statistic values, standard errors with Newey West lags and t-statistic values with Newey West lags.

Table 6.6 : Regression Results

EH Return of the Momentum Sorted HML Portfolio	Independent Variables	Coefficient	Std. Error	t-Statistic	Std. Error (With NW 1 Lags)	t-Statistic (With NW 1 Lags)
Regression 1 (2016-2019)	Constant	0.0076	0.0089	0.8495	0.0086	0.8803
	TLREF	-0.0015	0.0009	-1.7017	0.0006	****-2.6452**
	Tahvil 5Y	0.0016	0.0012	1.3077	0.0007	****2.2306**
	USDTRY	-0.0383	0.0381	-1.0050	0.0334	-1.1477
	Inverted YC	-0.0004	0.0073	-0.0578	0.0070	-0.0602
Regression 2 (2020-2023)	Constant	0.0024	0.0124	0.1902	0.0079	0.2986
	TLREF	-0.0006	0.0011	-0.5772	0.0007	-0.8246
	Tahvil 5Y	0.0006	0.0008	0.8305	0.0008	0.8104
	USDTRY	0.0205	0.0420	0.4886	0.0222	0.9256
	Inverted YC	-0.0012	0.0064	-0.1812	0.0041	-0.2816
Regression 3 (2016-2023)	Constant	0.0065	0.0069	0.9336	0.0063	1.0326
	TLREF	-0.0009	0.0006	-1.4904	0.0004	****-2.1309**
	Tahvil 5Y	0.0007	0.0006	1.2893	0.0006	1.1901
	USDTRY	-0.0088	0.0279	-0.3157	0.0173	-0.5091
	Inverted YC	0.0002	0.0046	0.0330	0.0037	0.0413

EH Return of the BM Sorted HML Portfolio	Independent Variables	Coefficient	Std. Error	t-Statistic	Std. Error (With NW 1 Lags)	t-Statistic (With NW 1 Lags)
Regression 4 (2016-2019)	Constant	0.0082	0.0098	0.8427	0.0094	0.8767
	TLREF	-0.0023	0.0010	****-2.3651**	0.0008	*****-2.9485**
	Tahvil 5Y	0.0025	0.0013	1.892	0.0008	*****3.062**
	USDTRY	-0.0621	0.0416	-1.4906	0.0326	-1.9043
	Inverted YC	0.0084	0.0079	1.0542	0.0086	0.9672
Regression 5 (2020-2023)	Constant	0.0024	0.0097	0.2476	0.0068	0.3509
	TLREF	-0.0007	0.0008	-0.8494	0.0006	-1.2304
	Tahvil 5Y	0.0004	0.0006	0.7383	0.0007	0.6373
	USDTRY	0.0470	0.0327	1.4371	0.0209	****2.2521**
	Inverted YC	0.0057	0.0050	1.1337	0.0034	1.6637
Regression 6 (2016-2023)	Constant	0.0077	0.0067	1.1503	0.0073	1.0536
	TLREF	-0.0009	0.0006	-1.6517	0.0005	-1.8182
	Tahvil 5Y	0.0006	0.0006	1.0450	0.0007	0.8602
	USDTRY	-0.0091	0.0271	-0.3349	0.0255	-0.3551
	Inverted YC	0.0091	0.0044	****2.0449**	0.0041	****2.2222**

EH Return of the Basis Sorted HML Portfolio	Independent Variables	Coefficient	Std. Error	t-Statistic	Std. Error (With NW 1 Lags)	t-Statistic (With NW 1 Lags)
Regression 7 (2016-2019)	Constant	-0.0655	0.0132	*****-4.9790**	0.0113	*****-5.7878**
	TLREF	0.0020	0.0013	1.5039	0.0009	****2.2768**
	Tahvil 5Y	-0.0013	0.0018	-0.7575	0.0008	-1.7378
	USDTRY	0.0389	0.0561	0.6927	0.0389	1.0003
	Inverted YC	0.0172	0.0107	1.6037	0.0108	1.5901
Regression 8 (2020-2023)	Constant	-0.0211	0.0123	-1.7144	0.0112	-1.8831
	TLREF	0.0022	0.0011	****2.0793**	0.0009	****2.3433**
	Tahvil 5Y	-0.0013	0.0008	-1.7478	0.0007	-1.9680
	USDTRY	0.0228	0.0416	0.5484	0.0210	1.0852
	Inverted YC	-0.0006	0.0064	-0.0878	0.0057	-0.0982
Regression 9 (2016-2023)	Constant	-0.0466	0.0105	*****-4.4384**	0.0125	*****-3.7235**
	TLREF	0.0010	0.0009	1.0697	0.0007	1.3021
	Tahvil 5Y	0.0005	0.0009	0.5817	0.0008	0.6741
	USDTRY	0.0465	0.0423	1.0991	0.0323	1.4384
	Inverted YC	-0.0017	0.0069	-0.2516	0.0068	-0.2553

*** Significant at 0.01, ** Significant at 0.05

Detailed interpretation of the results for each regression is provided as follows :

In regression 1, excess holding return of the momentum sorted HML portfolio is regressed on the macrofinancial data series that comprise our independent variables and a dummy variable representing the inversion of the yield curve for the sub sample 1 covering the period 2016-2019. With regular standard errors, we do not observe any significant variables to explain the relationship. After calculating the newey-west adjusted standard errors, however, previously insignificant Tahvil 5Y becomes significant at 0.05 level since its standard error decreases. Also previously insignificant TLREF becomes significant at 0.05 level after adjusting for newey-west standard errors. In regression 2, same dependent and independent variables are used for the sub sample 2 covering the period 2020-2023. For regression 2, we do not observe any significant variables. In regression 3, the analysis is done for the whole sample covering the period 2016-2023. With regular standard errors, we do not observe any significant variables, however, after calculating the newey-west standard errors, previously insignificant TLREF variable becomes significant at 0.05 level. In regressions 4, 5 and 6, excess holding return of the

BM sorted HML portfolio is regressed on the macrofinancial data series that comprise our independent variables and a dummy variable representing the inversion of the yield curve. In regression 4 which covers the period 2016-2019, before adjusting for newey-west standard errors, only TLREF variable is significant at 0.05 level. After adjusting for one lag with newey-west standard errors, previously insignificant Tahvil 5Y becomes significant as its standard error decreases and we see that TLREF variable becomes more significant at 0.01 level as its standard error decreases. In regression 5 which covers the period 2020-2023, while there are no significant variables without adjusting for lag values, after calculation of newey-west standard errors with one lag, previously insignificant USDTRY variable becomes significant. In regression 6 which covers the period 2016-2023, the only significant variable which is the dummy variable representing the yield curve inversion, becomes more significant after the calculation of newey-west standard errors with one lag. In regressions 7, 8 and 9, excess holding return of the basis sorted HML portfolio is regressed on the macrofinancial data series that comprise our independent variables and a dummy variable representing the inversion of the yield curve. In regression 7 which covers the period 2016-2019, the only significant variable which is the constant becomes more significant after the calculation of newey-west standard errors as its standard error decreases. Also, previously insignificant TLREF variable becomes significant at 0.05 as its standard error decreases after adjusting for 1^{st} lag with newey-west standard errors. In regression 8 which covers the period 2020-2023, only significant variable is the TLREF. After adjusting for 1^{st} lags with newey-west standard errors, TLREF becomes more significant as its standard error decreases.

Finally, in regression 9 which covers the period 2016-2023, we observe the Constant as the only significant variable before adjusting for lags. After the calculation of newey-west standard errors the constant becomes more significant as its standard error decreases.

6.5 Vector Autoregressive Model

6.5.1 Unit Root Tests

In the unit root tests, we check our variables for stationarity in level (without taking difference) and with their first differenced values. For our unit root tests, Augmented Dickey-Fuller methodology is employed. In the Table 9 below, results of the Augmented Dickey-Fuller tests are reported which contain ADF statistics and the respective p-values. As it is mentioned in the methodology section, we dropped the Tahvil 2Y variable since it showed multicorrilinearity with the Tahvil 5Y.

Table 6.7 : Unit Root Tests

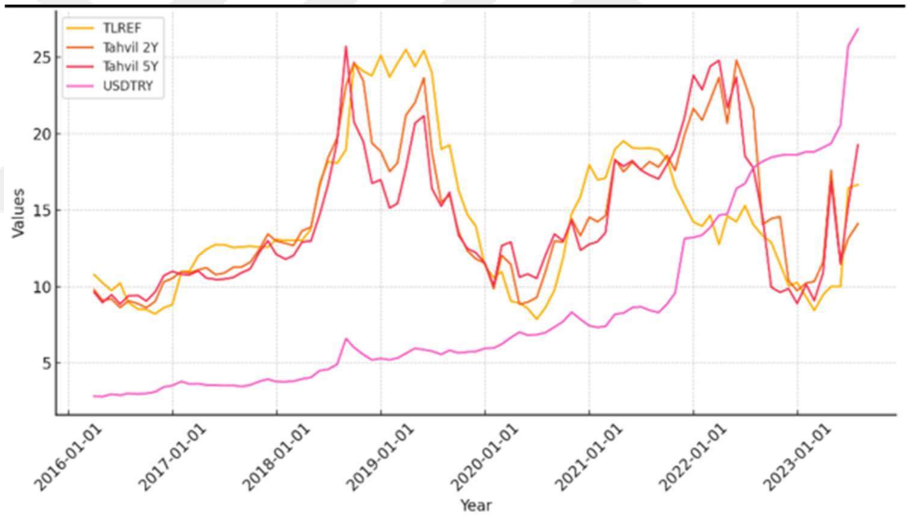
	In Level			In First Difference		
	ADF Statistic	P-Value	Stationary	ADF Statistic	P-Value	Stationary
Variables						
HML EHR BM	-3.3178	0.07	No	-7.0033	0.01***	Yes
HML EHR Momentum	-3.5920	0.03**	Yes	-3.5776	0.03**	Yes
HML EHR Basis	-3.8313	0.02**	Yes	-3.5888	0.03**	Yes
TLREF*	-3.1111	0.12	No	-3.6674	0.03**	Yes
Tahvil 5Y	-2.8666	0.22	No	-4.5364	0.01***	Yes
USDTRY	-5.2991	0.01***	Yes	-5.2452	0.01***	Yes

*** Significant at 0.01, ** Significant at 0.05
*TLREF first difference taken after log transformation

In Figure 2 and Figure 3 below, level values (non-differenced) of the variables that we utilize in our tests and VAR model are plotted. It can be seen that macrofinancial variables exhibit a non-stationary structure and thus need to be adjusted for our analysis while HML portfolio returns representing the term premiums exhibit a structure somewhat similar to being stationary. Nevertheless, it is necessary to conduct unit root tests in order to determine the stationarity.

Figure 6.2 : EH Returns of HML Portfolios, BM-M-B Sorts

Figure 6.3 : TLREF-Tahvil 2Y-Tahvil 5Y-USDTRY



ADF tests conducted on the level values of our variables show that the only stationary variables are EH Return of the Momentum Sorted HML Portfolio, EH Return of the Basis Sorted HML Portfolio and the USDTRY while the remaining variables are non-stationary. As a prerequisite for a robust and accurate VAR model, variables in question need to be stationary. In order to make the non-stationary variables stationary, we turn to the differencing method. Results of the ADF tests conducted on the first differenced values of our previously non-stationary variables indicate that the differenced variables became stationary. Only for TLREF, differencing is conducted after turning the variable to log base.

6.5.2 Optimal Lag Selection

In order to set up our VAR model, we now proceed with the selection of the most appropriate lag order to capture the most information from the past values of the variables. We calculate the Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ), Schwarz Information Criterion (SC), Final Prediction Error (FPE) values for a maximum of 4 lags. Maximum of 4 lags are chosen for the process considering the fact that our data is monthly. AIC values indicate the use of 1st lag and thus we proceed with using the first lag. Values of the AIC, HQ, SC and FPE information criterion values calculated for each lag up to the 4th lag is provided in the Table 10 below.

Table 6.8 : VAR Lag Order Selection Criteria

Lag	AIC	HQ	SC	FPE
1	-3.28E+01	-3.23E+01	-3.16E+01	5.58E-15
2	-3.25E+01	-3.16E+01	-3.03E+01	7.74E-15
3	-3.25E+01	-3.12E+01	-2.92E+01	8.10E-15
4	-3.24E+01	-3.07E+01	-2.81E+01	9.25E-15

6.5.3 Residual Autocorrelation Tests

After determining the most suitable lag length for our model, Portmanteau tests are conducted in order to ensure that there is no serial autocorrelation left in the residuals of the model. The results of our portmanteau tests are given in the Table 11 below.

Table 6.9 : Portmanteau Tests for Serial Autocorrelation

Model	Chi-squared	P-value	Serial Autocorrelation Remaining
VAR(1)	352.31	0.9441	No

Results of the portmanteau tests indicate that there is no serial autocorrelation present in the residuals of the VAR (1) model.

6.5.4 Estimation of The Model

In this part of our analysis, we proceed on estimating the coefficients of our VAR (1) since we ensured that there is no remaining serial autocorrelation. As explained in the methodology section of our study, our sample covers the period between 03/2016 and 07/2023 with monthly frequency data. Our aim is to define the interactions and interdependencies between the current and past values of the following variables of interest : EH Return of the Momentum Sorted HML Portfolio, EH Return of the BM Sorted HML Portfolio, EH Return of the Basis Sorted HML Portfolio which represent term premium and TLREF (Overnight Turkish Lira borrowing rate quoted annually), Tahvil 5Y (Yield on the 5-year Türkiye Treasury Bond quoted annually), USDTRY (Return on the exchange rate between USD and TRY on the observation date).

The log likelihood of our model is 699.847 and the roots of the characteristic polynomial are between 0.6478 being the highest value and 0.0714 being the lowest value. All roots of the characteristic polynomial are less than 1 which means that they all lie within the unit circle. Since all the roots are within the unit circle, we can say that our model is stable. In the Table 12 below, the coefficient estimates of the variables' past values for the equations of each of the variables are reported next to the standard error and t-statistic values of the estimates and the R-squared and F-statistic values for the equation itself. Significance is determined at the 0.05 level for each estimate.

Table 6.10 : VAR (1) Estimates

	HML EHR BM	Significant	HML EHR Momentum	Significant	HML EHR Basis	Significant	TLREF	Significant	Tahvil 5Y	Significant	USDTRY	Significant
HML EHR BM L1	**-0.4332**	**Yes**	-0.0409	No	-0.2537	No	-0.5501	No	-8.6970	No	0.3604	No
	0.1135		0.1010		0.1386		0.5501		11.6277		0.3871	
	*****-3.817**		-0.4050		-1.8300		-1.0000		-0.7480		0.9310	
HML EHR Momentum L1	-0.1984	No	-0.0695	No	0.3487	No	0.8158	No	16.7237	No	0.0063	No
	0.1504		0.1338		0.1837		0.7290		15.4097		0.5130	
	-1.3190		-0.5190		1.8980		1.1190		1.0850		0.0120	
HML EHR Basis L1	0.0024	No	0.0197	No	**0.5192**	**Yes**	**0.9681**	**Yes**	7.1603	No	0.2132	No
	0.0958		0.0853		**0.1171**		**0.4645**		9.8193		0.3269	
	0.0260		0.2310		*****4.435**		****2.084**		0.7290		0.6520	
TLREF L1	-0.0161	No	-0.0105	No	0.0317	No	0.2133	No	2.0719	No	-0.1310	No
	0.0222		0.0197		0.0271		0.1076		2.2735		0.0757	
	-0.7270		-0.5310		1.1680		1.9830		0.9110		-1.7310	
Tahvil 5Y L1	-0.0003	No	0.0010	No	0.0007	No	**0.0149**	**Yes**	-0.0747	No	0.0011	No
	0.0012		0.0011		0.0015		**0.0060**		0.1272		0.0042	
	-0.2520		0.9020		0.4360		****2.476**		-0.5870		0.2490	
USDTRY L1	0.0257	No	-0.0081	No	-0.0214	No	0.3514	No	-2.1150	No	0.0723	No
	0.0376		0.0335		0.0460		0.1824		3.8566		0.1284	
	0.6830		-0.2410		-0.4660		1.9260		-0.5480		0.5630	
Constant	0.0007	No	0.0054	No	**-0.0135**	**Yes**	0.0085	No	0.1086	No	**0.0303**	**Yes**
	0.0033		0.0029		**0.0040**		0.0160		0.3377		**0.0112**	
	0.2160		1.8450		*****-3.36**		0.5320		0.3220		*****2.695**	
Multiple R-Squared	0.2624		0.0270		0.2177		0.1609		0.0278		0.0556	
Adj. R-Squared	0.2070		-0.0460		0.1590		0.0980		-0.0451		-0.0153	
Residual Standard Error	0.0207		0.0184		0.0253		0.1002		2.1190		0.0706	
F-Statistic	4.7420		0.3693		3.7110		2.5570		0.3815		0.7845	
F-Statistic P-Value	0.0004		0.8964		0.0026		0.0257		0.8888		0.5846	

In the first column of the Table 12, we can see the coefficient estimates of the equation of EH Return of the BM Sorted HML Portfolio for each of the lagged values of the variables at hand. Only significant coefficient is for the HML EHR BM, which is the first lag of the equation variable itself with a coefficient of -0.4332 which indicates a negative relationship. Adjusted R-squared and F-statistic p-values for the regression are 0.2070 and 0.0004 respectively. In the second column of the Table 12, we can see the coefficient estimates of the equation of EH Return of the Momentum Sorted HML Portfolio for each of the lagged values of the variables at hand. We do not observe any significant coefficient for the equation. Adjusted R-squared and F-statistic p-values for the regression are -0.0460 and 0.8964 respectively. In the third column, we can see the coefficient estimates of the equation of EH Return of the Basis Sorted HML Portfolio for each of the lagged values of the variables at hand. Significant coefficients are the Constant, with a coefficient of -0.0135 and HML EHR Basis, which is the first lag of the equation variable itself wih a coefficient of 0.5192 indicating a positive relationship. Adjusted R-squared and F-statistic p-values for the regression are 0.1590 and 0.0026 respectively. In the fourth column, we can see the coefficient estimates of the equation of TLREF for each of the lagged values of the variables at hand. Significant coefficients are for HML EHR Basis with a coefficient of 0.9681 indicating a positive relationship and for Tahvil 5Y with a coefficient of 0.0149. An important consideration is the fact that the influence is flowing from HML EHR Basis to TLREF while it is expected to be the other way around. Adjusted R-squared and F-statistic p-values for the regression are 0.0980 and 0.0257 respectively. In the fifth column, we can see the coefficient estimates of the equation of Tahvil 5Y for each of the lagged values of the variables at hand. We do not observe any significant coefficient for the equation. Adjusted R-squared and F-statistic p-values for the regression are -0.0451 and 0.8888 respectively. In the sixth column, we can see the coefficient estimates of the equation of USDTRY for each of the lagged values of the variables at hand. In the sixth column, only significant variable is the constant with a coefficient of 0.0303. Adjusted R-squared and F-statistic p-values for the regression are -0.0153 and 0.5846 respectively.

6.5.5 Variance Decomposition Analysis

Finally, we conduct an analysis of variance decomposition which is known as "Forecast Error Variance Decomposition" in order to observe the contribution of each variable in our model to the forecast error variance. Results of the variance decomposition analysis for our main variables that are HML EHR BM, HML EHR Momentum and HML EHR

Basis which represent the term premiums for forecast horizons of 1, 2 and 3 months are provided in Table 13 below.

Table 6.11 : Variance Decomposition

HML EHR BM			
Forecast Period (Months)	TLREF	Tahvil 5Y	USDTRY
1	**0.0530**	0.0220	0.0015
2	**0.0645**	0.0350	0.0073
3	**0.0635**	0.0342	0.0084
HML EHR Momentum			
Forecast Period (Months)	TLREF	Tahvil 5Y	USDTRY
1	**0.0109**	0.0102	0.0000
2	0.0121	**0.0219**	0.0006
3	0.0123	**0.0221**	0.0011
HML EHR Basis			
Forecast Period (Months)	TLREF	Tahvil 5Y	USDTRY
1	**0.0237**	0.0153	0.0000
2	**0.0194**	0.0126	0.0015
3	**0.0207**	0.0175	0.0019

For the HML EHR BM variable, influence of the innovations from Tahvil 5Y and USDTRY variables are neglible compared to the contribution from TLREF variable. In all horizons TLREF is the biggest contributor to the variance and it is followed by Tahvil 5Y which is also followed by USDTRY.

For the HML EHR Momentum variable, greatest influence is coming from the TLREF for one month horizon with %1.09. For the two and three month horizons, the biggest effects are coming from Tahvil 5Y with %2.19 and %2.21 respectively. For the HML EHR Basis variable, greatest influence is coming from the TLREF for all horizons with %2.37 for one month horizon, %1.94 for two month horizon and finally %2.07 for three month horizon respectively.

7. CONCLUSION

In our study, we aim to capture the two main risk premia defined under the hypothesis of risk premium, in the equity futures in Türkiye which are spot risk premium and term premium. In the Unconditional Returns section, we first start by creating an equally-weighted portfolio of the 20 equity futures contract after calculating their short roll returns and excess holding returns that represent, respectively, the spot risk premium and term premium. After that, we run constant only regressions on the returns of the equally-weighted portfolios to determine whether the spot risk and term premiums are reliably different from zero in the cross section of equity futures and we found all of the equally-weighted returns to be significant, showing that the risk premiums are different from zero in the cross section. In the following section which is the Conditional Returns section, we start utilizing the characteristics of Basis, Basis-Momentum and Momentum to create portfolio sorts of the equity futures and then calculate the short roll and excess holding returns of the portfolios which represent spot risk and term premiums as mentioned before. The importance of using portfolio sorting based on the mentioned characteristics is the fact that different returns which are short roll and excess holding returns, are exposed to the mentioned characteristics in different ways, and conducting analysis on returns which are exposed to Basis, Basis-Momentum and Momentum in different levels is one way to ensure that risk premiums are captured from all aspects. In all sorts which are Basis-Momentum, Basis and Momentum sorts, only significant HML portfolios are the Excess Holding return which represent the term premia, thus, they are chosen to be at the center of our Newey West OLS and VAR models.

Before proceeding with OLS and VAR models, we also test the Basis, Basis-Momentum and Momentum characteristics to find out whether they are robust to the inclusion of others or not. We test this via Pooled OLS regressions with the Time and Equity fixed effects in order to take into account the systematic differences across different underlyings and the passive component coming from time variation in average equity futures returns. Our results show that while all characteristics give significant coefficients while they are isolated, only the basis characteristic is significant in the presence of other characteristics in both nearby and spreading returns which represent spot and term premiums. In our OLS models with Newey West standard errors, for the regression of Term Premia represented by the EH return of the Momentum sorted HML portfolio on macro financial variables which are our independent variables, we do not observe significant variables before NW standard errors, however, after taking into account the first lags of the variables, previously insignificant TLREF and Tahvil 5Y become significant for the periods 2016-2019 and 2016-2023. For the regression of the EH return of the BM sorted HML, previously insignificant Tahvil 5Y becomes significant after adjusting for first lag values via NW for the period of 2016-2019. For the same period, TLREF is significant in both normal standard errors and newey-west standard errors. Also, we observe USDTRY as significant for 2020-2023 and the Yield Curve dummy variable as significant for the whole sample (2016-2023) after adjusting for newey-west standard errors. For the regressions of the EH return of the Basis sorted HML portfolio, we see the constant as significant for 2016-2019 and 2016-2023. Also for the 2016-2019 period, previously insignificant TLREF becomes significant after adjusting for newey-west standard errors. For the 2020-2023 period, TLREF is significant in both normal standard errors and newey-west standard errors.

In our VAR(1) model, while we do not observe an effect flowing from TLREF, Tahvil 2Y, Tahvil 5Y and USDTRY to BM, Basis and Momentum sorted Excess Holding returns representing term premia, we see an influence flowing from lag 1 of the Basis sorted Excess Holding return to TLREF with a positive coefficient. Finally, in our variance decomposition analysis, we observe that TLREF is the biggest contributor to the forecast variance of the BM sorted Excess Holding return for 1, 2 and 3 month horizons. For the Momentum sorted Excess Holding return, while TLREF is the biggest contributor to forecast variance in the 1 month horizon, Tahvil 5Y is the biggest contributor in the 2 and 3 month horizons. Finally, for the Basis sorted Excess Holding return, TLREF is the biggest contributor to variance in the 1, 2 and 3 month horizons.

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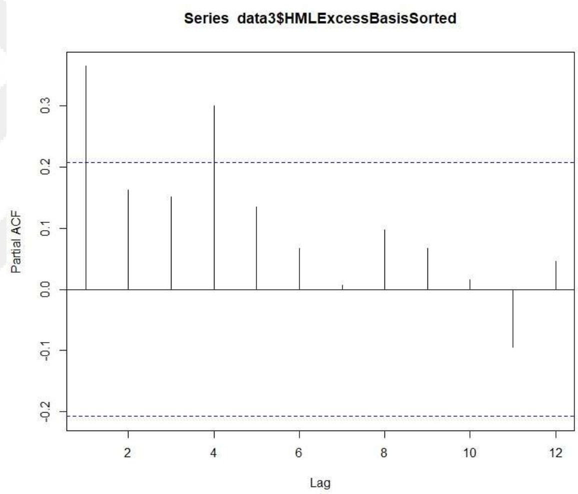
APPENDICES

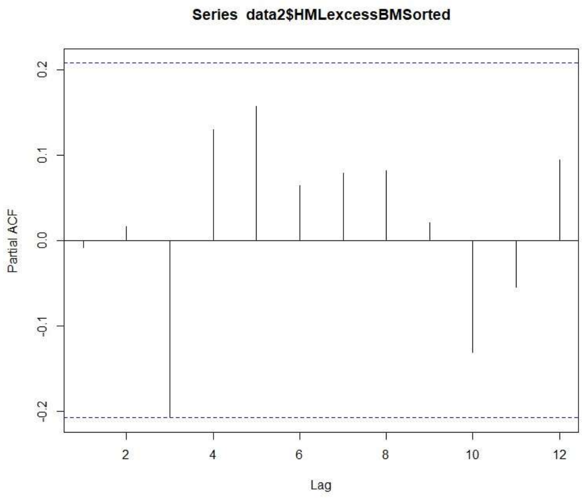
APPENDIX A. PACF Graphs

Provided below, are the partial autocorrelation functions of each of the varibles used in our the Newey West OLS and Vector Autoregressive (1) model. The PACF graphs are used as a starting point in determining the significant autocorrelation structure in each of our variables which later used as a comparison point while calculating information criterion values to determine a single lag length to be used in our VAR model and to determine the most appropriate lag to be used in our Newey West OLS models.

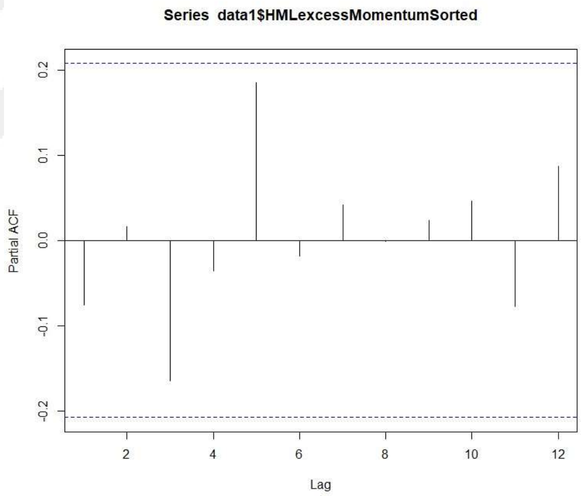
EH Return of the Basis Sorted HML Portfolio - PACF



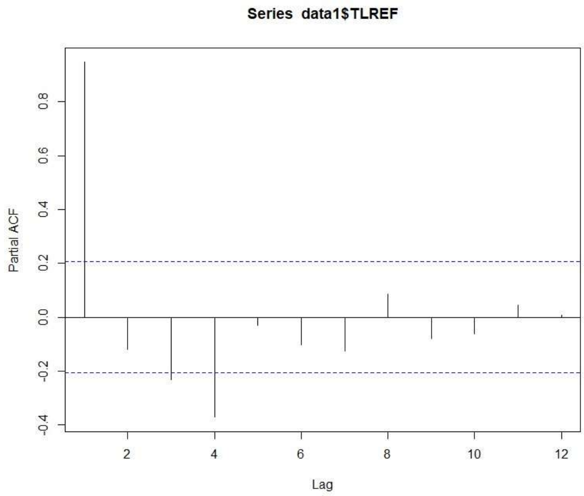
EH Return of the BM Sorted HML Portfolio - PACF



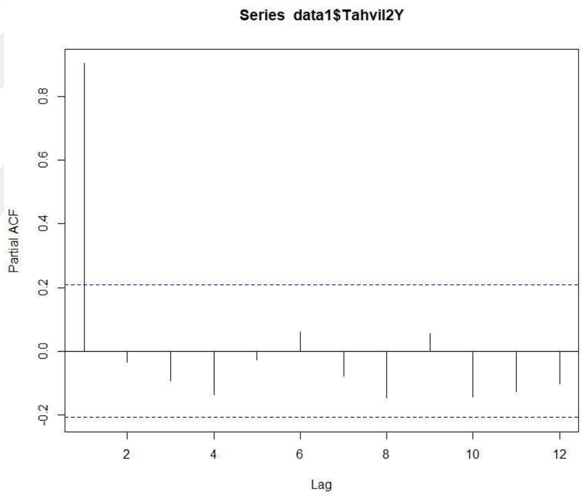
EH Return of the Momentum Sorted HML Portfolio - PACF



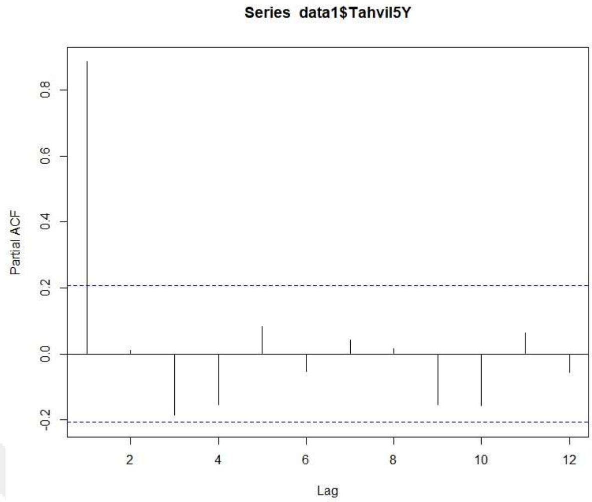
TLREF – PACF



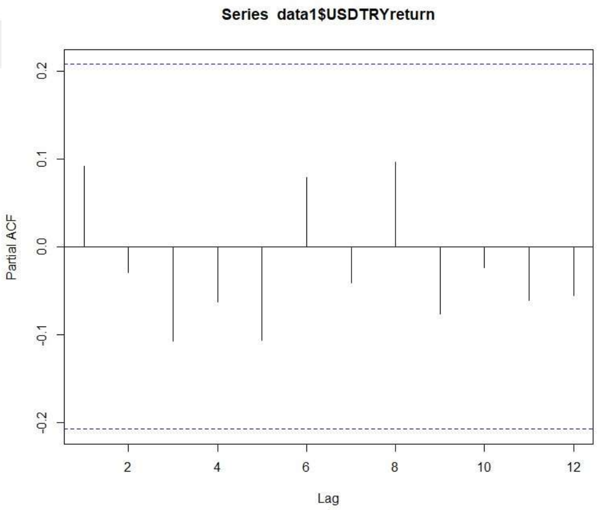
Tahvil 2Y – PACF



Tahvil 5Y – PACF



USDTRY – PACF



APPENDIX B. Comprehensive Regression Outputs

Below provided, are the comprehensive outputs for the standard OLS regressions before calculating the Newey West standard errors in the section 6.4 . Numbers of the regression below directly corresponds to the regression numbers in section 6.4 .

Regression 1 Output

Regression Statistics	
Multiple R	0.310042637
R Square	0.096126437
Adjusted R Square	-0.022804295
Standard Error	0.016923539
Observations	44

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.001157447	0.000231489	0.808255658	0.551060942
Residual	38	0.010883435	0.000286406		
Total	43	0.012040882			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.005417867	0.011356036	0.477091388	0.636029547	-0.017571226	0.028406959	-0.017571226	0.028406959
TLREF	-5.7328E-05	0.001913697	-0.029956671	0.976258395	-0.003931406	0.00381675	-0.003931406	0.00381675
Tahvil2Y	-0.003861484	0.004096779	-0.942565768	0.351857281	-0.012154981	0.004432012	-0.012154981	0.004432012
Tahvil5Y	0.004858708	0.004083763	1.189762646	0.241520395	-0.003408437	0.013125853	-0.003408437	0.013125853
USDTRY	-0.002507959	0.008491475	-0.295350169	0.769334224	-0.019698052	0.014682134	-0.019698052	0.014682134
YieldCurveInverted	-5.43239E-06	0.007372735	-0.000736821	0.999415957	-0.014930754	0.014919889	-0.014930754	0.014919889

Regression 2 Output

Regression Statistics	
Multiple R	0.179688305
R Square	0.032287887
Adjusted R Square	-0.091777768
Standard Error	0.019866732
Observations	45

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.000513583	0.000102717	0.26024839	0.931983238
Residual	39	0.015392794	0.000394687		
Total	44	0.015906377			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.002111058	0.015477322	-0.136396837	0.892209238	-0.033416896	0.029194781	-0.033416896	0.029194781
TLREF	-0.000403533	0.001184403	-0.340705765	0.735153683	-0.002799215	0.001992149	-0.002799215	0.001992149
Tahvil2Y	-8.25003E-05	0.002432268	-0.033919077	0.97311469	-0.005002227	0.004837226	-0.005002227	0.004837226
Tahvil5Y	0.000663308	0.002212647	0.299780118	0.765936878	-0.003812194	0.00513881	-0.003812194	0.00513881
USDTRY	0.000325408	0.000635383	0.512143933	0.611438499	-0.000959776	0.001610591	-0.000959776	0.001610591
YieldCurveInverted	-0.002174567	0.007938325	-0.273932666	0.785582045	-0.018231344	0.013882211	-0.018231344	0.013882211

Regression 3 Output

Regression Statistics	
Multiple R	0.190895046
R Square	0.036440919
Adjusted R Square	-0.021604809
Standard Error	0.018012985
Observations	89

ANOVA

	df	SS	MS	F	Significance F
Regression	5	0.001018499	0.0002037	0.62779674	0.678995844
Residual	83	0.026930814	0.000324468		
Total	88	0.027949312			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.005995971	0.007526747	0.796621815	0.427943502	-0.008974426	0.020966368	-0.008974426	0.020966368
TLREF	-0.000738249	0.000726667	-1.015938464	0.312611059	-0.00218356	0.000707062	-0.00218356	0.000707062
Tahvil2Y	-0.000810059	0.00179101	-0.452291443	0.652238938	-0.004372306	0.002752189	-0.004372306	0.002752189
Tahvil5Y	0.001430441	0.00156341	0.914949339	0.362868722	-0.001679119	0.00454	-0.001679119	0.00454
USDTRY	-3.5174E-05	0.000408872	-0.086026822	0.931652283	-0.000848404	0.000778056	-0.000848404	0.000778056
YieldCurveInverted	0.001147445	0.005015399	0.228784424	0.819599243	-0.008827982	0.011122872	-0.008827982	0.011122872

Regression 4 Output

Regression Statistics	
Multiple R	0.466437086
R Square	0.217563555
Adjusted R Square	0.114611391
Standard Error	0.017827566
Observations	44

ANOVA

	df	SS	MS	F	Significance F
Regression	5	0.003358186	0.000671637	2.113248978	0.084887842
Residual	38	0.01207724	0.000317822		
Total	43	0.015435426			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.015913615	0.011962656	1.330274445	0.19135681	-0.008303515	0.040130745	-0.008303515	0.040130745
TLREF	0.001696704	0.002015924	0.841651114	0.40524897	-0.00238432	0.005777729	-0.00238432	0.005777729
Tahvil2Y	-0.007849989	0.004315622	-1.818970216	0.076803091	-0.016586509	0.000886532	-0.016586509	0.000886532
Tahvil5Y	0.011127976	0.00430191	2.586752351	0.013642304	0.002419214	0.019836738	0.002419214	0.019836738
USDTRY	-0.017860105	0.008945075	-1.996641079	0.053064435	-0.035968463	0.000248253	-0.035968463	0.000248253
YieldCurveInverted	0.009108306	0.007766574	1.172757365	0.248192568	-0.0066143	0.024830913	-0.0066143	0.024830913

Regression 5 Output

Regression Statistics	
Multiple R	0.321120093
R Square	0.103118114
Adjusted R Square	-0.011866743
Standard Error	0.015381884
Observations	45

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.001060922	0.000212184	0.896797341	0.492853177
Residual	39	0.009227492	0.000236602		
Total	44	0.010288414			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.007702635	0.011983369	-0.642777072	0.524129991	-0.031941286	0.016536017	-0.031941286	0.016536017
TLREF	-0.000144228	0.000917028	-0.157277883	0.8758373	-0.001999093	0.001710636	-0.001999093	0.001710636
Tahvil2Y	-0.001423517	0.001883192	-0.755906741	0.454246854	-0.005232633	0.002385598	-0.005232633	0.002385598
Tahvil5Y	0.001554069	0.00171315	0.907141431	0.369903183	-0.001911103	0.005019242	-0.001911103	0.005019242
USDTRY	0.000784279	0.000491948	1.594233467	0.118957013	-0.000210779	0.001779337	-0.000210779	0.001779337
YieldCurveInverted	0.005627769	0.006146275	0.915639027	0.365483405	-0.006804245	0.018059784	-0.006804245	0.018059784

Regression 6 Output

Regression Statistics	
Multiple R	0.267824137
R Square	0.071729768
Adjusted R Square	0.015809875
Standard Error	0.017359404
Observations	89

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.001932737	0.000386547	1.282723621	0.2791886
Residual	83	0.025011959	0.000301349		
Total	88	0.026944696			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.00735833	0.007253647	1.014431791	0.313324828	-0.007068882	0.021785543	-0.007068882	0.021785543
TLREF	-0.000699239	0.000700301	-0.998484422	0.320946626	-0.002092109	0.00069363	-0.002092109	0.00069363
Tahvil2Y	-0.001762398	0.001726025	-1.021072907	0.310186874	-0.005195393	0.001670597	-0.005195393	0.001670597
Tahvil5Y	0.002154791	0.001506683	1.43015539	0.156426184	-0.000841941	0.005151524	-0.000841941	0.005151524
USDTRY	-0.000144934	0.000394037	-0.367817611	0.713945557	-0.000928657	0.000638789	-0.000928657	0.000638789
YieldCurveInverted	0.011251011	0.004833421	2.32775325	0.022359996	0.001637531	0.020864491	0.001637531	0.020864491

Regression 7 Output

Regression Statistics	
Multiple R	0.499558243
R Square	0.249558438
Adjusted R Square	0.150816128
Standard Error	0.024706466
Observations	44

ANOVA

	df	SS	MS	F	Significance F
Regression	5	0.007713655	0.001542731	2.527370857	0.04532933
Residual	38	0.02319556	0.000610409		
Total	43	0.030909215			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.07473274	0.016578536	-4.507800944	6.09569E-05	-0.108294232	-0.04117125	-0.108294232	-0.041171249
TLREF	0.001274896	0.002793783	0.456333253	0.650747933	-0.004380822	0.006930614	-0.004380822	0.006930614
Tahvil2Y	-0.000824282	0.005980838	-0.137820492	0.891110004	-0.012931855	0.011283291	-0.012931855	0.011283291
Tahvil5Y	-0.002244129	0.005961835	-0.376415822	0.708701407	-0.014313232	0.009824974	-0.014313232	0.009824974
USDTRY	0.010538654	0.0123966	0.850124587	0.400580616	-0.01455695	0.035634259	-0.01455695	0.035634259
YieldCurveInverted	0.017177014	0.010763364	1.595877772	0.118800282	-0.004612278	0.038966306	-0.004612278	0.038966306

Regression 8 Output

Regression Statistics	
Multiple R	0.44185222
R Square	0.195233385
Adjusted R Square	0.092058178
Standard Error	0.018855616
Observations	45

ANOVA

	df	SS	MS	F	Significance F
Regression	5	0.0033638	0.00067276	1.89225096	0.117904693
Residual	39	0.013865836	0.000355534		
Total	44	0.017229636			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.025704803	0.014689605	-1.749863427	0.088007221	-0.055417334	0.004007728	-0.055417334	0.004007728
TLREF	0.002107342	0.001124123	1.874654152	0.068344028	-0.000166412	0.004381096	-0.000166412	0.004381096
Tahvil2Y	0.004070416	0.002308478	1.763246675	0.085693187	-0.000598921	0.008739754	-0.000598921	0.008739754
Tahvil5Y	-0.004913376	0.002100035	-2.339663937	0.02451424	-0.009161098	-0.00066565	-0.009161098	-0.000665654
USDTRY	0.000171698	0.000603045	0.284718786	0.777366049	-0.001048076	0.001391473	-0.001048076	0.001391473
YieldCurveInverted	-0.009172448	0.007534305	-1.217424676	0.230757927	-0.024412018	0.006067121	-0.024412018	0.006067121

Regression 9 Output

Regression Statistics	
Multiple R	0.483521985
R Square	0.23379351
Adjusted R Square	0.187636493
Standard Error	0.024702426
Observations	89

ANOVA

	df	SS	MS	F	Significance F
Regression	5	0.015454108	0.003090822	5.065178014	0.000422203
Residual	83	0.050647419	0.00061021		
Total	88	0.066101527			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.059705897	0.010321938	-5.78436904	1.24628E-07	-0.080235816	-0.03917598	-0.080235816	-0.039175978
TLREF	0.002087911	0.000996528	2.095186698	0.039202344	0.000105858	0.004069964	0.000105858	0.004069964
Tahvil2Y	-0.000293067	0.002456134	-0.119320416	0.905309842	-0.005178218	0.004592084	-0.005178218	0.004592084
Tahvil5Y	-0.000625079	0.00214401	-0.291546494	0.771360792	-0.004889428	0.003639271	-0.004889428	0.003639271
USDTRY	0.00237623	0.000560714	4.237864432	5.81522E-05	0.001260992	0.003491467	0.001260992	0.003491467
YieldCurveInverted	-0.002890547	0.006877956	-0.420262484	0.67537974	-0.016570526	0.010789432	-0.016570526	0.010789432