KADİR HAS UNIVERSITY
SCHOOL OF GRADUATE STUDIES
PROGRAM OF FINANCE AND BANKING

ESTIMATE THE YIELD CURVE FOR SOVEREIGN BONDS IN TURKEY AND FORECASTING TURKISH ECONOMY FROM THE SHAPE OF YIELD CURVE (2005 - 2018)

TEOMAN SAMET TEMUÇİN

ADVISOR: PROF. DR. NURHAN DAVUTYAN

SECONDARY ADVISOR: ASS. PROF. DR. SABRİ ARHAN ERTAN

PHD THESIS

ISTANBUL, MAY, 2019

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PHD THESIS

Submitted to the School of Graduate Studies of Kadir Has University in partial fulfillment of the requirements for the degree of PhD in the Program of Finance and Banking

ISTANBUL, MAY, 2019

DECLARATION OF RESEARCH ETHICS /

METHODS OF DISSEMINATION

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TEOMAN SAMET TEMUÇİN

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i

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ACCEPTANCE AND APPROVAL

This work entitled **Estimate The Yield Curve for Sovereign Bonds in Turkey and Forecasting Turkish Economy from the Shape of Yield Curve (2005 - 2018)** prepared by **Teoman Samet Temuçin** has been judged to be successful at the defense exam held on **30.05.2019** and accepted by our jury as **PhD Thesis.**

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ii

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TABLE OF CONTENTS

LIST OF TABLES

(Note: Table 1.1 indicates the first table in Chapter 1, Table 2.1 indicates the first table in Chapter 2 and Table A.1 indicates the first table in Appendix.)

LIST OF GRAPHS

(Note: Graph 1.1 indicates the first graph in Chapter 1 and Graph 2.1 indicates the first graph in Chapter 2.)

ABBREVIATIONS

BIST100	: Istanbul Stock Exchange 100
CPI	: Consumer Price Index
DNS	: Dynamic Nelson-Siegel
ENS	: Extended Nelson-Siegel
EU	: European Union
GDP	: Gross Domestic Product
IPI	: Industrial Production Index
OLS	: Ordinary Least Squares
UK	: United Kingdom
US	: United States

ABSTRACT

TEMUÇİN, TEOMAN SAMET. *ESTIMATE THE YIELD CURVE FOR SOVEREIGN BONDS IN TURKEY AND FORECASTING TURKISH ECONOMY FROM THE SHAPE OF YIELD CURVE (2005 - 2018)*, Ph.D. THESIS, ISTANBUL, 2019

Yield curve that reflects the interest expectations of market participants is one of the cornerstones of the financial analysis. In the first chapter of our study, Turkey yield curve for sovereign bond market is estimated in 2005-2018 by using Extended Nelson-Siegel (ENS) and Dynamic Nelson-Siegel (DNS) models. Since Turkish sovereign market becomes more liquid and 10-year fixed rate coupon bonds were started to be traded after 2010, this allows us to make estimation for 10-year term to maturity. As a result of estimation via two methodologies, it is concluded that Dynamic Nelson-Siegel model estimates Turkey yield curve slightly better than the Extended Nelson-Siegel model. Besides, OLS (Ordinary Least Square) is better methodology than optimization tools in DNS.

This is why, the estimated Turkey yield curve via Dynamic Nelson-Siegel model with OLS methodology is used to forecast Turkish macroeconomic and financial indicators in the second chapter of the study. The yield curve can be simply perceived as a representation of interest rates of treasury bonds or other security instruments in different maturities. However, that simple graph is beyond the representation of interest rate. If it is read carefully, the market efficiency theory can be beaten and regular profits from the market can be made. Many scholars and empirical studies of them have proved the significant forecasting ability of the yield curve about recessions, turning points in the stock market and inflation rates. Therefore, it seems as a reliable mechanism for forecasting to some important indicators in the macroeconomic set. I also simply test the forecasting capabilities of the estimated Turkey yield curve on Turkish recessions, bear market, industrial production index, bist100 index and consumer price index. As a result of analysis, it is concluded that parameters, which represent the Turkey's yield curve, contain important information and predictions regarding recessions, bear market formation, bist100 index and consumer price index.

Keywords: Sovereign Bonds, Yield Curve Estimation, Nelson Siegel, Turkey Yield Curve, Forecasting Recession, Bear Market and Inflation

ÖZET

TEMUÇİN, TEOMAN SAMET. *TÜRKİYE HAZİNE KAĞITLARININ VERİM EĞRİSİNİ TAHMİN ETMEK VE TÜRKİYE EKONOMİSİNİ VERİM EĞRİSİ ÜZERİNDEN ÖNGÖRMEK (2005 - 2018),* DOKTORA TEZİ, İSTANBUL, 2019

Piyasa katılımcılarının faiz beklentilerini yansıtan verim eğrileri finansal analizin temel taşlarından biridir. Tezin 1.Bölümü'nde, 2005-2018 yılları arasındaki Türkiye Hazine kağıtlarının verim eğrileri Extended Nelson-Siegel (ENS) ve Dynamic Nelson-Siegel (DNS) modelleri aracılığıyla tahmin edilmiştir. 2010 yılından sonra Türkiye menkul kıymet piyasalarının daha likit olması ve 10 yıllık Hazine kağıtlarının işlem görmeye başlaması, verim eğrisi tahminlerimizin 10 yıllık yapılmasına imkan tanımıştır. İki metodoloji ile yaptığımız verim eğrisi tahminleri üzerinden ulaşılan sonuç: Dynamic Nelson-Siegel modelinin Türkiye verim eğrilerini Extended Nelson-Siegel modelinden bir miktar daha iyi tahmin ettiği yönündedir. DNS modeli içerisinde ise, OLS yönteminin optimizasyon araçlarına göre daha iyi bir yöntem olduğu sonucuna ulaşılmıştır.

Araştırmamızın 2.Bölümü'nde, Dynamic Nelson-Siegel modeli OLS yöntemiyle elde edilen verim eğrileriyle, Türkiye makroekonomik ve finansal verileri tahmin edilmeye çalışılmıştır. Verim eğrisi, farklı vadelerde hazine bonosu ya da diğer menkul kıymetlerin faizlerini gösteren basit bir eğri olarak algılanabilir ancak söz konusu eğri, faizlerin temsilinden çok daha öte bir anlam taşımaktadır. Verim eğrisi dikkatli okunursa, piyasa etkinliği teorisi kırılabilir ve hatta piyasadan düzenli kârlar elde edilebilir. Birçok akademisyen ve bilimsel araştırma, verim eğrisinin resesyonları, borsadaki dönüş anlarını ve enflasyon oranlarını tahmin etmede anlamlı sonuçlar verdiğini kanıtlanmıştır. Bu yüzden verim eğrisi, makroekonomik kümedeki bazı göstergeleri tahmin etmek için güvenilir bir araç olarak gözükmektedir. Çalışmanın 2.bölümünde, ilk bölümde tahmin ettiğimiz Türkiye verim eğrisinin; Türkiye'deki resesyonları, ayı piyasasını, sanayi üretim endeksini, bist100 endeksini ve enflasyon oranlarını öngörebilme kabiliyeti test edilmiştir. Analizlerin sonucunda, Türkiye verim eğrisini temsil eden parametrelerin, Türkiye'de resesyon, ayı piyasası oluşumu, bist100 endeksi ve tüketici fiyat endeksinin gelişimine ilişkin önemli bilgi ve öngörüler içerdiği tespit edilmiştir.

Anahtar Sözcükler: Devlet Tahvili, Verim Eğrisi Tahmini, Nelson Siegel, Türkiye Verim Eğrisi, Resesyon, Ayı Piyasası ve Enflasyon Tahmini

CHAPTER - 1

ESTIMATING TURKEY YIELD CURVE FOR SOVEREIGN BONDS

1.1 INTRODUCTION

Yield curve (also known as term structure of interest rates or spot rate curve) indicates the relationship between interest rate of security and term to maturity. The main benefit of estimating yield curve is that having interest rate data without being affected by interest rate fluctuation of specific bonds (Akıncı et al., 2006). Besides, estimating accurate yield curve is crucial for monetary policy decisions and portfolio management. If discounted bonds that have term to maturity from one-day to ten-year and traded on a daily basis, then the graph of these bonds' interest rate would automatically give the yield curve. However, since we have a limited number of securities with specific term to maturity, we need to estimate yield curve.

There are several methodologies which estimate the yield curve in literature. Bliss and Fama (1987) got available spot rate and then estimated the curve via regression. This method is called as smoothed bootstrap (Annaert et al., 2012). Similar to this method, there are other curve fitting spline methods that include many estimated parameters such as quadratic and cubic splines (McCulloch (1971, 1975)), exponential splines (Vasicek and Fong, 1982), basis splines (Steeley, 1991), maximum smoothness splines (Adams and Deventer, 1994) and roughness penalty function splines (Fisher et al., 1994; Waggoner, 1997).

Under the models of the short rate, some apply equilibrium method which models the dynamics of the instantaneous rate and obtains yields at other maturities under specific assumptions about risk premium. Vasicek (1977), Cox et al. (1985) and Duffie and Kan (1996) are important contributors to equilibrium methodology. Some use no-arbitrage method which tries to fit the yield curve at a point in which there is no chance of arbitrage. We mean that the yield curve is estimated by eliminating the possibility of arbitrage returns with different maturities. Hull and White (1990) estimated yield curve by comparing the results of two models and interest rate option prices. Brennan and Schwartz (1979) and Ho and Lee (1986) are other contributors to the no-arbitrage methodology. Unlike these academics in no-arbitrage literature, Heath-Jarrow-Morton (1992) differently modeled the entire forward curve as opposed to simple short rate.

Models mentioned so far are mainly used for derivative pricing. Lastly and popularly, parametric models are used for estimating yield curve. In this group, Nelson-Siegel (1987) model, its extension by Svensson (1994) and its dynamic version by Diebold and Li (2006) are widely used by central banks, academia and other market participants for estimating yield curve. Nelson-Siegel built a static model which makes a curve fitting of the current data regardless of forward time period. The logic of these models will be explained in the next section.

The purpose of this chapter of the thesis is to estimate Turkey yield curve for discounted and fixed coupon government bonds by applying the Nelson-Siegel model's derivatives, namely Extended Nelson-Siegel (ENS) and Dynamic Nelson-Siegel (DNS) models. Since these methods are commonly used by many financial institutions and there is a consensus in literature on their quality for fitting better yield curves, we apply ENS and DNS for estimating Turkey yield curve. As a result of estimation, although both ENS and DNS have very similar shapes for yield curve, DNS estimates Turkey yield curve slightly better than ENS by comparing their sum of squares of deviation between theoretical price and dirty price of securities. Besides, OLS technique in DNS methodology performs better in estimating yield curves than optimization techniques. The figures regarding these figures will be shared in the following sections.

First chapter of the thesis is organized as follows. In section 1.2, a detailed explanation and formulas of Nelson-Siegel model and its derivatives will be discussed. Besides, we provide how they interact and contribute to each other to estimate yield curve. In section 1.3, our data for Turkish sovereign bond market and methodologies for estimating will be introduced. In section 1.4, estimated yield curve, founded ENS and DNS parameters and their advantages and disadvantages will be evaluated and compared. In the final section, our concluding remarks regarding Chapter-1 of the thesis will be mentioned.

1.2 EXTENDED AND DYNAMIC NELSON-SIEGEL MODELS

Nelson and Siegel (1987) estimated the yield curve by using four parameters. (1.2.1) According to the authors, β_0, β_1 and β_2 represent the short, medium and long-term components of the yield curve. The long term component is represented via β_0 because it remains constant when term to maturity parameter (T) evolves. β_1 serves the representation of short-term and β_2 contributes the representation of the medium-term component. As Ibanez (2016) stated, the fourth parameter (λ), which is not entirely described, is a decay factor. That's means it influences the fitting power of the model.

$$r(T) = \beta_0 + (\beta_1 + \beta_2)\,\frac{1 - e^{-\frac{T}{\lambda}}}{\frac{T}{\lambda}} - \beta_2 e^{-\frac{T}{\lambda}} \qquad (1.2.1)$$

where β_0, β_1, β_2 and λ are parameters (λ must be positive) to be extracted from the current bond price.

The Extended Nelson Siegel (ENS) Model Svensson (1994) added an extension to the model in order to fit better and capture highly non-linear, in other words hump-shape (or U-shape), yield curves. Therefore, the curve is estimated by using six parameters. (1.2.2) The logic of estimation is the same as in the case of the Nelson Siegel model.

$$r(T) = \beta_0 + (\beta_1 + \beta_2)\,\frac{1 - e^{-\frac{T}{\lambda 1}}}{\frac{T}{\lambda 1}} - \beta_2 e^{-\frac{T}{\lambda 1}} + \beta_3\left(\frac{1 - e^{-\frac{T}{\lambda 2}}}{\frac{T}{\lambda 2}} - e^{-\frac{T}{\lambda 2}}\right) \qquad (1.2.2)$$

where β_0, β_1, β_2, β_3, λ_1 and λ_2 are parameters (λ_1 and λ_2 must be positive) to be extracted from the current bond price.

The Dynamic Nelson Siegel (DNS) Model Diebold and Li (2006) introduced the dynamic version of the Nelson Siegel model. (1.2.3) The most important contribution of them to the literature, DNS parameters that represent the curve can be used for forecasting purposes as well. In other words, they reinterpreted the parameters as level (β_1), slope (β_2) and curvature (β_3). The level parameter (β_1) represents the long-term factor therefore it is $\beta_1 = yt(\infty)$. The slope parameter (β_2) represents the short-term factor which is defined as ten-year yield minus the three-month yield by Diebold and Li, i.e. $\beta_2 = y_t(120) - y_t(3)$. The curvature parameter (β_3) represents the medium-term factor which is defined as twice the two-year yield minus the sum of the ten-year and three-month yields, i.e. $\beta_3 = 2y_t(24) - (y_t(120) + y_t(3))$. Later on, we will also graph estimated parameters against β_1, β_2, β_3 and test whether the logic works for Turkey as well or not in Chapter-2. Although 4 parameters could be estimated by nonlinear least squares, Diebold and Lie preferred to fix λ at a predefined value so as to increase reliability of betas. Now, betas could be estimated by using ordinary least squares because non-linearity in the equation is eliminated by fixing λ.

$$r(T) = \beta_1 + \beta_2 \left(\frac{1 - e^{-\lambda T}}{\lambda T}\right) + \beta_3 \left(\frac{1 - e^{-\lambda T}}{\lambda T} - e^{-\lambda T}\right) \quad (1.2.3)$$

where β_1, β_2, β_3 and λ are parameters (λ must be positive) to be extracted from the current bond price.

In the following sections, we will estimate Turkey's yield curve for sovereign bond market by using these two methodologies, namely ENS and DNS. ENS will be applied in order to achieve a better fit yield curve because it contains hump-shape as well by using six parameters. DNS will be also applied so as to get foreseeable parameters and use them for forecasting purposes in Chapter-2 of the thesis.

1.3 DATA AND METHODOLOGY

The data consists of monthly observations of Turkish sovereign bonds and bills market in the period of February 2005-December 2018. One of the most important feature of our thesis is that Turkish yield curve would be estimated with the latest bond market data. We need to point out that Turkish sovereign market becomes more liquid and longer maturities are started to be traded in the same period as well. This is why it is necessary to make such a kind of work for current data in order to get longer and trustworthy yield curves. February 2005 is chosen as a starting point because 5-year fixed coupon rate bonds were started to be traded in Turkey. Besides, Turkish financial markets became more transparent, accountable and officially controlled in early 2000s with the foundation of new financial regulatory bodies such as Banking Regulation and Supervision Agency and additional precautions were taken in order to protect investors. On the other hand, 10-year fixed coupon rate bonds were started to be traded in January 2010. We conclude that estimating 10-year yield curve without having a security with 10-year term to maturity and traded in the market would give incorrect estimation results. This is why although yield curves which have 5-year term to maturity are estimated in 2005-2010, 10-year yield curves are estimated for 2010-2018 period.

The data is received from Istanbul Stock Exchange database. Each day's data reports value date, days to maturity, days to coupon, accrued interest, prices, simple and compound rate of return and transaction volume of each security. Since the data is daily, the last business day of each month is used as a representative of the related month. The sample consists of 167 months (n=167). Although both fixed coupon and floating rate bonds are issued in the period, we only apply TL denominated zero-coupon and fixed-coupon rate bonds for curve estimation since cash flows of floating rate bonds cannot be determined in advance.

Besides, the 7-9 most liquid sovereign bonds of each specific day to maturity (around 3-month, 6-month, 1-year, 2-year, 3-year, 4-year, 5-year, 7-year and 10-year) are chosen for estimating yield curve. For instance, if the last business day of the month includes 15 sovereign bonds, we choose the most liquid 9 of them which represent specific days to maturity and exclude illiquid ones by working in each 167 of them manually. The reason why we do this is that the price of illiquid ones could manipulate the estimation results and estimated yield curves will not reflect the reality. Besides thanks to this method, the possibility of manipulating the entire data of the securities that are focused on a certain period (such as from 1 month to the 1 year) has been eliminated. Moreover, since Istanbul Stock Exchange's daily data does not include coupon rates of the bonds, we calculated them by using accrued interest. The coupon rates are calculated with the following formula[1];

$$C = \left(\frac{364 \times AI}{182 - \text{Days to Coupon}}\right) \quad (1.3.1)$$

where C represents coupon rate and AI represents accrued interest.

Weighted average price is used as clean price and dirty price is calculated by summing up clean price and accrued interest of each bond. After we calculate r(T) by using formula (1.2.2) and (1.2.3), present value of each coupon and principal payments are obtained. We reach ENS and DNS theoretical prices by summing up all present values of coupon and principal payments. And then, we minimize the sum of the squared deviations of the dirty prices from the estimated theoretical prices of 9 bonds found via ENS and DNS. (1.3.2)

$$\text{min. } A(\beta_0, \beta_1, \beta_2, \beta_3, \lambda_1, \lambda_2) = \sum_{n=1}^{9} \left(P_i^{ENS/DNS} - P_i^{Dirty\ (Data)}\right)^2 \quad (1.3.2)$$

We apply two methodologies, namely GRG nonlinear and Matlab optimization tools in order to minimize the sum of the squared deviations between dirty price and ENS/DNS theoretical prices.

Besides, we apply ordinary least squares as a different technique for estimating Turkey's yield curve. Diebold and Li (2006) defined λ as if it determines the maturity at which the loading on the curvature factor (β_3) reaches its maximum and fixed λ at a predefined value by assuming 30 months used as medium term in US sovereign bond market. Since Diebold and Li worked on a developed economy, we need to fix λ at a

[1] The chosen Turkish sovereign bonds pay coupon once every 6 months.

different value so as to reflect Turkey yield curve accurately. Murat Duran (2014) fixed λ at 1,017 for Turkey yield curve estimation between 2010 and 2014. We realize that the loading on the medium-term (curvature) factor, i.e. $((1-e^{-\lambda T})/\lambda T)-e^{-\lambda T}$, is maximized at around 24 months (T=2) for Turkey case. Therefore, the curvature factor (β_3) reaches its maximum at λ=0,897 by assuming 24 months (T=2) as medium term in Turkish sovereign bond market in order to use ordinary least squares for estimating betas. After all, we fix λ at 0,897 for the period of February 2005-December 2018 when we apply OLS methodology of Diebold&Li for estimating betas.

Moreover, we attempt to add a new perspective to the literature. We simply apply Diebold&Li's technique of OLS beta estimation for Svensson (ENS) formula as well. After making some mathematical adjustments on Svensson formula (1.2.2), we get (1.3.3) for Extended Nelson Siegel Model. This mathematical representation of ENS formula also exists in Gilli et al.'s (2010) working paper:

$$r(T) = \beta_0 + \beta_1\left(\frac{1-e^{-\frac{T}{\lambda 1}}}{\frac{T}{\lambda 1}}\right) + \beta_2\left(\frac{1-e^{-\frac{T}{\lambda 1}}}{\frac{T}{\lambda 1}} - e^{-\frac{T}{\lambda 1}}\right) + \beta_3\left(\frac{1-e^{-\frac{T}{\lambda 2}}}{\frac{T}{\lambda 2}} - e^{-\frac{T}{\lambda 2}}\right) \quad (1.3.3)$$

Now, we adapt Diebold&Li's curvature interpretation to Svensson model and the loading on the medium-term (curvature) factors are maximized at λ_1=1,115 and λ_2=2,788 by assuming 24 months (T=2) as first curvature and 60 months (T=5) as second curvature (medium term) of the yield curve respectively in Turkish sovereign bond market. After fixing λ_1 at 1,115 and λ_2 at 2,788, we apply ordinary least squares for estimating 4 betas in 1.3.3 as a new attempt.

However, we do not fix any λ value during GRG nonlinear or Matlab optimization techniques of ENS/DNS estimations. Since we decide to use the optimization method in order to minimize the sum of the squared deviations (1.3.2), adding an extra constraint to the equations makes the estimation results inefficient. This is why we do not fix any parameter at all during the optimization techniques.

1.4 ESTIMATION RESULTS AND COMPARISON OF METHODS

1.4.1. GRG Nonlinear Optimization Method

Both ENS and DNS model do not work perfectly because running a standard optimization technique could not achieve complete price equality between theoretical and realized dirty prices for 167 observations. However, the difference is minor for most of our data. The sum of the squared deviations between ENS theoretical price and dirty price for bonds is less than “2” for 94% of our daily observations. The same ratio is %96 for DNS. We can also conclude that DNS estimates Turkey yield curve slightly better than ENS model by comparing their sum of square deviations between theoretical prices and dirty prices of securities. Although the sum of square deviation is 129,2 in ENS methodology for 167 observations, the sum is 101,3 for DNS methodology.

As mentioned above, we work on last business day of every month one by one and apply optimization method GRG nonlinear in Excel. Let us discuss first quarter of 2018 ENS and DNS results as an example for closer inspection by comparing their theoretical/dirty prices, sum of squared errors and shape of yield curves (**Table 1.1, Table 1.2** and **Graph 1.1**) before presenting whole results for 167 observations.

Table 1.1 Example: How to Estimate Turkey Yield Curve via ENS on 31.01.2018

#	Security ISIN	Dirty Price (Pdirty)	ENS Theoretical Price (Pens)	(Pens-Pdirty)^2
1	TRT140218T10	102.671	102.720	0.0024
2	TRT110718T18	98.741	98.938	0.0388
3	TRT270319T13	101.197	101.010	0.0351
4	TRT150120T16	96.744	96.791	0.0022
5	TRT170221T12	100.572	100.863	0.0848
6	TRT020322T17	101.385	101.241	0.0208
7	TRT180123T10	101.637	101.429	0.0434
8	TRT110226T13	99.285	99.468	0.0337
9	TRT110827T16	98.716	98.649	0.0045
			Sum of Squares	0.2658

Parameters Make Min. Sum of Square	
β0	0.1069
β1	0.0386
β2	0.0386
β3	0.0596
Lambda 1	0.0000
Lambda 2	0.6138

Yield Curve	
Term	Rate
0.08	11.06%
0.50	12.13%
1.00	12.47%
1.50	12.40%
2.00	12.22%
2.50	12.03%
3.00	11.86%
3.50	11.71%
4.00	11.60%
4.50	11.50%
5.00	11.42%
5.50	11.36%
6.00	11.30%
6.50	11.25%
7.00	11.21%
7.50	11.18%
8.00	11.15%
8.50	11.12%
9.00	11.10%
9.50	11.08%
10.00	11.06%

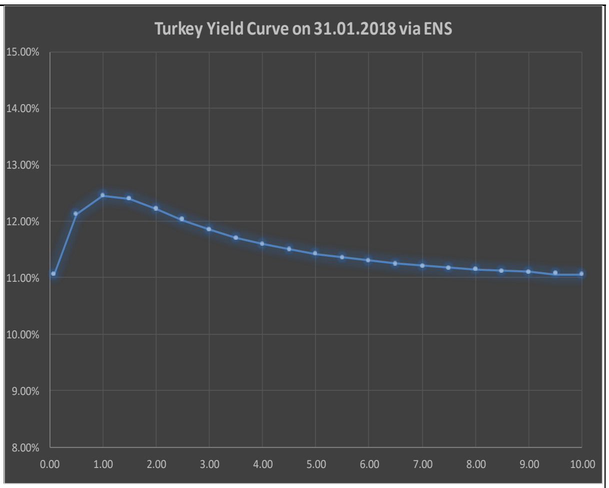


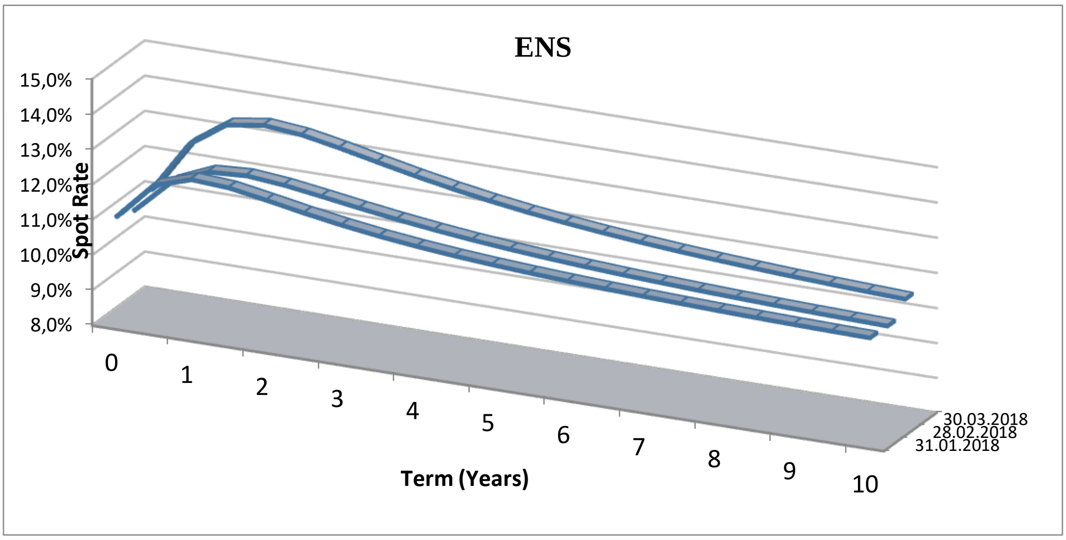
Table-1.1. shows how Turkey yield curve on 31.01.2018 is calculated via ENS. First, dirty prices of the most liquid 9 securities based on specific day to maturity are got from Istanbul Stock Exchange database and they are compared with calculated ENS theoretical prices. The optimal ENS parameters are determined by minimizing the sum of difference between dirty and ENS theoretical prices based on GRG nonlinear. Then, Turkey yield curve is plotted with optimal ENS parameters based on different terms.

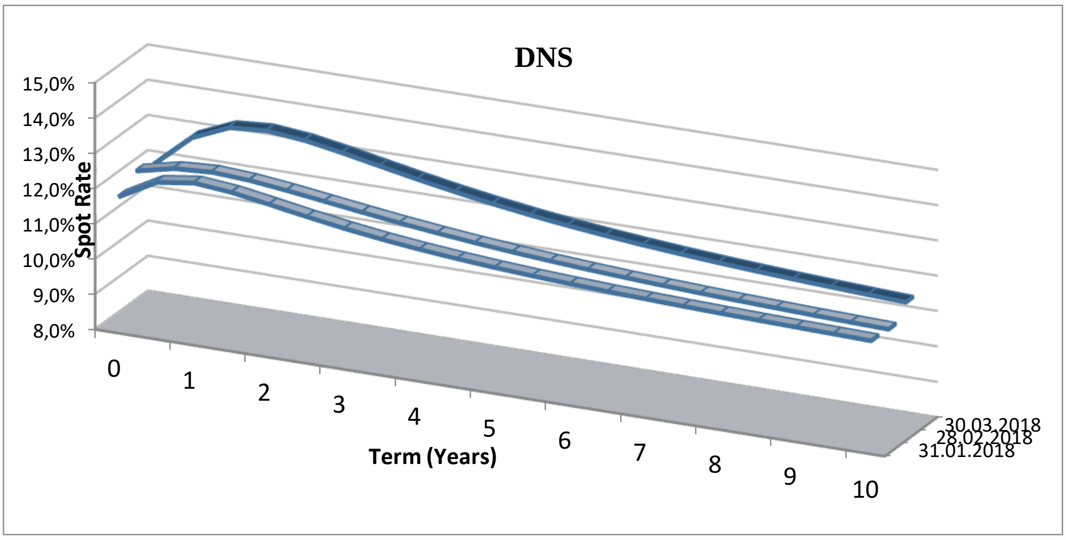
Table 1.2 Comparison of Optimal Parameters of ENS and DNS for 2018 Q1

Date	Parameters that Make Min. Sum Of Squares via ENS							Parameters that Make Min. Sum Of Squares via DNS				
	Beta 0	Beta 1	Beta 2	Beta 3	Alfa 1	Alfa 2	(Zthe-Zreal)^2	Beta 1	Beta 2	Beta 3	Alfa 1	(Ztheo-Zdirty)^2
31.01.2018	0.1069	0.0386	0.0386	0.0596	0.0000	0.6138	0.27	0.1067	0.0087	0.0455	1.4339	0.25
28.02.2018	0.1056	0.0386	0.0386	0.0611	0.0000	0.7719	0.73	0.1049	0.0155	0.0358	0.9770	0.61
30.03.2018	0.1065	0.0386	0.0386	0.0936	0.0000	0.8298	1.46	0.1059	0.0108	0.0762	1.0585	1.39

Table-1.2. shows ENS/DNS optimal parameters and the sum of difference between dirty and ENS/DNS theoretical prices based on GRG nonlinear for 2018 Q1.

Graph 1.1 Estimated Turkey Yield Curves via ENS and DNS for 2018 Q1

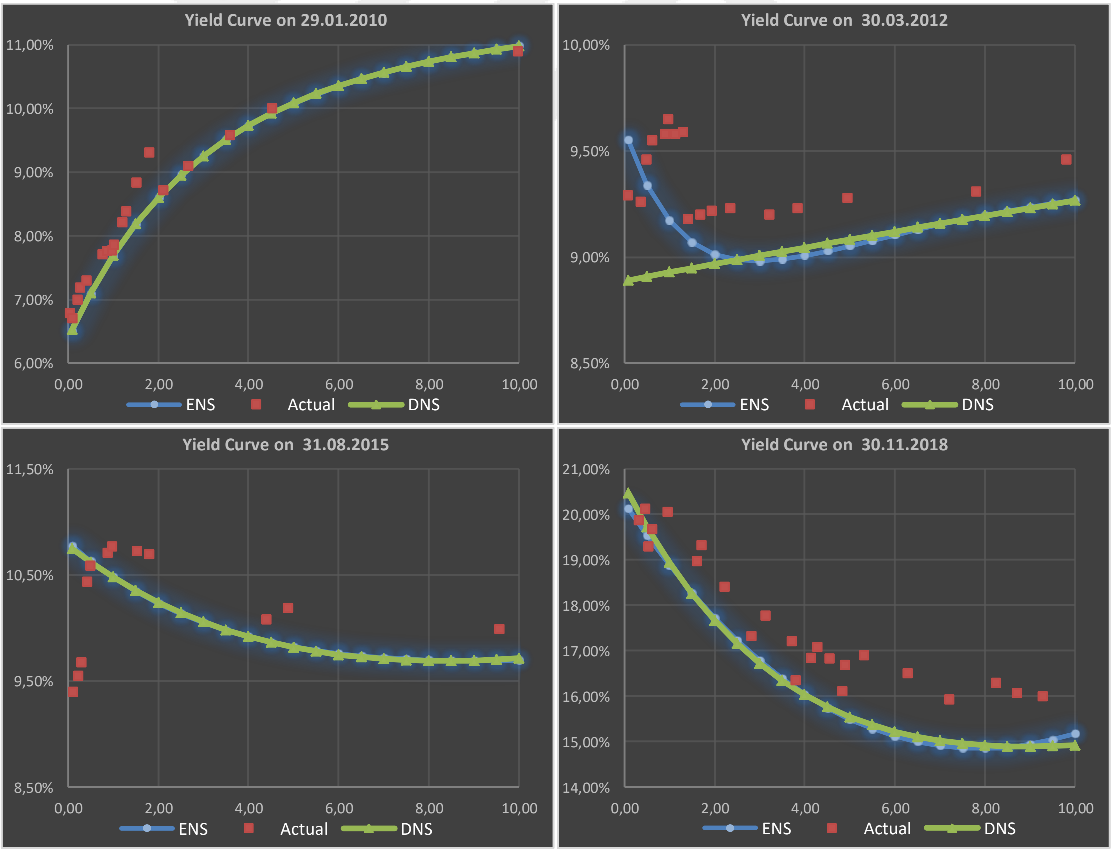




Graph-1.1. illustrates Turkey yield curve for 2018 Q1 with optimal ENS and DNS parameters based on different terms (years).

Before we present entire ENS and DNS yield curves for the period of 2005-2018 via GRG Nonlinear, let us lastly compare the estimated yields and actual data for selected dates. We use weighted average simple rate of return from Istanbul Stock Exchange database as actual data. The estimated yields are randomly selected based on their representation of different kind of shapes. I mean that although most of the Turkey's yields have increasing function, we chose decreasing and constant yields as well. According to the results, both ENS and DNS are capable of representing different shapes of yield curves. However, it is worth mentioning an important point here that both yields estimated via ENS and DNS using optimization GRG nonlinear technique underestimate the actual values. This is important because this graphical representation clearly proves the poor performance of estimations. Secondly, ENS is more successful especially for humped shapes (such as 30.03.2012) as it is expected because ENS model has an extension in order to fit better and capture highly non-linear, in other words hump-shape, yield curves as well. **(Graph 1.2)**

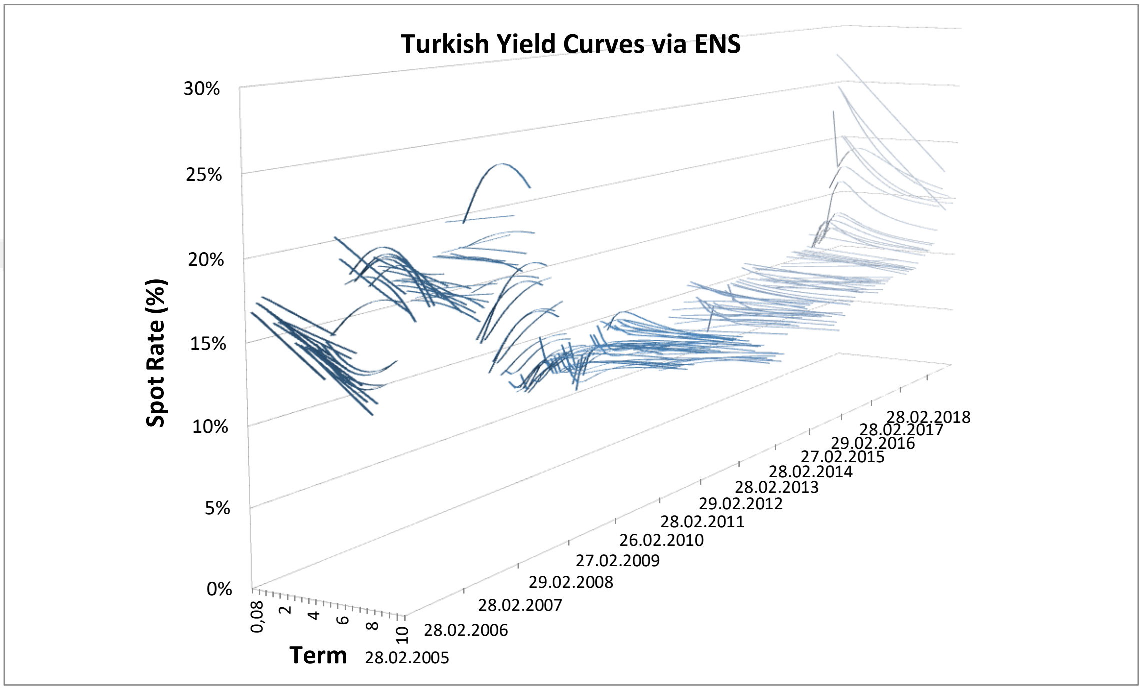
Graph 1.2 Comparison of Estimated (GRG Nonlinear) and Actual Yields

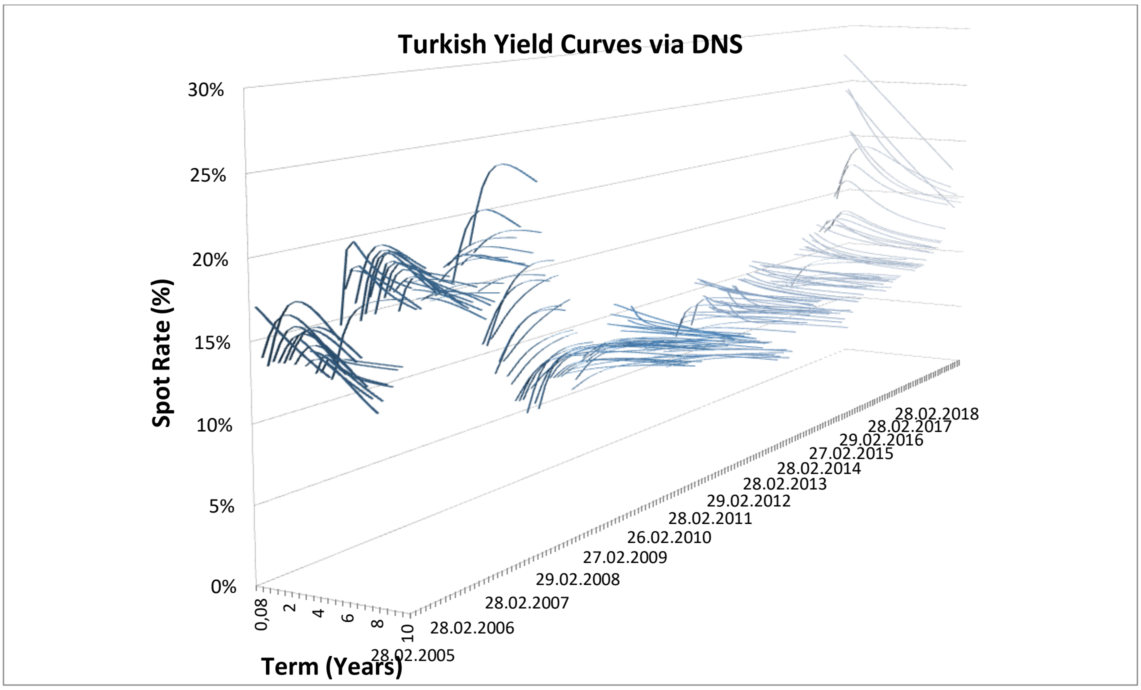


Graph 1.2. illustrates actual (data-based) and fitted (ENS/DNS model-based) Turkey yield curves for selected dates.

Finally, we follow the same methodology for all data, obtain time series of optimal ENS/DNS parameters and estimate Turkey yield curve for 167 observations via both methodologies. **(**See all estimated results in **Appendix A and B)** Although there is a little difference between the sum of squared errors of both methods and DNS is slightly better for estimating Turkey's yield curve, the graphical representation of the estimation for two methodologies as a whole is mainly similar to each other. **(Graph 1.3)**

Graph 1.3 Turkish Yield Curves Estimated via ENS/DNS GRG Nonlinear





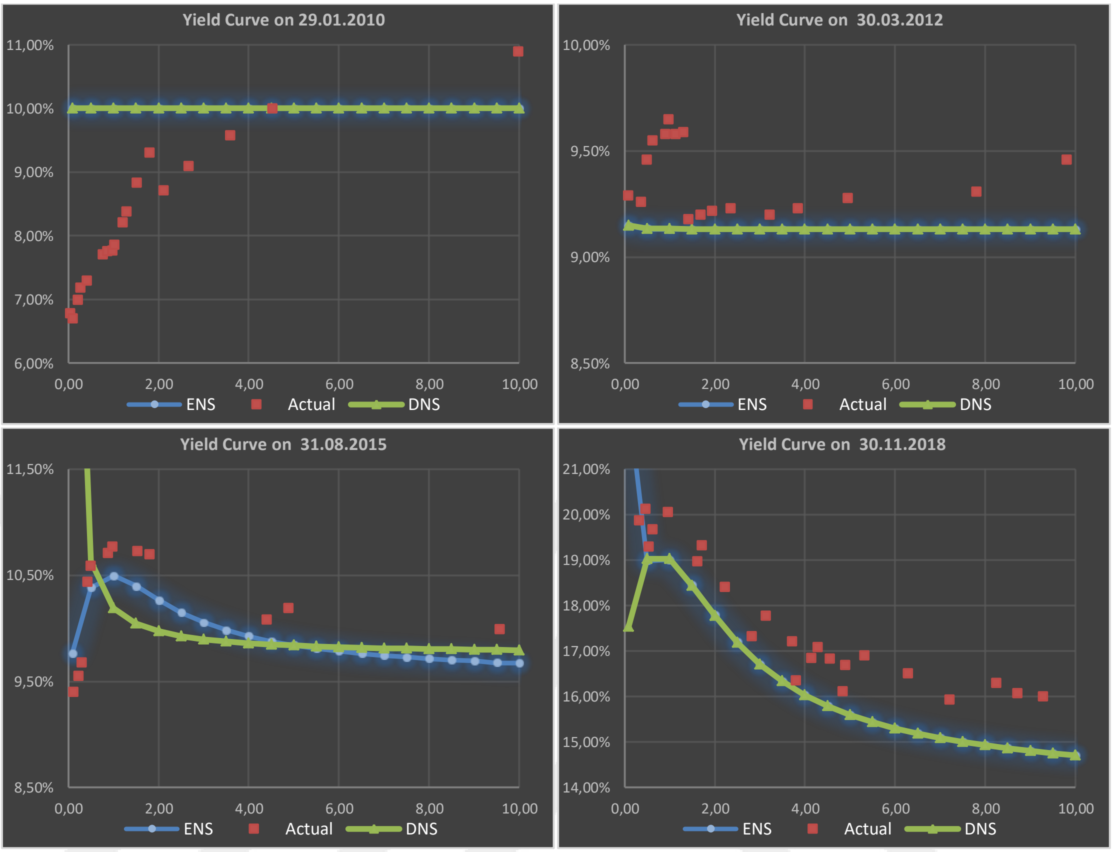
Graph 1.3 plots Turkey yield curves between 2005.02 and 2018.12 via ENS and DNS methodology via GRG Nonlinear. The sample consists of 167 observations. Since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yield curves which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period.

1.4.2. Matlab Optimization Method

What we did in Excel's GRG Nonlinear optimization tool in 1.4.1. is repeated in this section by using another software program, namely Matlab optimization tool. We apply Matlab's fmincon function which finds minimum of constrained nonlinear multivariable functions for optimization. The purpose of repeating the same process in another program is that the Matlab's optimization might perform better estimations by reducing the difference to a smaller value between theoretical and dirty prices. In other words, we expect to solve the underestimation problem of GRG Nonlinear via Matlab's fmincon function. However comparing to GRG Nonlinear's results, Matlab's optimization tool performs worse. In Matlab's results, the sum of the squared deviations between ENS theoretical price and dirty price for bonds is less than "2" for only 40% of our observations. The ratio is %41 for DNS. We can also conclude that DNS estimates Turkey yield curve slightly better than ENS model in Matlab too by comparing their sum of square deviations between theoretical prices and dirty prices of securities. Although the sum of square deviation is 1.455,9 in ENS methodology for 167 observations, the sum is 1.447,8 for DNS methodology. However, these results are very high in compare to GRG Nonlinear optimization results, this is why we can conclude that GRG Nonlinear performs better for estimating Turkey's yield curve than Matlab's fmincon function.

Let us compare the estimated yields of Matlab and actual data for selected dates too. We use weighted average simple rate of return from Istanbul Stock Exchange database as actual data. The same yields are selected based on their representation of different kind of shapes parallel to section 1.4.1. **(Graph 1.4)**

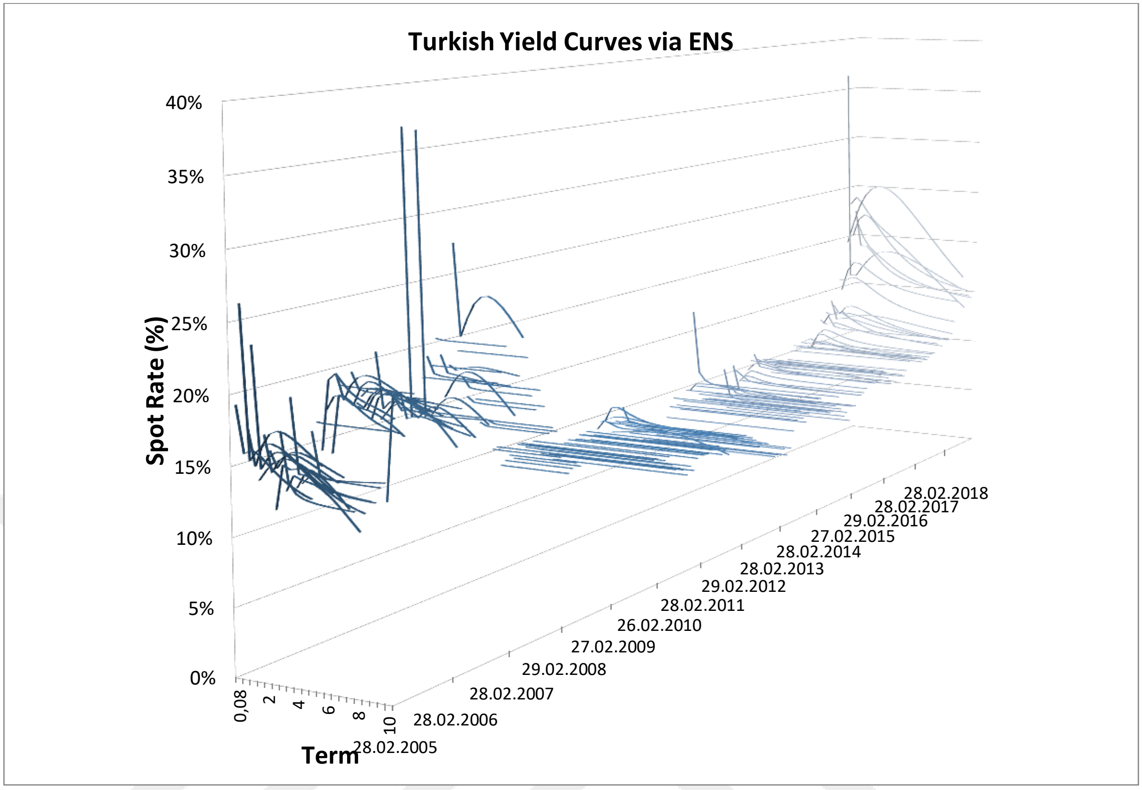
Graph 1.4 Comparison of Estimated (Matlab) and Actual Yields

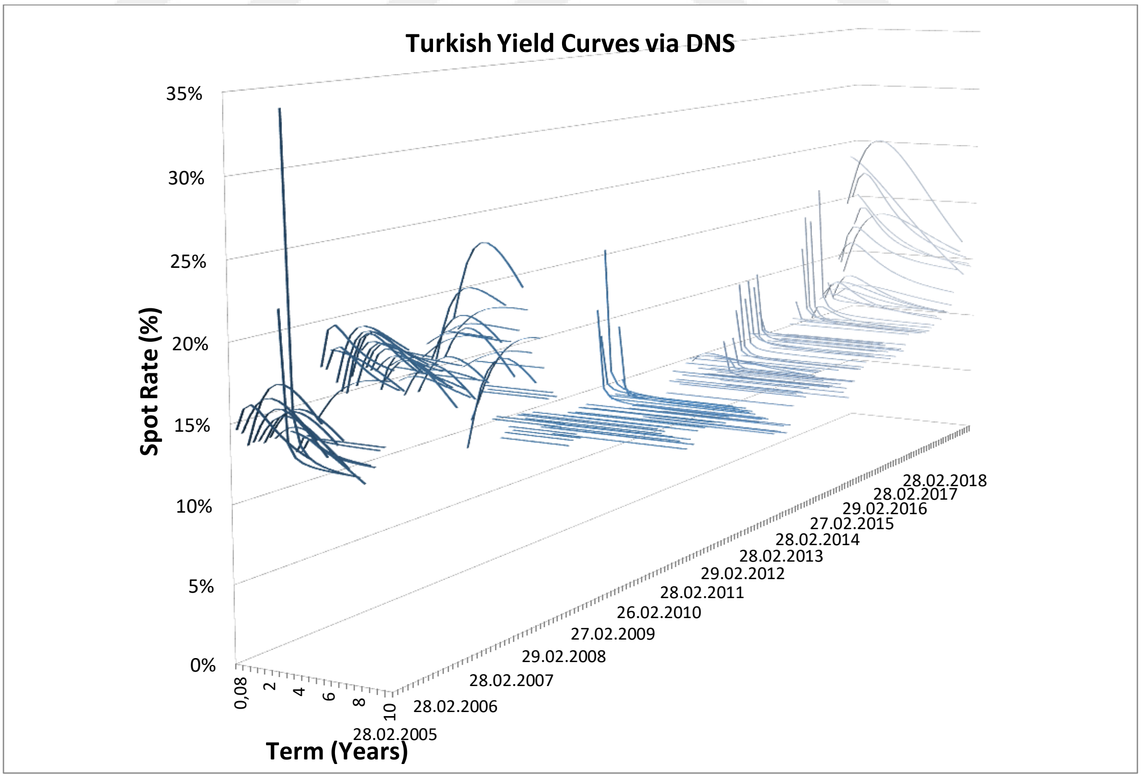


Graph 1.4. illustrates actual (data-based) and fitted (ENS/DNS model-based) Turkey yield curves for selected dates via Matlab optimization

Lastly, we estimate Turkey yield curve for 167 observations via Matlab's fmincon optimization tool for both ENS and DNS. **(**See fmincon optimization code details and all estimated results in **Appendix C and D)** Let us look at the graphical representation of the estimated yield curves. **(Graph 1.5)**

Graph 1.5 Turkish Yield Curves Estimated via ENS/DNS Matlab Optimization





Graph 1.5 plots Turkey yield curves between 2005.02 and 2018.12 by ENS and DNS methodology via Matlab optimization. The sample consists of 167 observations. Since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated

yield curves which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period.

Not only Matlab has the problem of underestimating the yield curve similar to Excel GRG Nonlinear methodology, but also Matlab has major deficiencies regarding estimation. First of all, Matlab shows the rate of short-term sections of the curves (such as 1-12 months) higher than expected. **(Graph 1.5)** Secondly, although most of the yields should have a curvature shape or increasing/decreasing function at least, Matlab's fmincon function estimates a horizontal curve for most of the data, especially in 2010-2017.

1.4.3. Ordinary Least Squares Method

We have not obtained desired estimation results yet in both optimization methodologies, therefore we apply a new one. Diebold&Li (2006) proposed a dynamic approach for estimating yield curves such that they used interest rates and extracted beta values (β_1, β_2 and β_3) by applying ordinary least squares regression analysis to the equation (1.2.3). They fixed λ at a constant value such that betas could be estimated by using ordinary least squares because non-linearity in the equation is eliminated by fixing λ.

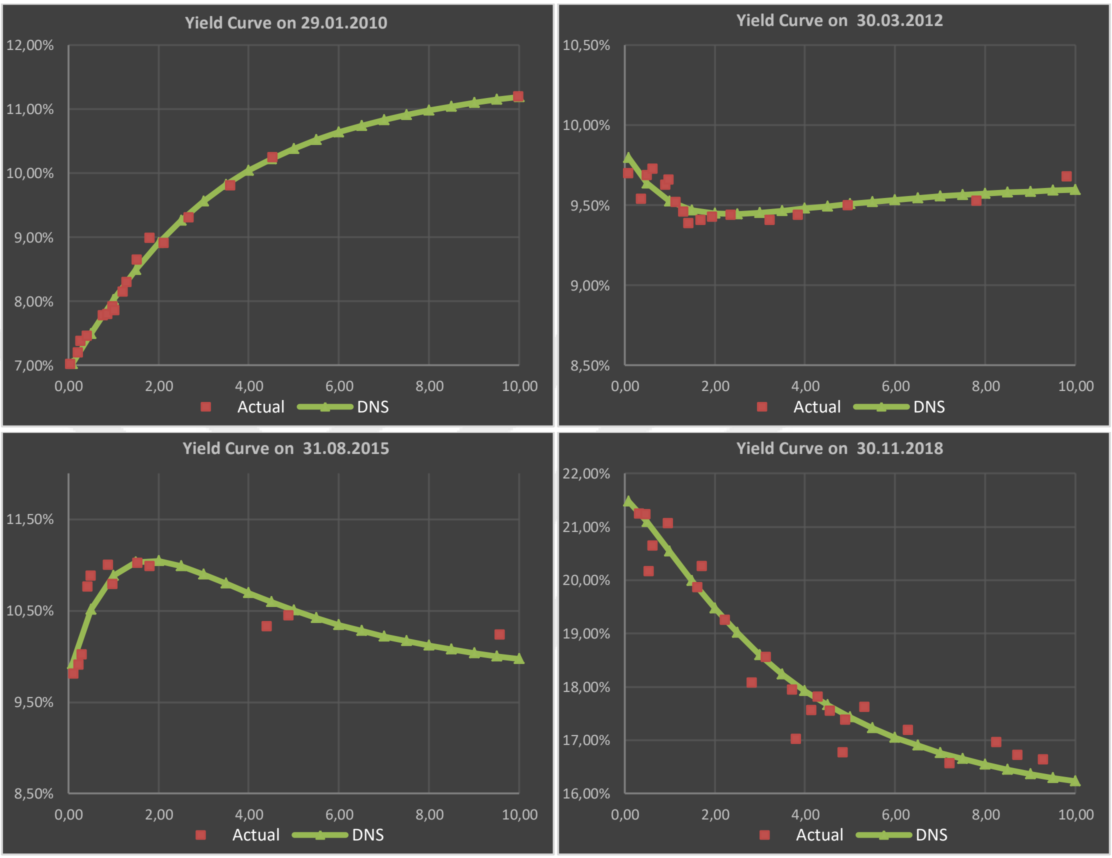
$$r(T) = \beta_1 + \beta_2 \left(\frac{1 - e^{-\lambda T}}{\lambda T}\right) + \beta_3 \left(\frac{1 - e^{-\lambda T}}{\lambda T} - e^{-\lambda T}\right) \quad (1.2.3)$$

As we mention in section 1.3 of the thesis, we fix λ at 0.897 and make our consolidated OLS regression analysis via Stata software.

All estimation results with adjusted R values and significance level of betas exist in **Appendix E**. Briefly, most of the variables, especially all of the β_1 (level), are statistically significant. Besides, adjusted R^2 are mainly above 90%.

Before sharing all estimation results, let us again compare the estimated yields and actual data for selected dates. We use weighted average compound rate of return from Istanbul Stock Exchange database as actual data. The same yields are selected based on their representation of different kind of shapes parallel to methodologies in section 1.4.1 and 1.4.2. **(Graph 1.6)**

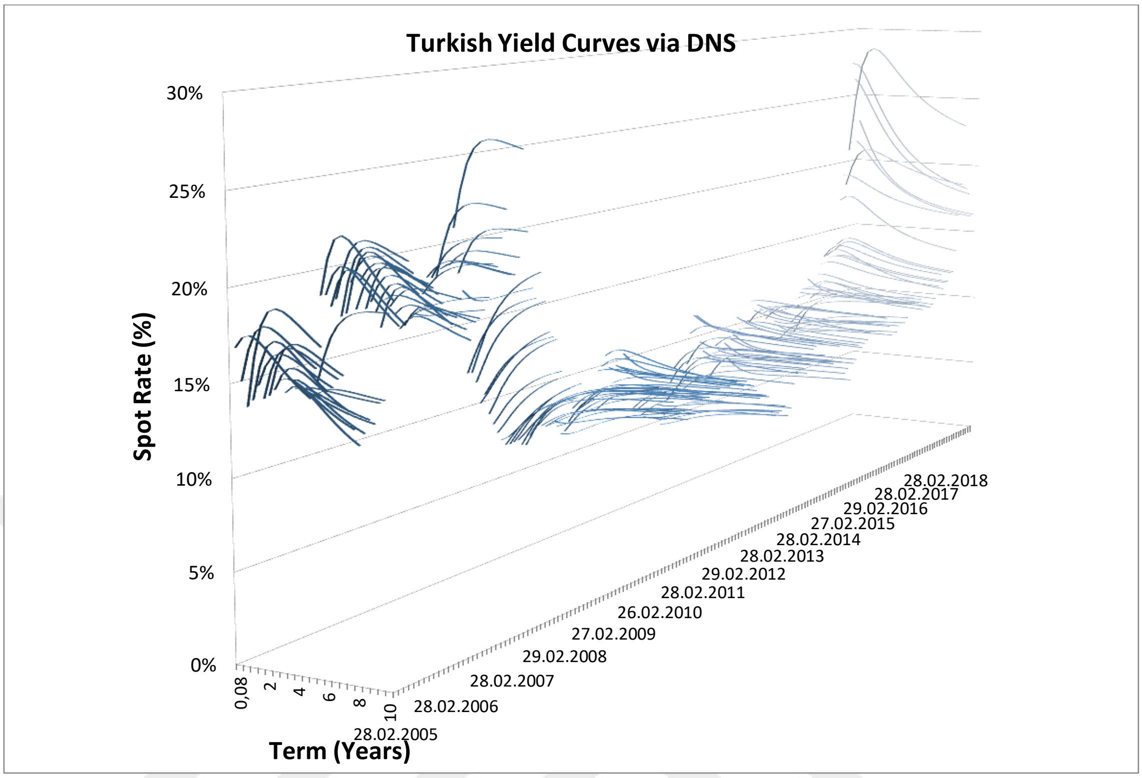
Graph 1.6 Comparison of Estimated (OLS) and Actual Yields



Graph 1.6. illustrates actual (data-based) and fitted (DNS model-based) Turkey yield curves for selected dates via OLS.

It is clearly seen that the most accurate estimation results are got via OLS method for selected four dates because estimated curves pass through the actual values, instead of falling below them. Let us evaluate the graphical representation of 167 estimated yield curves via OLS. **(Graph 1.7)**

Graph 1.7 Turkish Yield Curves Estimated via OLS Methodology



Graph 1.7 plots Turkey yield curves between 2005.02 and 2018.12 via DNS methodology via OLS technique. The sample consists of 167 observations. Since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yield curves which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period.

A New Attempt: Applying OLS Methodology for ENS

Since the estimated yield curves pass through actual rates for randomly selected four days and we get reasonable 167 estimated yields that have no marginal trends or jumps, we apply the Diebold&Li (2006) approach to the modified version of ENS formula (1.3.3) as well. Honestly, we have not encountered this kind of study or attempt in literature review such that trying to estimate four betas of Svensson by using OLS.

$$r(T) = \beta_0 + \beta_1\left(\frac{1-e^{-\frac{T}{\lambda 1}}}{\frac{T}{\lambda 1}}\right) + \beta_2\left(\frac{1-e^{-\frac{T}{\lambda 1}}}{\frac{T}{\lambda 1}} - e^{-\frac{T}{\lambda 1}}\right) + \beta_3\left(\frac{1-e^{-\frac{T}{\lambda 2}}}{\frac{T}{\lambda 2}} - e^{-\frac{T}{\lambda 2}}\right) \quad (1.3.3)$$

Similar to Diebold&Li, we fix λ_1 at 1,115 and λ_2 at 2,788 which maximize the loading factors of curvature terms for 24 and 60 months respectively and then try ordinary least squares for estimating betas in 1.3.3. However, the results are not as we expected. We could not succeed to get significant results and accurate estimations for Svensson formula (ENS) as we did with Diebold&Li's (DNS). The details of the estimation results and graph of consolidated yield curves appear in **Appendix F**. In short, there are even negative estimated yields that are impossible for Turkish economy. Besides, there are very irrelevant results in 2005-2010 when we generally have 7 securities (observations) in our regression analysis. That's mean trying to estimate four variables by using only 7 observations makes getting an accurate estimation result impossible. To sum up, OLS method is used to estimate three independent variables (β_1, β_2 and β_3) in Diebold&Li's formula, is not successful in estimating four independent variables (β_0, β_1, β_2 and β_3) in Svensson's formula. Therefore, our attempt to add a new perspective to the literature by combining Diebold&Li's OLS methodology to Svensson formula failed.

1.4.4. Comparison of Methods

As it is remembered, sum of squared errors between theoretical and dirty prices are higher in Matlab's fmincon optimization tool. Graph 1.4 proves similar results such that Matlab's optimization tool is worse than Excel's GRG Nonlinear optimization. According to Graph 1.4, the Matlab tool does not only underestimate the yield curve, but also follows irrelevant trends on the selected days. Therefore, we conclude that the results are produced by the Excel GRG Nonlinear tool are more accurate than the results of Matlab's fmincon optimization tool.

By the way, minimizing the difference between theoretical price and dirty price via optimization of GRG Nonlinear and Matlab fmincon optimization techniques do not perfectly estimate the yield curves. Therefore, we could not find the desired betas which equalize the difference to "0" between theoretical and dirty prices via optimization. According to the literature, this problem stems from "local minima". (Hladikova, Radova (2012) and Gilli et. al. (2010)) It is basically argued that the optimization methods can find local minima instead of global minima (i.e. equal to 0). Therefore, we can estimate the yield curve, yet it is not an ideal one.

At the same time, when we evaluate the Graph 1.2 and 1.4, it is concluded that the estimated yield curves obtained via two optimization methods are below the actual rates and thus the yield curves are underestimated. Eventually, another method is needed in order to achieve more accurate yields by eliminating the constraints and problems of optimization methodologies: Ordinary Least Squares (OLS).

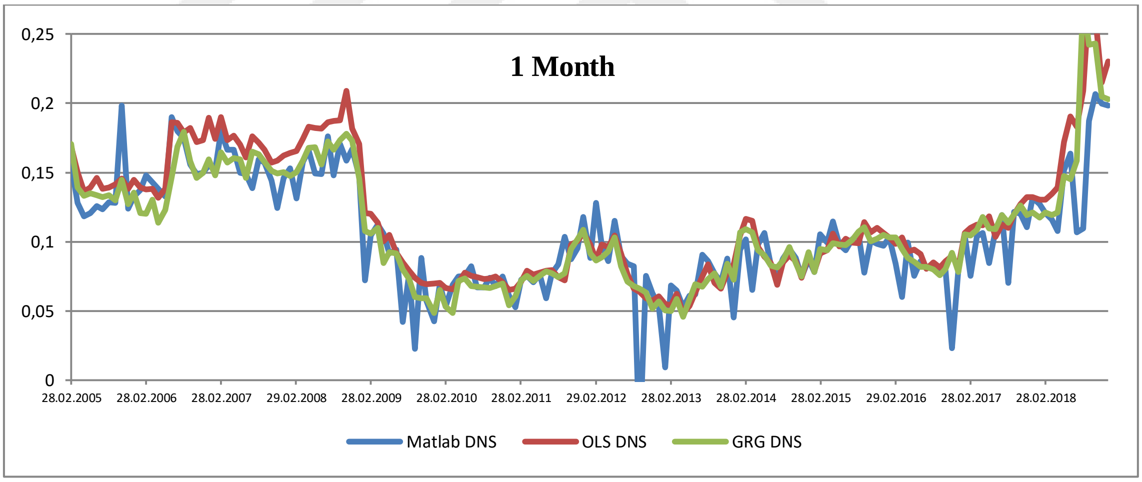
Eventually, we compare 3 methodologies, namely Excel GRG Nonlinear opt., Matlab fmincon opt. and OLS, of estimated yields that are derived from DNS formula based on their maturities **(Graph 1.8)**. And, we conclude that OLS is the best methodology for estimating yield curves.

- First of all, Matlab optimization is baddish especially in estimating shorter maturities of yield curve as we discussed before. This is why blue line, that represents Matlab, differentiates from OLS and GRG Nonlinear methods especially in 1 month-1 year maturities of the curves. It overreacts and makes unreasonable jumps. And, this unreasonable jumps also explain why Matlab technique's sum of square deviation between theoretical and dirty price is very higher than the GRG Nonlinear technique.

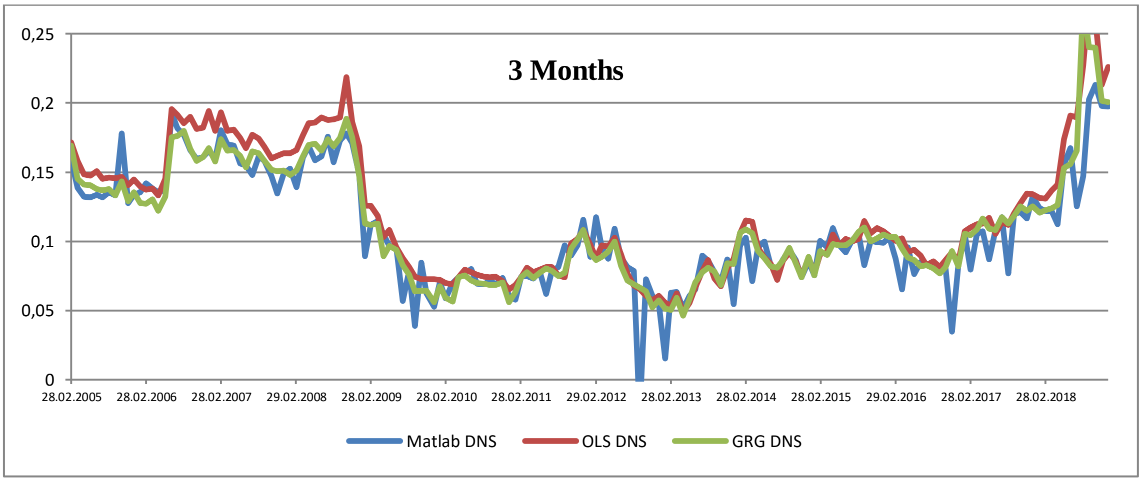
- Secondly, although GRG Nonlinear estimates more accurate yield curves than Matlab optimization technique, it is still unsuccessful in compare to OLS methodology. It can easily seen that green line, that represents GRG Nonlinear methodology, is generally under the red line, that represents OLS methodology, in most of maturities. That's mean GRG Nonlinear optimization technique unfortunately underestimates the yield curves.

As a result of our tests, we conclude that OLS methodology is the best alternative for estimating Turkish yield curve.

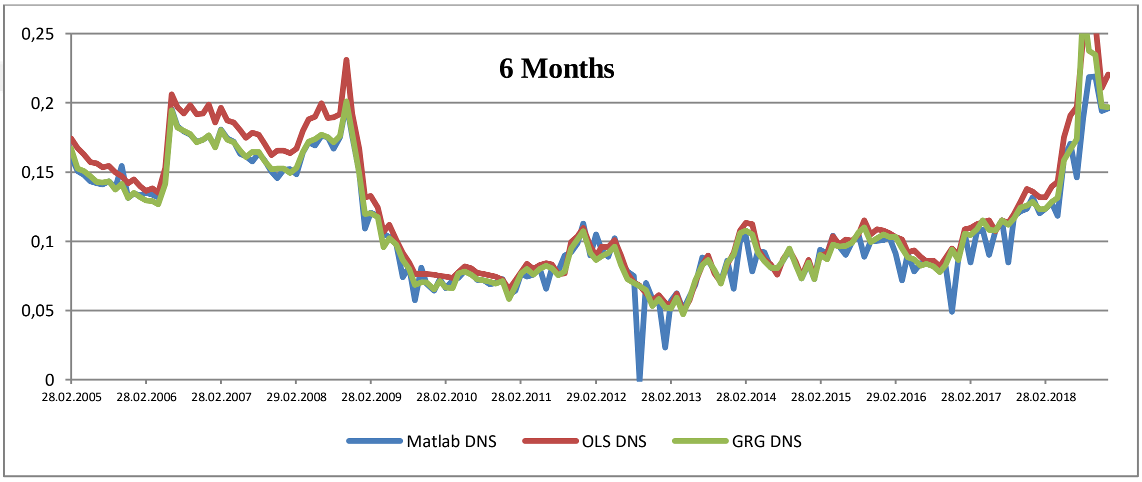
Graph 1.8 Comparison of Estimated Yields Based on Maturities



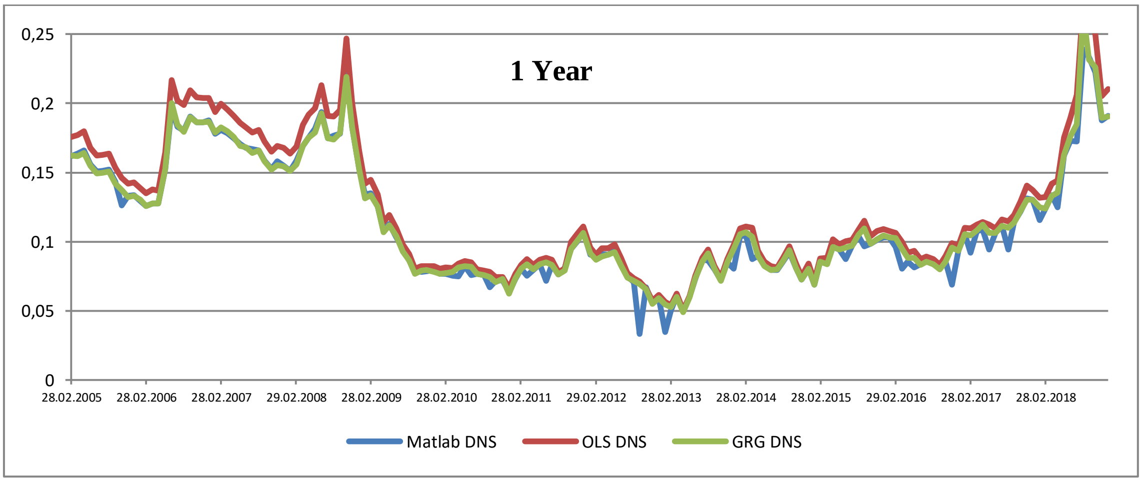
*Graph 1.8 plots comparison of three DNS estimated yields via GRG Nonlinear optimization (**green** lines), Matlab's fmincon optimization (**blue** lines) and ordinary least squares (**red** lines) based on different maturities, such as 1 month, 3-6-12 months and 2-3-4-5-6-7-8-9-10 years.*



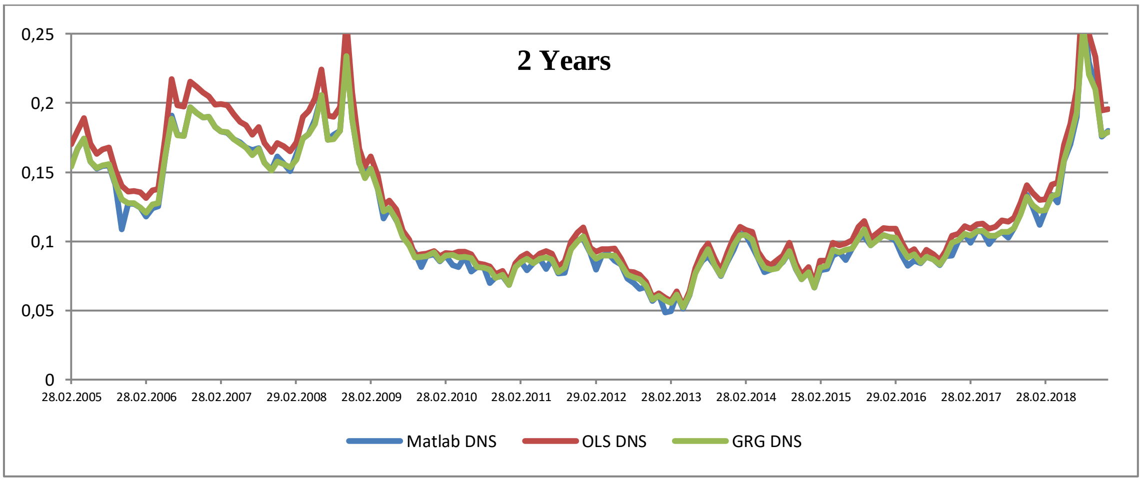
3 Months
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

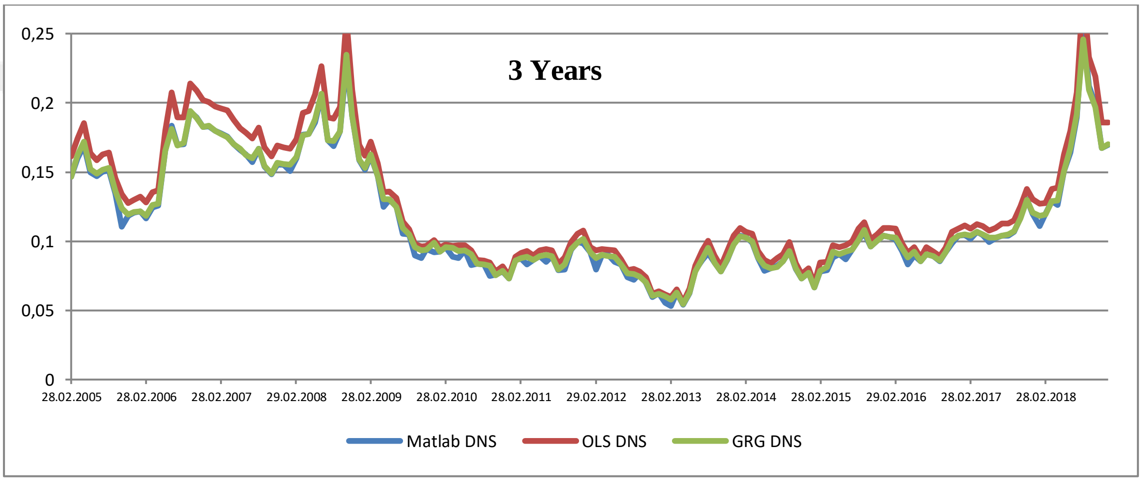


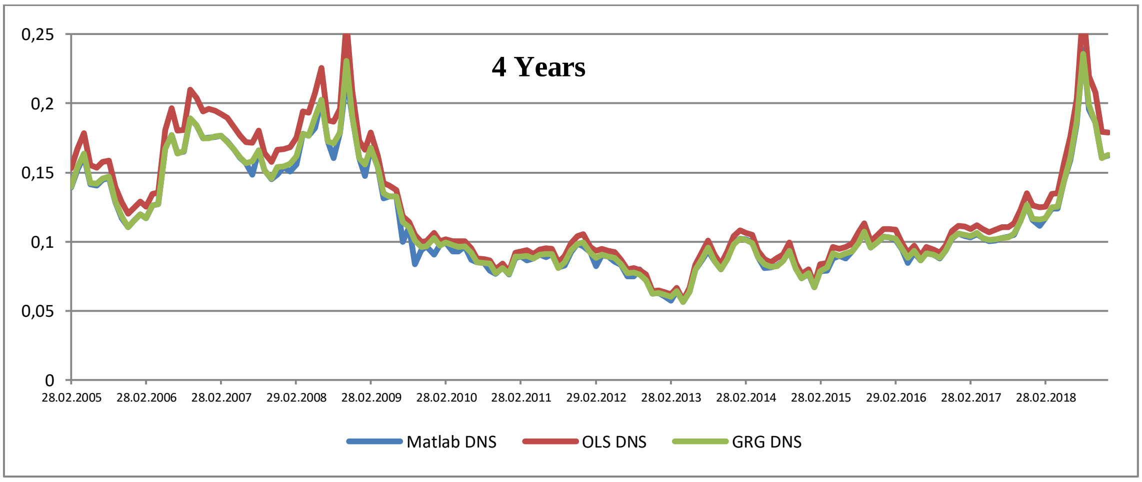
6 Months
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

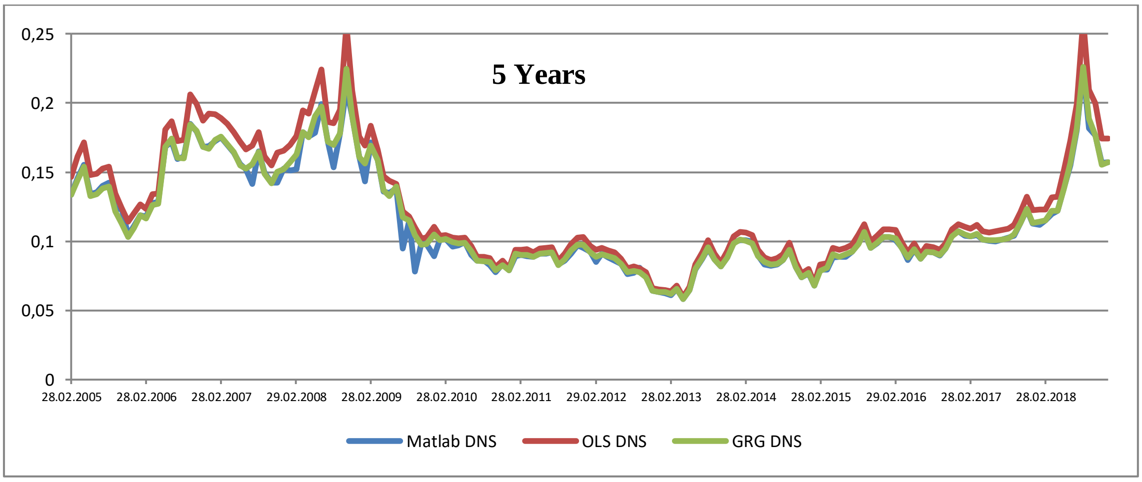


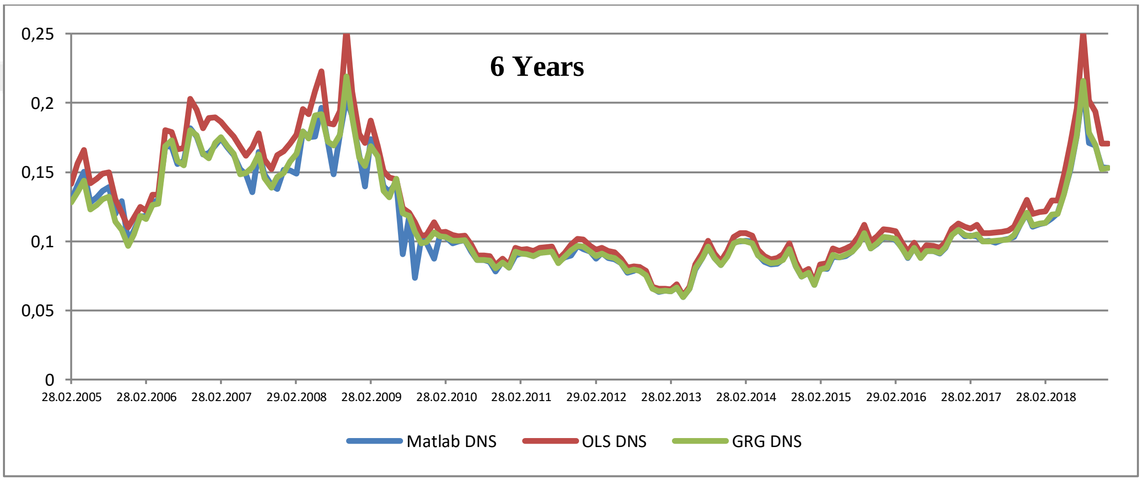
1 Year
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

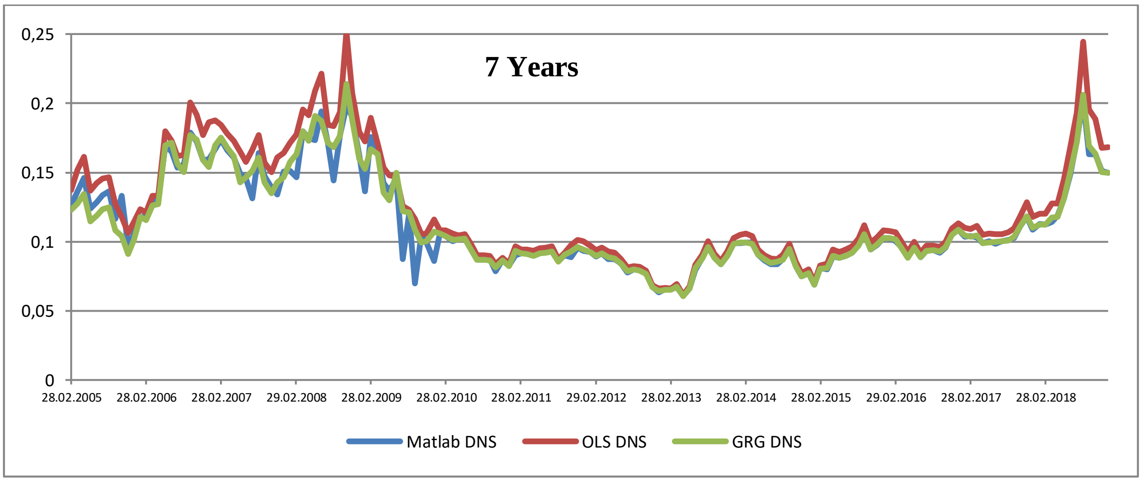

2 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

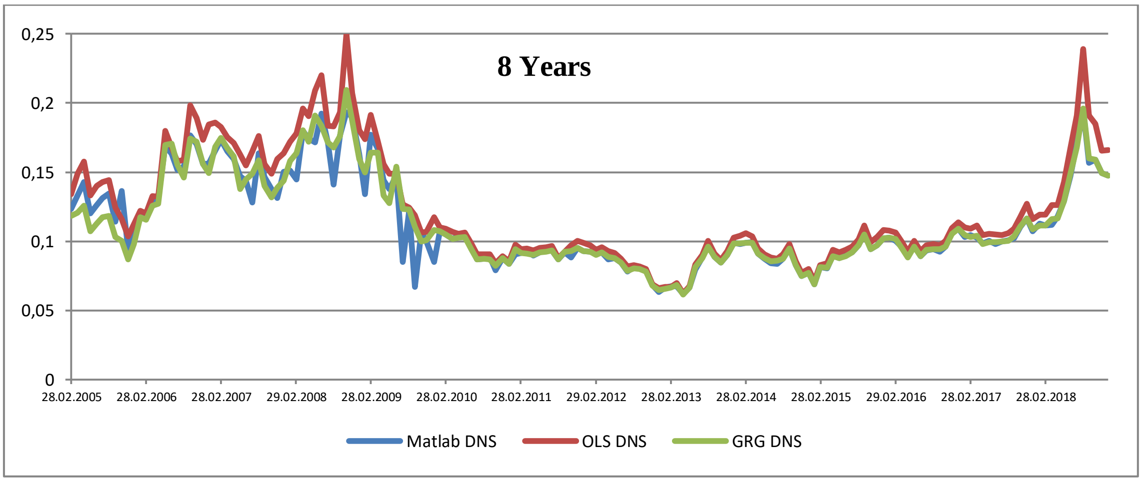

3 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

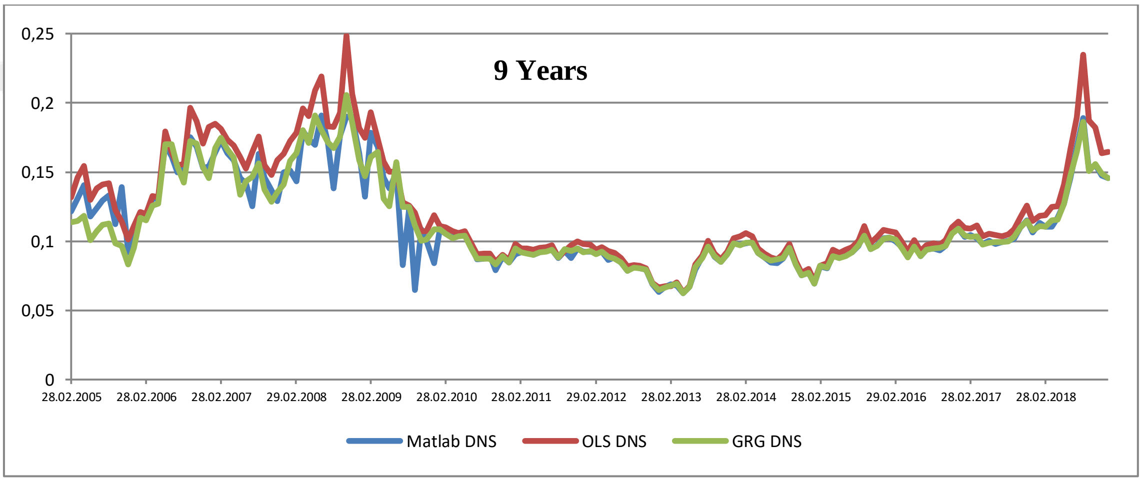

4 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

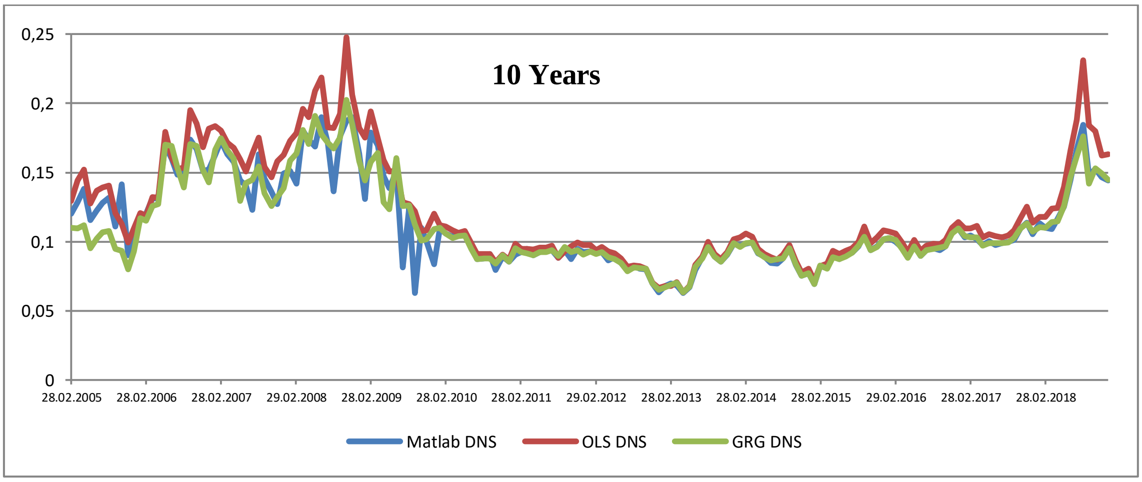

5 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS


6 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS


7 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS


8 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS


9 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS


10 Years
0,25
0,2
0,15
0,1
0,05
0
28.02.2005
28.02.2006
28.02.2007
29.02.2008
28.02.2009
28.02.2010
28.02.2011
29.02.2012
28.02.2013
28.02.2014
28.02.2015
29.02.2016
28.02.2017
28.02.2018
Matlab DNS
OLS DNS
GRG DNS

1.5 CONCLUSION OF CHAPTER 1

Yield curves that show interest rates with varying maturities are very crucial for investment decisions of firms, borrowing strategies of ministries of treasury, risk management of banks and monetary policies of central banks. Therefore, accurate estimation of the yield curve is highly critical. This is why there are so many attempts and methodologies that try to reach the most accurate estimation results in literature.

In this methodology chapter, we estimate Turkey yield curve for sovereign bonds by using two of the most famous parametric models, namely Extended Nelson-Siegel (ENS) and Dynamic Nelson-Siegel (DNS) models. We apply contemporary monthly data between 2005 and 2018 in order to estimate 10-year Turkey yield curve. Besides, we divide sample into the pre-2010 and post-2010 periods. Since 10-year fixed rate coupon bonds were started to be traded after January 2010, our estimation includes 5-year term to maturity for 2005-2010 and 10-year term to maturity for 2010-2018 periods.

Although we find the appropriate λ value for Turkey, we do not fix λ at 0,897 during our optimization techniques of GRG Nonlinear and Matlab fmincon because adding an extra constraint makes the optimization results worse. However, we fix λ at 0,897 during applying ordinary least square approach in DNS. At the beginning of the work, we expect that ENS method obtains a better estimation by keeping in mind that six parameters are used and hump shapes are included. However, although ENS and DNS estimation results graphically indicate very similar trends for Turkey yield curve, the sum of squares of difference between DNS theoretical and dirty prices is slightly less than ENS results according to optimization techniques. Although the sum of square deviation is 129,2 in ENS methodology for 167 observations, the sum is 101,3 for DNS methodology. By the way, we detect that optimization techniques are still quite unsuccessful by estimating yield curves as a result of the problem of local minima.

Therefore, we apply Diebold&Li’s (2006) Ordinary Least Square approach. As a result of comparison, OLS proves to estimate more accurate yield curves that are planned to be used in the next section for forecasting purposes as well. Lastly, relying on the success of Diebold&Li's technique on estimation, we try a new perspective by combining Diebold&Li's technique with Svennson formula. But, the results are insignificant.

CHAPTER - 2

FORECASTING PERFORMANCE OF TURKISH ECONOMY

2.1 INTRODUCTION

The shape of yield curve is very crucial for policy makers and regularly followed by firms, ministries of treasury, risk managers of banks and economists of central banks because they believe that shape of yield curve contains some clues regarding course of economy. On the other hand, the discussion and experiments on the yield curve may be one of the most important threats against Eugene Fama's the "efficient market" hypothesis (1965, 1970). The curve is also used by many traders and investors in order to forecast macroeconomic variables in the future.

There are many academics who tried to forecast macroeconomic variables by using parameters that represent the shape of yield curve. As parameters that represent the shape of yield curve, some academics apply "term spread", i.e. the difference between the interest rates on long term and short term treasury securities. And, the difference between 10-year and 3-month treasury security yields are mostly applied as "term spread" indicator. Some academics use more parameters in order to capture the shape of yield curve. For example, Diebold and Li (2006) contributed the literature of parameters that represent the shape of yield curve by reinterpreting level (β_1), slope (β_2) and curvature (β_3). Most of scholars were successful in their forecasting macroeconomic variables regardless of using term spread or level, slope and curvature parameters as representatives of yield curves. They got significant results regarding forecasting recessions, timing of bear or bull market, real GDP, exchange rates and inflation rates by using the shape of yield curves.

First of all, the yield curve may be the most reliable predictor of recessions and economic growth. The economic history of the developed markets proves the significance of this hypothesis. For instance, when the spread reaches the negative numbers, it tells dramatic increases in the short term interest rates of the economy that directly harms to investment and consumption levels of the economy. Not only it pushes the economy into recession, but also it may high probably turn into a severe economic crisis. And of course, it is inevitable that the real GDP growth will certainly be affected from such kind of situations. Therefore, the shape of yield curve can give important clues about real GDP and recessions. Estrella and Mishkin (1998) obtained significant results such that the yield curve predicts U.S. recessions by using a probit model. Mehl (2009) got similar results for emerging economies as well. Mehl proved a relationship between changes in slope of the yield curve and industrial production growth in many emerging economies. Wheelock and Wohar (2009) graphically proved how the term spread between 10-years and 3-months treasury security yields predicts most of the recessions in the US, German and UK economies. Moench (2012) found that an unexpected increase of the curvature factor predicts a significant decline of output more than 1 year ahead. And, Bernard and Gerlach (1998) showed that the term spreads can forecast recessions up to two years ahead in eight countries, namely United States, Germany, United Kingdom, France, Canada, Belgium, Japan and the Netherlands.

Similarly, Laurent (1988), Estralla and Hardouvelis (1991), Ang et. al. (2006), Rudebush and Williams (2009), Chionis et. al. (2010), Kaya (2013), Hvozdenska (2015) and Argyropoulos and Tzavalis (2016) are other contributors to the literature that show the empirical relationship between the shape of the yield curve and output growth/recessions in various countries.

Secondly, since the yield curve gives early warnings about recessions and crisis, it can be used as a significant technical analysis so as to capture bearish turnovers in the stock market as well. Shiu-Sheng Chen (2009) found that term spread is one of the most useful predictors of recessions in the US stock market according to both in-sample and out-of-sample forecasting performance. According to Resnick and Shoesmith (2002), the term spread is a reliable mechanism so as to forecast bear stock markets. They extended to the probit model of Estralla and Mishkin (1998) and used it to test the forecasting power of the term spread for bear markets in S&P500. Similar to Resnick and Shoesmith (2002), Perez et. al. (2014) applied a probit model and concluded that the slopes of US and European yield curves have some notions that assist to forecast the probability of bear markets.

Thirdly, the negative term spread usually implies higher interest rates in the short term maturities. It is only possible with a monetary expansion or expectation for losing money’s nominal value in the near future. That’s mean an inflation. Arturo Estralla (2005) emprically comfirmed that the slope of the US yield curve has predictive information for inflation in most cases. Rudebusch and Wu (2008) supported that the level factor can be interpreted as the central bank's implicit inflation target as perceived by private agents. Kaya and Yazgan (2011) reached similar results for Turkey such that the yield curve has gained significant forecasting power for future inflation after 2002. Kaya (2013) used estimated level, slope and curvature factors of Diebold and Li (2006) and concluded that there is a high correlation between the level factor of Turkish yield curve and inflation rate.

Lastly, relative yield curve, i.e. difference between two countries’ yield curves, can give clues about exchange rate between these two countries. If the yield curve contains information regarding economies’ interest rate expectations, recessions and inflation rates, parameters that are extracted from two countries’ relative yield curves can expectedly forecast future exchange rate changes as well. According to Chen and Tsang (2013), the Nelson-Siegel factors extracted from two countries’ relative yield curves can predict future exchange rate changes and excess currency returns 1 to 24 months ahead. Duran (2014) used the relative yield curve approach for Turkey-US and Turkey-EU and found statistical relationship between level, slope and curvature factors of relative yield curves and USD/TL and EUR/TL exchange rates.

The purpose of this chapter of the thesis is to forecast Turkish economy, namely recession, bear market, industrial production index, real GDP index, bist100 index and inflation rate, by using estimated Turkey yield curve that is extracted from discounted and fixed coupon government bonds in Chapter-1. Using our own estimated yield curves that created via the most contemporary data and combining all forecasting results of Turkish macroeconomic indicators in a single thesis make our work unique. As we discussed in Chapter-1, a parametric model is used for estimating Turkey yield curve. In this group, Nelson-Siegel (1987) model and its dynamic version by Diebold and Li (2006) are widely used by central banks, academia and other market participants for estimating yield curve. We apply both term spread between 5-year and 3-month treasury security yields and level, slope and curvature factors as representatives of the estimated Turkey yield curves via DNS in order to forecast Turkish macroeconomic indicators.

Chapter-2 of the thesis is organized as follows. In section 2.2, a detailed explanation and formulas of Nelson-Siegel model and its dynamic version (DNS) will be repeated and time series of estimated betas will be discussed. In section 2.3, data of independent and dependent variables will be mentioned and forecasting model will be introduced. In section 2.4, forecasting results will be presented. In the final section, our concluding remarks regarding Chapter-2 will be summarized.

2.2 DYNAMIC NELSON-SIEGEL (DNS) MODEL

As we described in the Chapter-1 of the thesis, Nelson and Siegel (1987) estimated the yield curve by using four parameters. (2.2.1) According to the authors, β_0, β_1 and β_2 represent the short, medium and long-term components of the yield curve. The long term component is represented via β_0 because it remains constant when term to maturity parameter (T) evolves. β_1 serves the representation of short-term and β_2 contributes the representation of the medium-term component. As Ibanez (2016) stated, the fourth parameter (λ), which is not entirely described, is a decay factor. That's means it influences the fitting power of the model.

$$r(T) = \beta_0 + (\beta_1 + \beta_2)\frac{1 - e^{-\frac{T}{\lambda}}}{\frac{T}{\lambda}} - \beta_2 e^{-\frac{T}{\lambda}} \qquad (2.2.1)$$

where β_0, β_1, β_2 and λ are parameters (λ must be positive) to be extracted from the current bond price.

The Dynamic Nelson Siegel (DNS) Model Diebold and Li (2006) introduced the dynamic version of the Nelson Siegel model. (2.2.2) The most important contribution of them to the literature, DNS parameters that represent the curve can be used for forecasting purposes as well. In other words, they reinterpreted the parameters as level (β_1), slope (β_2) and curvature (β_3). The level parameter (β_1) represents the long-term factor therefore it is $\beta_1 = y_t(\infty)$. The slope parameter (β_2) represents the short-term factor which is defined as ten-year yield minus the three-month yield, i.e. $\beta_2 = y_t(120) - y_t(3)$. The curvature parameter (β_3) represents the medium-term factor which is defined as twice the two-year yield minus the sum of the ten-year and three-month yields, i.e. $\beta_3 = 2y_t(24) - (y_t(120) + y_t(3))$. We plan to apply these estimated level, slope and curvature factors as if they represent the yield curve and use them as independent variables during forecasting dependent variables, namely recession, bear market, industrial production index, real GDP index, bist100 index and inflation rate of Turkey.

$$r(T) = \beta_1 + \beta_2 \left(\frac{1 - e^{-\lambda T}}{\lambda T}\right) + \beta_3 \left(\frac{1 - e^{-\lambda T}}{\lambda T} - e^{-\lambda T}\right) \tag{2.2.2}$$

where β_1, β_2, β_3 and λ are parameters (λ must be positive) to be extracted from the current bond price.

In Chapter 1 of the thesis, we find β_1, β_2 and β_3 by using OLS and get the most accurate yields by applying the formula (2.2.2). Now, we will evaluate time series of these estimated parameters and test whether they meet the conditions of being level, slope and curvature factors of yield curves. If the parameters meet the requirements, then they are accepted as real representatives of the yield curve and they can be used as independent variables in Chapter 2 of the thesis.

According to **(Graph 2.1)**, the estimated DNS parameters (level, slope and curvature) do not have big variations over time and have meaningful variability. The level parameter represents the long-term factor. When changes in the shape of the level graph are observed, it is realized that long-term interest rate is affected by volatility changes in Turkish market. After global crisis in 2009, Turkey experienced a more stable period in economy. And this stability is reflected in graph via lower level as well. On the other hand, economic and politic tribulations after 2016 are reflected with higher level factor in the graph.

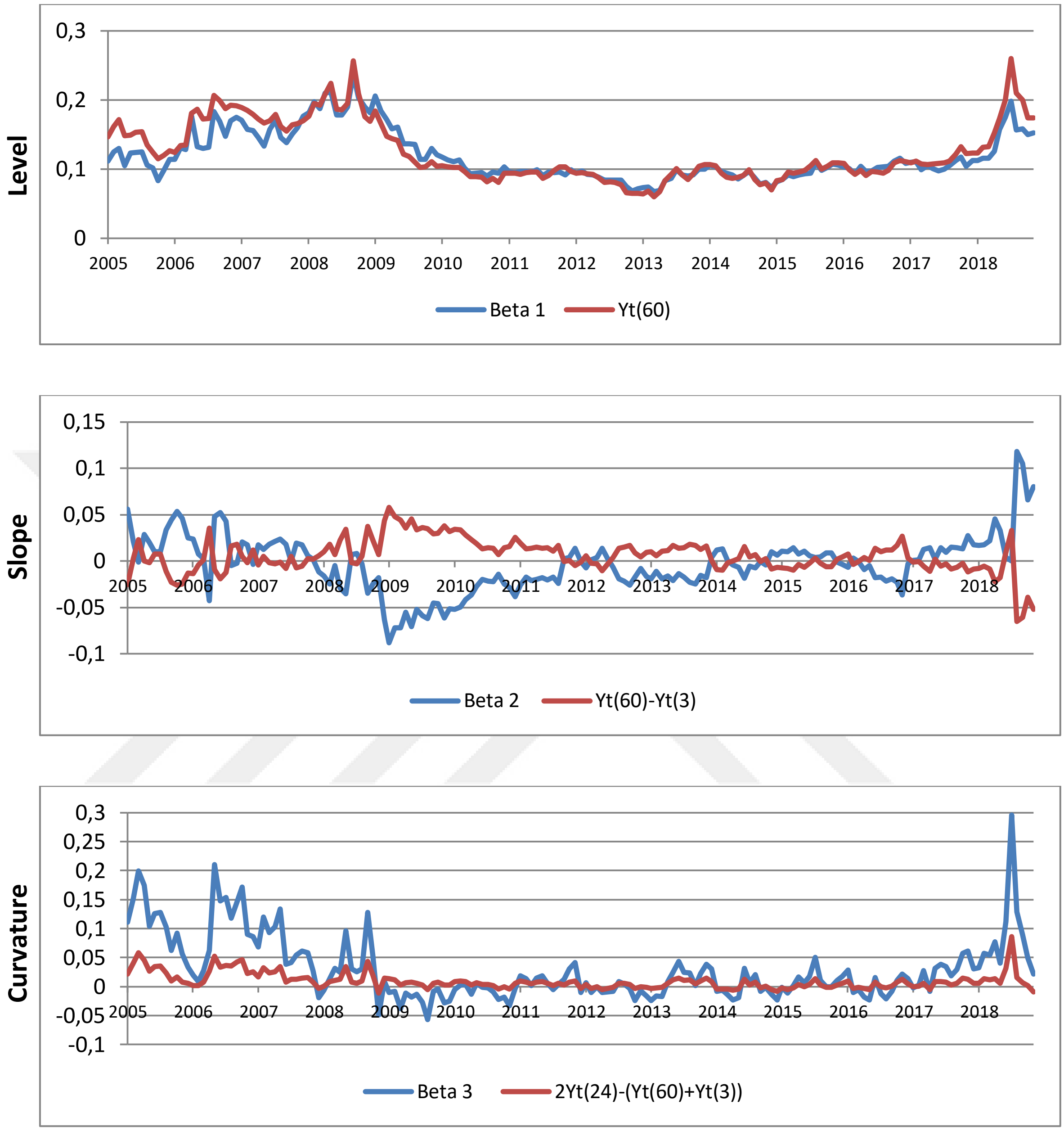
The slope and curvature parameters represent the short and medium-term factors respectively. When changes in the shape of the slope and curvature graphs are observed, it is realized that both have more volatility in the pre-crises period (2005-2009). Similarly, their volatility begins to increase in 2018 when Turkish economy has faced to many problems in macroeconomic set. It is understood from the graphs that DNS parameters could be useful for forecasting the performance of Turkish economy.

Let us remember the definition of Diebold and Li for level, slope and curvature: the level parameter (β_1) represents the long-term factor. The slope parameter (β_2) represents the short-term factor which is defined as ten-year yield minus the three-month yields. And, the curvature parameter (β_3) represents the medium-term factor which is defined as twice the two-year yield minus the sum of the ten-year and three-month yields. When we modify this definition of parameters for Turkish data, we represent the level parameter (β_1) via $y_t(60)$, the slope parameter (β_2) via $[y_t(60) - y_t(3)]$, the curvature parameter via $[2y_t(24) - (y_t(60) + y_t(3))]$ and compare these representation with the estimated results.

Similar to Diebold and Li's results[2] which represent a high correlation between level, slope, curvature and defined parameters for US economy, we also detect high correlations between level and $y_t(60)$; slope and $[y_t(60) - y_t(3)]$ and curvature and $[2y_t(24) - (y_t(60) + y_t(3))]$ for Turkey case. The correlations between the estimated factors (β_1, β_2 and β_3) and the level, slope and curvature are **corr (β_1, L_t) = 0.93, corr (β_2, S_t) = -0.96** and **corr (β_3, C_t) = 0.94** where $y_t(60)$ represents L_t, $[y_t(60) - y_t(3)]$ represents S_t and $[2y_t(24) - (y_t(60) + y_t(3))]$ represents C_t. **(Graph 2.1)** Therefore, we can accept β_1, β_2 and β_3 as the real representatives of the yield curve as if they are level, slope and curvature of the estimated yield curves.

[2] Diebold&Li (2006) found high correlations between the estimated factors (β_1, β_2 and β_3) and the level, slope and curvature factors such that **corr (β_1, L_t) = 0.97, corr (β_2, S_t) = -0.99** and **corr (β_3, C_t) = 0.99.**

Graph 2.1 Time Series of Estimated DNS Parameters



Graph 2.1. illustrates model based level, slope and curvature (i.e. estimated factors of β_1, β_2 and β_3) and data-based level, slope and curvature. The data-based level is defined as the 5-year yield, the slope as difference between the 5-year yield and 3-month yield and the curvature as the twice the 2-year yield minus the sum of the 5-year and 3-month yields.

2.3 DATA AND MODEL

2.3.1. Data

We take advantage of Chapter 1 of the thesis for Turkey yield curves. As you remember, the data consists of monthly observations of Turkish sovereign bonds and bills market in the period of February 2005-December 2018. We chose February 2005 as a starting point because 5-year fixed coupon rate bonds were started to be traded in Turkey. Besides, Turkish financial markets became more transparent, accountable and officially controlled in early 2000s with the foundation of new financial regulatory bodies such as Banking Regulation and Supervision Agency and additional precautions were taken in order to protect investors. On the other hand, 10-year fixed coupon rate bonds were started to be traded in January 2010. This is why we estimated yield curves which have 5-year term to maturity between 2005 and 2010, 10-year term to maturity in 2010-2018 period.

The data is received from Istanbul Stock Exchange database. Each day's data reports value date, days to maturity, days to coupon, accrued interest, prices, simple and compound rate of return and transaction volume of each security. Since the data is daily, the last business day of each month was used as a representative of the related month. The sample consists of 167 months (n=167). Although both fixed coupon and floating rate bonds are issued in the period, we only applied TL denominated zero-coupon and fixed-coupon rate bonds for curve estimation since cash flows of the floating rate bonds could not be determined in advance.

As discussed in Section 1.4.4 of the thesis, we will use level (β_1), slope (β_2) and curvature (β_3) as independent variables, that represent yield curves, are extracted via Diebold&Li's (2006) methodology. As you remember, $\beta_{1,}$ β_2 and β_3 are estimated via fixing λ to 0,897 and applying ordinary least squares to the formula (2.2.2).

We also apply a number of macroeconomic variables namely real GDP index, industrial production index, Istanbul Stock Exchange (BIST100) index and consumer price index as dependent variables. The mentioned monthly data are received from the Central Bank of the Republic of Turkey's database.

We apply both the real GDP index[3] and industrial production index[4] in order to see the forecasting capability of yield curve regarding performance of Turkish economy. Since monthly real GDP is not available, we apply quarterly published real GDP series. Similar to Huseyin Kaya's (2013) work, quarterly series are firstly seasonally adjusted and then monthly series are calculated by using the cubic spline function of the EViews program. We also use industrial production index (IPI) as a substitute for real GDP index. Since IPI is a monthly economic indicator measuring real output in the manufacturing, mining, electric and gas industries, we do not apply similar procedures of real GDP index for converting data to the monthly basis.

Monthly Istanbul Stock Exchange 100 (bist100) index[5] and consumer price index[6] (inflation) are applied so as to evaluate forecasting performance of the yield curve about other macroeconomic indicators parallel to the literature. In order to introduce the inflation data a little more, we would like to make a statement such that the one year change of the consumer price index gives the Turkish Statistical Institute's yearly inflation rate declarations of given months. For example, $[(cpi_{12.2018} - cpi_{12.2017})/cpi_{12.2017}]$ is equal to 20,3% that was published as inflation rate in January 2019.

Besides, descriptive statistics and autocorrelations of 1, 12 and 30 months of both dependent and independent variables are presented. **(Table 2.1)** According to the autocorrelation (AC) results, we can conclude that the first parameter of DNS (β_1) is the most persistent among independent variables. Real GDP index is also the most persistent among dependent variables. Graphical representation of the dependent variables also exist in **Graph 2.2**.

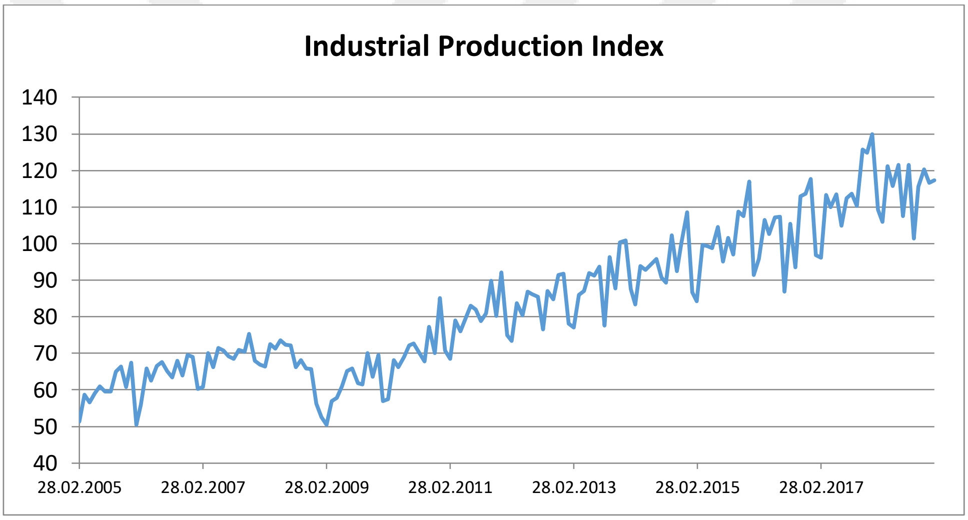
[3] Real GDP index for the base year 2009 is 100.
[4] Industrial production index for the base year 2015 is 100.
[5] Bist100 index for the base year 1986 is 1.
[6] Consumer price index for the base year 2003 is 100.

Table 2.1 Descriptive Statistics of Variables

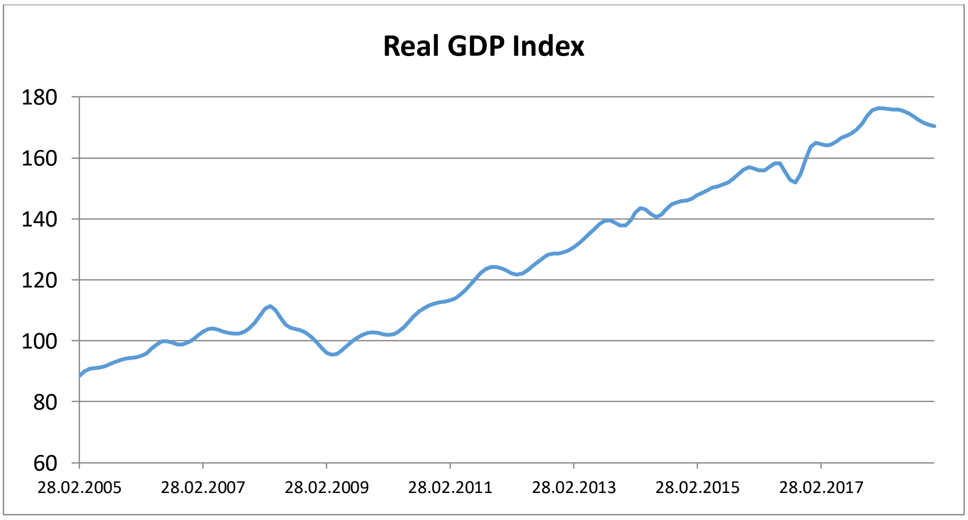
Variables	Parameters	Mean	Std. Dev.	Minimum	Maximum	AC(1)	AC(12)	AC(30)
Independent	β_1	0,119	0,036	0,067	0,237	0,929	0,512	0,093
	β_2	-0,003	0,03	-0,088	0,118	0,791	0,319	-0,078
	β_3	0,03	0,055	-0,057	0,296	0,772	0,329	-0,041
Dependent	ipi	83,64	19,59	50,45	130	0,892	0,773	0,445
	rgdp	127,28	26,94	88,43	176,38	0,985	0,783	0,486
	bist	63.687	23.066	24.114	116.815	0,976	0,609	0,416
	cpi	212,12	70,8	114,51	401,27	0,973	0,72	0,419

Note that we apply DNS model using monthly yield data 2005:02–2018:12 by fixing λ to 0,897 and we present descriptive statistics for the three estimated factors β_1, β_2 and β_3. The last three columns contains sample autocorrelations at displacements of 1, 12, and 30 months.

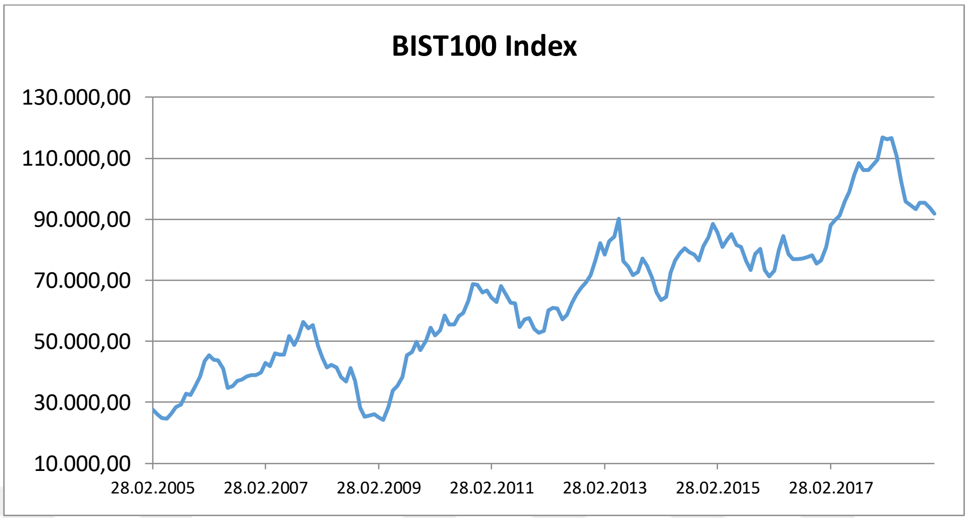
Graph 2.2 Time Series of Dependent Variables



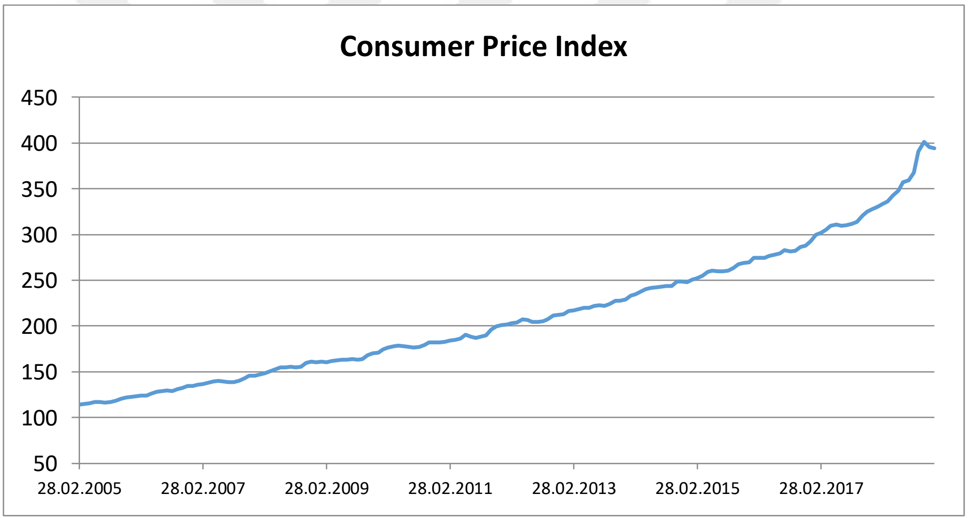
Graph 2.2.a illustrates graphical representation of Industrial Production Index between 02:2005 and 12:2018.



Graph 2.2.b illustrates graphical representation of real GDP Index between 02:2005 and 12:2018.
Data is seasonally adjusted during transformation of data from quarterly to monthly via cubic spline method.



Graph 2.2.c illustrates graphical representation of BIST100 Index between 02:2005 and 12:2018.



Graph 2.2.d illustrates graphical representation of Consumer Price Index between 02:2005 and 12:2018.

In addition to empirical econometric regression analysis, we also plan to apply graphical analysis in order to capture the forecasting ability of the yield curve on Turkey's recessions and bear markets by replicating the works in literature. This is why we also define recession and bear market in the data.

Rudebush and Williams (2009) defined two kinds of recession for US economy. By benefiting from definition of the National Bureau of Economic Research (2003), they defined Recession-1 (R1) as occurring any single quarter of negative real GDP growth as a recession and defined Recession-2 (R2) as occurring if there are two consecutive quarters of negative real GDP growth. Since the second definition is more popular in the literature, we also apply R2 in our works as recession. We use monthly real GDP index, calculate real GDP growth as [($rgdp_t$ – $rgdp_{t-12}$)/ $rgdp_{t-12}$] and label recessions as "shaded area" if there are two consecutive months of negative real GDP growth. **(Graph-2.4)**

> *Recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production and wholesale-retail sales. A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough. Between trough and peak, the economy is in an expansion.* (NBER, 2003)

Similarly, defining a bear market is not a trivial task because there is no consensus in the literature about how to identify them. (Perez, et. al 2014) However, most of the academics agree with the Bry–Boschan's (1971) approach of turning points of the market which are the maximum locals in the stock market index. Similarly, a bear market is characterized by a 20 percent fall or greater decline in stock prices from recent highs with widespread pessimism and negative investor sentiment in web searches. And, it generally lasts around 12 - 15 months. Therefore, we use monthly bist100 index data, calculate yearly and monthly rate of changes in the index such that [($bist_t$ – $bist_{t-12}$)/ $bist_{t-12}$] and [($bist_t$ – $bist_{t-1}$)/ $bist_{t-1}$] so as to capture local maximums and label consecutive periods of declines after maximum locals and label these "shaded areas" as if bear markets in **(Graph-2.5)**

2.3.2. Model

Our main goal in the empirical analysis is to test whether the shape of the estimated yield curve could forecast the macroeconomic indicators of Turkey, or not. Therefore, it is clear that representatives of yield curve, namely level (β_1), slope (β_2) and curvature (β_3), will be used as independent variables and macroeconomic indicators, namely real GDP index, industrial production index, bist100 index and consumer price index, will be used as dependent variables in the multiple regression analysis.

Just remind that since industrial production index and real GDP index has seasonal effect, their data are seasonally adjusted by using moving average methodology of Eviews. However, bist100 index and consumer price index do not have seasonal effect problem, so their data are not seasonally adjusted. See the graphs of seasonally adjusted dependent variables in **Appendix G.1.** Besides, since the variables do not have similar demonstration, that's mean some are indexes and some are just numerical values, we get logarithm of all dependent variables in order to make elasticity interpretation to the results. See the graphs of logarithm forms of variables in **Appendix G.2**.

Now, before we construct the models, we need to know whether the variables have a unit root or not. If they have, the model will be constructed accordingly. Therefore, Augmented Dickey-Fuller (ADF) unit root test statistics of variables are presented. **(Table 2.2)** ADF test with "0" lag length shows that only the second and third parameters of DNS (namely slope and curvature) and logarithm of industrial production index (Lipi) may be stationary series because others have a unit root. Details of the unit root tests can be found in **Appendix G.3.**

Table 2.2 Unit Root Test Results of Variables

Variables	Parameters	Lag Length Fixed	No Trend and Intercept[1]	With Intercept[2]	With Trend and Intercept[3]	Status
Independent	Level	0	(***) -15,181	(***) -15,138	(***) -15,106	I(1)
	Slope	0	(***) -3,757	(***) -3,764	(**) -3,941	I(0)
	Curvature	0	(***) -4,153	(***) -4,665	(***) -4,812	I(0)
Dependent	Lipi[4]	0	0,633	-2,044	(***) -6,394	I(0)
	Lrgdp[4]	0	(***) -4,067	(***) -4,338	(***) -4,322	I(1)
	Lbist[4]	0	(***) -9,629	(***) -9,709	(***) -9,714	I(1)
	Lcpi	0	(***) -6,799	(***) -9,719	(***) -9,792	I(1)

Variables	Parameters	Lag Length Fixed	No Trend and Intercept[1]	With Intercept[2]	With Trend and Intercept[3]	Status
Independent	Level	4	(***) -5,315	(***) -5,296	(***) -5,287	I(1)
	Slope	4	(***) -6,244	(***) -6,254	(***) -6,501	I(1)
	Curvature	4	(***) -2,799	(**) -3,088	-2,856	I(0)
Dependent	Lipi	4	(***) -6,531	(***) -6,858	(***) -6,838	I(1)
	Lrgdp	4	(***) -5,150	(***) -6,683	(***) -6,661	I(1)
	Lbist	4	(***) -4,398	(***) -4,477	(***) -4,490	I(1)
	Lcpi	4	(**) -2,235	(***) -5,471	(***) -5,659	I(1)

Variables	Parameters	Lag Length Automatic[0]	No Trend and Intercept[1]	With Intercept[2]	With Trend and Intercept[3]	Status
Independent	Level	3	(***) -6,282	(***) -6,261	(***) -6,255	I(1)
	Slope	2	(***) -11,258	(***) -11,245	(***) -11,493	I(1)
	Curvature	0	(***) -4,153	(***) -4,665	(***) -4,812	I(0)
Dependent	Lipi	0	(***) -28,620	(***) -28,828	(***) -28,744	I(1)
	Lrgdp	9	(**) -2,349	(**) -3,149	-3,11	I(1)
	Lbist	0	(***) -9,629	(***) -9,709	(***) -9,714	I(1)
	Lcpi	5,1,1	-1,592	(***) -9,707	(***) -9,899	I(1)

(***) denotes significance level at 1% percent; (**) denotes significance level at 5% percent; (*) denotes significance level at 10% percent.

0 Automatic - based on Schwarz Info Criterion (SIC), max lag=13

1 The MacKinnon critical values for rejection of hypothesis of a unit root are -2,579 at the %1 level, -1,943 at the %5 level and -1,615 at the %10 level.

2 The MacKinnon critical values for rejection of hypothesis of a unit root are -3,470 at the %1 level, -2,879 at the %5 level and -2,576 at the %10 level.

3 The MacKinnon critical values for rejection of hypothesis of a unit root are -4,014 at the %1 level, -3,437 at the %5 level and -3,143 at the %10 level.

4 Although industrial production, real GDP and BIST100 indexes have structural breaks in 2008-2009 financial crises, we do not apply breakpoint unit root test.

There are several options in order to decide the model. First of all, we can construct our model with stationary series (2.3.1). Since we will also examine the forecasting performance of yield curve on recession and bear market graphically, that model would be sufficient. Besides, we can see the effect of "level" parameter on industrial production index by applying Autoregressive Distributed-Lagged model (ARDL) (2.3.2). ARDL model's success arises from the fact that cointegration of nonstationary series is equivalent to an error correction (EC) process, and the ARDL model has a reparametrization in the EC form. (Engle and Granger, 1987; Hassler and Wolters, 2006) The existence of a long-run / cointegrating relationship can be tested based on the EC form. A "bounds testing" procedure is available to draw conclusive inference without knowing whether the variables are integrated of order zero or one, I(0) or I(1). (Paseran and Shin, 1999 and Pesaran, et. al. 2001)

$$\log(ipi_t) = \beta_0 + \beta_1\, slope_t + \beta_2\, curvature_t + \varepsilon_t \qquad (2.3.1)$$

$$\log(ipi_t) = \beta_0 + \beta_i \textstyle\sum_1^i lipi_{t-i} + \beta_{i+1}\, level_t + \beta_{i+2}\, slope_t + \beta_{i+3}\, curvature_t + \varepsilon_t \qquad (2.3.2)$$

Secondly, we can take the first difference of all non-stationary series and continue with all stationary series to the model. (2.3.3) However, these models only give us a chance for evaluations on rate of change from one month to the next. Hence, how much these models could be accepted as effective for discussing the forecasting performance of the yield curve regarding macroeconomic indicators are another discussion topic. However, the models 2.3.3 are not spurious regression at least.

$$dlog(rgdp_t) = \beta_0 + \beta_1\, dlevel_t + \beta_2\, dslope_t + \beta_3\, dcurvature_t + \varepsilon_t \qquad (2.3.3.a)$$

$$dlog(bist_t) = \beta_0 + \beta_1\, dlevel_t + \beta_2\, dslope_t + \beta_3\, dcurvature_t + \varepsilon_t \qquad (2.3.3.b)$$

$$dlog(cpi_t) = \beta_0 + \beta_1\, dlevel_t + \beta_2\, dslope_t + \beta_3\, dcurvature_t + \varepsilon_t \qquad (2.3.3.c)$$

Let us apply all these models and evaluate the results in the next section under Empirical Analysis.

2.4 FORECASTING RESULTS

In this section, we plan to analyze the graphs' visual elements and the results which are obtained via multiple regression analysis and their significance tests. After the evaluations, we will conclude whether term spread or independent variables that represent Turkey's yield curve forecast Turkish macroeconomic indicators, namely recession, bear market, industrial production index, real GDP index, bist100 index and inflation rate, or not.

2.4.1. Graphical Analysis

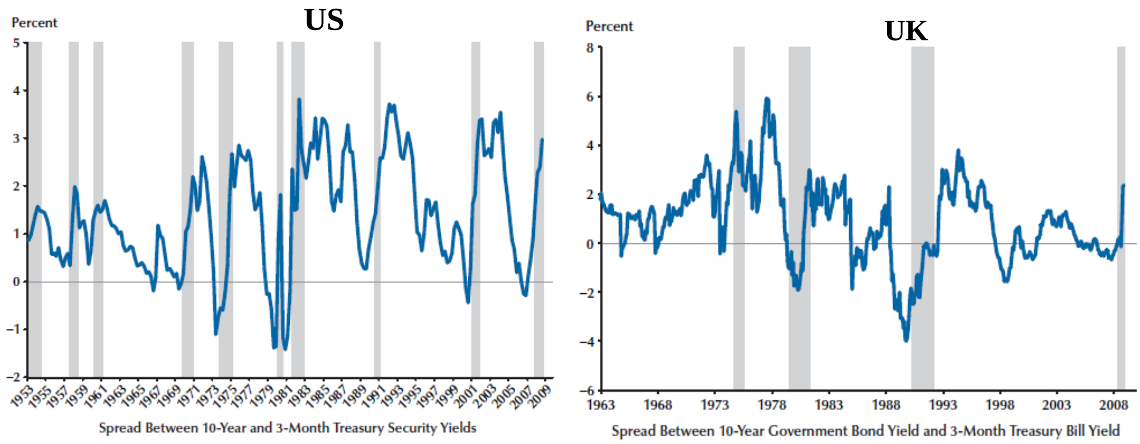
Recession

Many academics proved both graphically and empirically the forecasting power of yield curves on recessions. They mainly applied term spread, i.e. difference of return between the long-run and short-run of the yield curve, as an explanatory variable for forecasting recessions. It is normally expected that securities which have longer time to maturity should have a higher interest return than securities which have shorter time to maturity. The idea behind this rational expectation is that long-term includes more uncertainty than short-term and this is why it should be rewarded with a higher return.

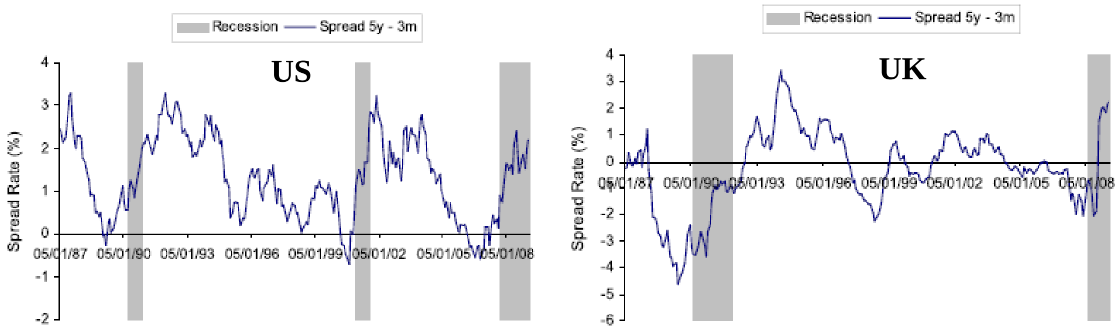
However, when the term spread (e.g. $y_t(60)$ - $y_t(3)$) turns into negative numbers, it tells sudden increases in the short term interest rates of the economy that means a problem is expected in the short-run. Not only it pushes the economy into recession, but also it may high probably turn into a severe economic crisis. Therefore, shape of the yield curve can give important clues about recessions. And, remind that there is a high correlation (corr (β_2, S_t) = -0.96) between the slope parameter (β_2) of estimated yield curve and slope [$y_t(60) – y_t(3)$] for our case discussed in the section 2.2.

Wheelock and Wohar (2009) graphically proved how the term spread between 10-years and 3-months treasury security yields predicts most of the recessions in the US, German and UK economies. Argyropoulos and Tzavalis (2016) attempted similar graphical representation by using the term spread between 5-years and 3-months treasury security yields. Both of them graphically proved that several recessions were preceded by an inversion of the yield curve. In other words, negative term spread is an early warning signal for an economic crises or recession. **(Graph-2.3)**

Graph 2.3 US/UK Term Spread and Recessions



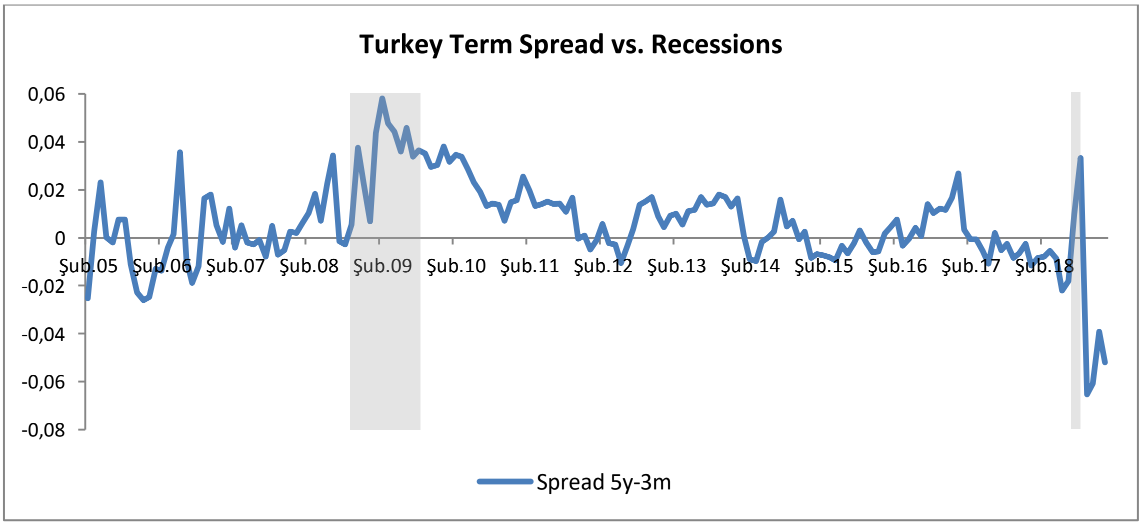
The graphs are directly taken from the works of Wheelock and Wohar (2009). Note that the term spread is calculated as the difference between the yields on 10-year and 3-month Treasury securities. The shaded areas denote recessions as determined by the National Bureau of Economic Research and Economic Cycle Research Institute respectively.



The graphs are directly taken from the works of Argyropoulos and Tzavalis (2016).

Both works graphically show that if 10/5-years treasury security yields are less than 3-months treasury bill yields (i.e. there is a negative term spread), a recession will be experienced in the near future. In other words, whenever term spread fell below "0", both economies subsequently experienced recession. Although there are some exceptions for UK economy in both scholars' works, negative term spread can definitely be called as an early warning for most of US recessions. We also apply similar methodology in order to forecast Turkey's recessions. Since we tell about how the data of term spread and recessions obtained in the previous parts, we directly present the graphical representation for Turkey. **(Graph-2.4)**

Graph 2.4 Turkey Term Spread and Recessions



Graph 2.4. plots Turkey term spread between 5-years Treasury bonds' yields and 3-months Treasury bills' yields and defined recessions with shaded areas.

Turkey's graphical representation is similar to UK's results in the mentioned works. I mean that unlike US results, all negative term spreads do not imply a recession in

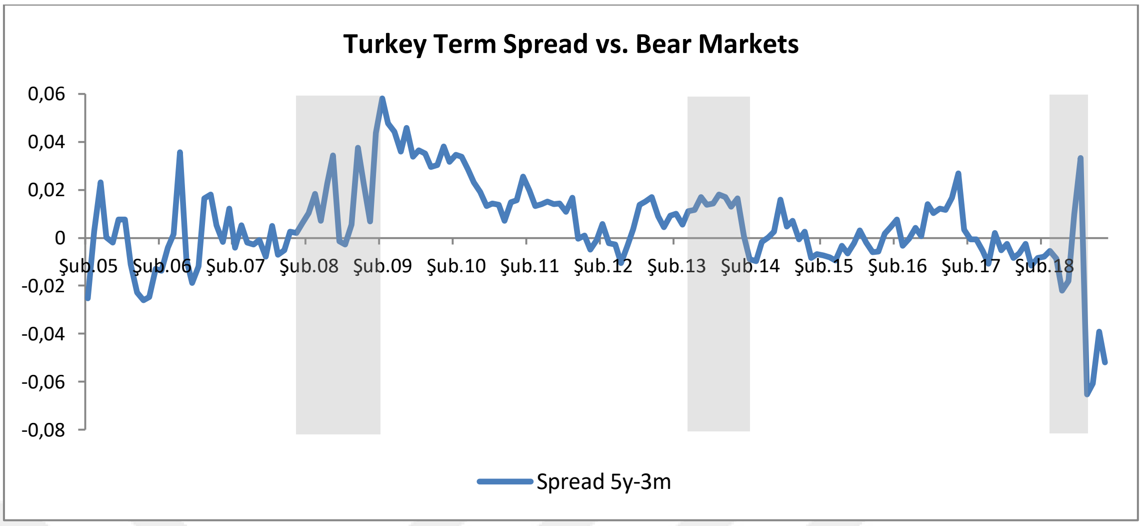
Turkey. On the other hand, some negative term spreads are followed with a recession as well similar to UK case. First of all, after negative term spread was experienced in July 2008, it was immediately followed by a recession. Secondly, after negative term spread was experienced in February 2017 and dramatized in May 2018, a recession begun in the same period. When we consider the increasing trend of the negative term spread in the last quarter of 2018, we can argue that the current economic crisis will dramatically continue for a while.

Bear Market

Since the yield curve gives early warnings about economic crisis, it can be applied as an important technical tool in order to forecast bearish turnovers in the stock market with the same logic. While there is an economic crisis or recession in a country, the stock market can not be expected to perform successfully. As mentioned in the section 2.1, Shiu-Sheng Chen (2009) found that term spread is one of the most useful forecaster of recessions in the US stock market according to both in-sample and out-of-sample performance. According to Resnick and Shoesmith (2002), the term spread is a reliable mechanism so as to predict bear stock markets. Similarly, Perez et. al. (2014) applied a probit model and concluded that the slopes of US and European yield curves have some notions that assist to forecast the probability of bear markets.

We compare Turkey's term spread and bearish turnovers by applying similar perspective with the previous section. **(Graph-2.5)** According the definitions that are mentioned in the section 2.3.1, Turkey experienced 3 bearish turnovers and they lasts around 12 months in February 2005 - December 2018 era. Similar to the findings of the recession section, 2 bearish turnovers in March 2008 and June 2018 started just after negative term spreads experienced in the security market. This is a good indicator for understanding the forecasting performance of Turkey yield curve about bearish turnovers as well. Although no negative term spread was experienced just before another bear market started in June 2013, this exception can be easily explained with the political turmoil in Turkey started with the Gezi Park Resistance in June 2013.

Graph 2.5 Turkey Term Spread and Bear Markets



Graph 2.5. plots Turkey term spread between 5-years Treasury bonds' yields and 3-months Treasury bills' yields and defined bearish turnovers.

Therefore, we can conclude that the term spread or slope parameter (β_2) extracted from the estimated yield curve of Turkey can be a good predictor for recessions and bear markets in Turkey.

2.4.2. Empirical Analysis

Industrial Production Index

If the yield curve has some clues regarding recessions and turning points in the stock market, it is not surprising to empirically analyze forecasting capability of the yield curve regarding Turkey's industrial production, real GDP and bist100 indexes. Recession or bearish stock market may inevitably end with low industrial production index, negative growth rate and poor performance of stock exchange. For example, Mehl (2009) proved a relationship between changes in slope of the yield curve and industrial production growth in many emerging economies.

As discussed in the section 2.3.2, let us first start our empirical analysis with stationary series' model (2.3.1). Name or explanations of all variables in statistical program can be found in **Appendix H**. In addition, details of all supporting regression analysis exist in **Appendix I**.

$$\log(ipi_t) = 4{,}47 + 3{,}91\, slope_t - 1{,}82\, curvature_t + \varepsilon_t \quad (2.3.1)$$

Table 2.3 Regression Results of Model 2.3.1

Variable	Coefficient	Std. Error	t-stat	Prob.
slope	3,905	0,587	6,657	0,0000
curvature	-1,815	0,323	-5,607	0,0000
c	4,466	0,019	238,714	0,0000

observations: 167 ; Adjusted R-squared: 0,229 ; Prob(F-stat): 0,0000

According to the regression results in **Table 2.3**, both slope and curvature variables are statistically significant. Although the model has a low adjusted R-squared, it is still significant as a whole with low prob(F-stat). However, results seem nonsense such that if slope is increased by 1 unit, we expect industrial production index of Turkey to increase by 391 percent. Remind that there is a strong negative correlation between slope (β_2) parameter of estimated yield curve and term spread ($y_t(60)$ - $y_t(3)$). Therefore, it is not surprising to find a statistically significant relationship between yield curve's slope and industrial production index. On the other hand, we need to eliminate meaningless results.

Therefore, let us apply Autoregressive Distributed-Lagged (ARDL) model (2.3.2) in order to see the effect of "level" parameter on industrial production index as well. Although "level" (β_1) parameter of estimated yield curve is a non-stationary series, we will try to cointegrate stationary and non-stationary series via ARDL.

Pesaran et al. (2001) develops a new approach (ARDL test) to the problem of testing the existence of a level relationship between a dependent and independent variables when it is not known with certainty whether the underlying regressors are trend or first-difference stationary. The basic steps in the ARDL test are:

- Identify the model
- Use F-test to evaluate the null and alternative hypothesis such that
    - $H_0 : \beta_i = \beta_{i+r} = 0$ (There is no long run relationship)
    - $H_1 : \beta_i$ and $\beta_{i+r} \neq 0$ (There is long run relationship)

- And, compare the F-statistics with the critical values. (If the F-statistics fall above the upper critical value, then the series are cointegrated. If the F-statistics fall below the lower bound critical value, then there is no cointegration.)

$$\log(ipi_t) = 0{,}18 + \beta_i \sum_1^i lipi_{t-i} - 0{,}34\, level_t - 0{,}1\, slope_t + 0{,}06\, curvature_t + \varepsilon_t \qquad (2.3.2)$$

Table 2.4 Regression Results of Model 2.3.2

Model Selection Method: Akaike Info Criterion (AIC)
Case-3: Unrestricted Constant and No Trend
Selected Model: ARDL (3, 0, 0, 0)

Variable	Coefficient	Std. Error	t-stat	Prob.
lipi(-1)	0,168	0,078	2,152	0,0329
lipi(-2)	0,599	0,063	9,497	0,0000
lipi(-3)	0,201	0,078	2,581	0,0108
level	-0,338	0,129	-2,611	0,0099
slope	-0,103	0,173	-0,596	0,5521
curvature	0,058	0,101	0,576	0,5654
c	0,184	0,097	1,890	0,0606

observations: 164 after adjustments ; Adjusted R-squared: 0,951 ; Prob(F-stat): 0,0000

Both Akaike info Criterion (AIC) with maximum 11 lags and Hannan-Quinn Criterion (HQC) with maximum 12 lags select the optimal model as ARDL (3, 0, 0, 0). The model shows that "level" parameter of the estimated yield curve is the only significant variable so as to forecast industrial production index of Turkey.

However, according to F-Bounds Test of both AIC and HQC in **Appendix I.2**, F-stat (that is found as 2,082) is below each reported critical values, so we fail to reject that there is no long-run relationship. In other words, since the F-statistics fall below the lower bound critical value, there is no level relationship (cointegration) among the variables. Therefore, although level (β_1) parameter, that represents the long-term factor (e.g. $y_t(60)$ or $y_t(120)$) of the estimated Turkey's yield curve, is statistically significant, it will not be accurate to interpret the results of this equation between the level and industrial production index. And, since there is no long-run relationship, we do not look for short-run relationships among variables as well.

Real GDP Index

As a result of works carried out with the mentioned logic in the recession section of the graphical analysis, Moench (2012) found a relationship between the changes in the shape of the yield curve and US output. We will look for similar results for Turkey's case as well.

Since logarithm of real GDP index is non-stationary in Table 2.2, we also take the first difference of level, slope and curvature series in order to make regression analysis. Hence, we will apply the model (2.3.3.a) such that

$$dlog(rgdp_t) = 0,004+0,09\,dlevel_t+0,07dslope_t+0,02\,dcurvature_t+ \varepsilon_t \qquad (2.3.3.a)$$

Table 2.5 Regression Results of Model 2.3.3.a

Variable	Coefficient	Std. Error	t-stat	Prob.
dlevel	0,088	0,072	1,216	0,2258
dslope	0,069	0,054	1,272	0,2053
dcurvature	0,017	0,019	0,909	0,3647
c	0,004	0,001	5,617	0,0000

observations: 166 after adjustments ; Adjusted R-squared: 0,000 ; Prob(F-stat): 0,5018

According to the regression results in **Table 2.5**, first difference of level, slope and curvature variables are statistically insignificant. Besides, the model has "0" adjusted R-squared and the model as whole is insignificant as well with high prob(F-stat). Therefore, it is not logical to interpret any relationship between dlrgdp and dlevel / dslope / dcurvature parameters.

BIST100 Index

Similarly, since logarithm of bist100 index is non-stationary according to Table 2.2, we also take the first difference of level, slope and curvature in order to make regression analysis. Hence, we will apply the model (2.3.3.b) such that

$$dlog(bist_t) = 0,01 - 1,97\,dlevel_t - 1\,dslope_t - 0,45\,dcurvature_t + \varepsilon_t \qquad (2.3.3.b)$$

Table 2.6 Regression Results of Model 2.3.3.b

Variable	Coefficient	Std. Error	t-stat	Prob.
dlevel	-1,972	0,479	-4,117	0,0001
dslope	-0,997	0,36	-2,772	0,0062
dcurvature	-0,452	0,129	-3,504	0,0006
c	0,008	0,005	1,651	0,1006

observations: 166 after adjustments ; Adjusted R-squared: 0,129 ; Prob(F-stat): 0,0000

Unlike regression results of the previous section, we detect statistically significant variables and model. According to the regression results in **Table 2.6**, first difference of level, slope and curvature variables are statistically significant. Although the model has a low adjusted R-squared, it is still significant as a whole with the low prob(F-stat). Therefore, the relationship between the variables can be interpreted.

Let us also apply Granger causality test in order to statistically clarify the direction of causality between variables. According to Granger causality test results **(Table 2.7)**, level causes changes in bist100 index, yet bist100 index does not cause changes in level parameter (one-way causality). Besides, there is no granger causality relationship between bist100 index and slope/curvature parameters.

Table 2.7 VAR Granger Causality Test Results (BIST100 Index)

Dependent Variable: **dlog(bist)**

Excluded	Chi-sq	df	Prob.
dlevel	13,953	2	0,0009
dslope	3,121	2	0,2100
dcurvature	3,809	2	0,1489
All	18,024	6	0,0062

Dependent Variable: **dlevel**

Excluded	Chi-sq	df	Prob.
dlog(bist)	0,526	2	0,7686
dslope	0,906	2	0,6357
dcurvature	2,542	2	0,2806
All	3,735	6	0,7124

Accordingly, as the transition from one month to the next, 1 percent unit increase in level parameter has a negative impact on the bist100 index of 2 percent. It is also an intuitive result such that if interest rates begin to increase, the opportunity cost of investing in stock exchange will rise and bist100 index will decline with decreasing demand for stocks. To sum up, we can conclude that shape of estimated Turkey's yield curve has some information regarding the changes in the bist100 index.

Consumer Price Index

As we discussed before, the negative term spread implies higher interest return for shorter-term of maturities. And, it should be possible with a monetary expansion or expectation for losing money's nominal value in the near future. Arturo Estralla (2005) comfirmed that the slope of the US yield curve has predictive power about inflation in most cases. Mehl (2009) also found that the slope of the yield curve has information content for future inflation in almost 14 emerging economies. Kaya (2013) used estimated level, slope and curvature factors and concluded that there is a high correlation between the level factor of Turkish yield curve and inflation rate. Therefore, we will lastly test the forecasting performance of estimated Turkey's yield curve for inflation.

Since logarithm of consumer price index is non-stationary in Table 2.2, we also take the first difference of level, slope and curvature series in order to make regression analysis. Hence, we will apply the model (2.3.3.c) such that

$$dlog(cpi_t) = 0{,}01 + 0{,}21\, dlevel_t + 0{,}26\, dslope_t + 0{,}02\, dcurvature_t + \varepsilon_t \qquad (2.3.3.c)$$

Table 2.8 Regression Results of Model 2.3.3.c

Variable	Coefficient	Std. Error	t-stat	Prob.
dlevel	0,207	0,069	3,018	0,0030
dslope	0,264	0,052	5,121	0,0000
dcurvature	0,015	0,018	0,790	0,4307
c	0,007	0,001	11,112	0,0000

observations: 166 after adjustments ; Adjusted R-squared: 0,126 ; Prob(F-stat): 0,0000

We detect statistically significant variables and model again. According to the regression results in **Table 2.8**, first difference of level and slope parameters are statistically significant. Although the model has a low adjusted R-squared, it is still significant as a whole with the low prob(F-stat). Therefore, the relationship between them can be interpreted.

Let us also apply Granger causality test in order to statistically clarify the direction of causality between variables. According to Granger causality test results **(Table 2.9)**, level and slope parameters cause changes in consumer price index, yet CPI does not cause changes in level and slope parameters (one-way causality).

Table 2.9 VAR Granger Causality Test Results (CPI)

Dependent Variable: **dlog(cpi)**

Excluded	Chi-sq	df	Prob.
dlevel	25,025	4	0,0000
dslope	8,7	4	0,0690
dcurvature	4,926	4	0,2949
All	43,736	12	0,0000

Dependent Variable: **dlevel**

Excluded	Chi-sq	df	Prob.
dlog(cpi)	3,332	4	0,5039
dslope	4,053	4	0,3989
dcurvature	0,845	4	0,9324
All	8,39	12	0,7539

Dependent Variable: **dslope**

Excluded	Chi-sq	df	Prob.
dlog(cpi)	2,279	4	0,6845
dlevel	1,428	4	0,8394
dcurvature	32,04	4	0,0000
All	43,483	12	0,0000

Accordingly, as the transition from one month to the next, 1 percent unit increase in level parameter has a positive impact on the consumer price index of 2 per thousand. It is also an intuitive result such that if interest rates begin to increase in longer term-to-maturities, Turkish lira will devalue. And, expectation of losing money's nominal value in future will end with a higher inflation rate. Similarly, as the transition from one month to the next, 1 percent unit increase in slope parameter has a positive impact on the consumer price index of 3 per thousand. To sum up, we can conclude that level and slope parameters of the estimated Turkey's yield curve has some clues regarding the changes in the consumer price index.

2.5 CONCLUSION OF CHAPTER 2

There are lots of studies in the literature which focused on the relationship between the shape of the yield curve and macroeconomic indicators. These studies' primary goal is to forecast recessions, bear markets, real GDP growth, inflation rate, etc. Although this attempts can be found suspicious and nonsense by considering the forms of efficient market hypothesis, most of them are quite successful to find a statistically significant relationship.

After we complete our studies on the estimation of Turkey's yield curve and extracted related level (β_1), slope (β_2), curvature (β_3) and term spread (y_t(5-year) - y_t(3-month)) parameters in the first chapter of the thesis, we accept them as the representatives of the shape of the estimated Turkey's yield curve. Then, we define the recessions and bear markets in Turkey and also apply a wide variety of dependent variables such as recession, bear market, industrial production index, real GDP index, bist100 index and consumer price index. Similar to the works in literature, our primary goal in this section is to determine the relationship between the shape of the yield curve and the mentioned data and to measure prediction ability of the estimated yield curves on macroeconomic indicators.

We apply both graphical and empirical analysis. Firstly, we graphically show the relationship between Turkey's defined recessions and bear markets and term spread which is defined as difference of return between 5-year and 3-month of the yield curve. Later on, we apply empirical analysis and try to forecast Turkey's industrial production index, real GDP index, bist100 index and consumer price index by using level (β_1), slope (β_2) and curvature (β_3) parameters of the estimated yield curve.

According to our results, we graphically prove that term spread, which is extracted from the difference of 5-year and 3-month of the estimated Turkey's yield curve, can predict Turkey's recessions and bear markets. The graphs indicate that Turkey's security market experienced negative term spreads on the eve of all recessions and bear markets.

Empirically, several regressions based on unit root test results are run. Accordingly,

- First difference of level (β_1) series may have forecasting capability regarding changes from one period to another in bist100 index.
- First difference of level and slope series may predict changes from one period to another in consumer price index of Turkey.

In conclusion, we obtain similar results with the literature such that estimated Turkey's yield curve has the ability to forecast performance of Turkish economy in Chapter-2 of the thesis.

CONCLUSIONS

In the thesis, we study on yield curve that is a representation of interest rates of treasury bonds in different maturities.

In Chapter-1 of the thesis, we estimate Turkey yield curve for sovereign bond market in 2005-2018 by using Extended Nelson-Siegel and Dynamic Nelson-Siegel models. As a result of estimation via two methodologies, we conclude that Dynamic Nelson-Siegel model estimates Turkey yield curve slightly better than the Extended Nelson-Siegel model by comparing their sum of square deviations between theoretical prices and dirty prices of securities. Although the sum of square deviation is 129,2 in ENS methodology for 167 observations, the sum is 101,3 for DNS methodology. In the meantime, yields estimated via both ENS and DNS by using optimization technique underestimate the actual values. Therefore, OLS (Ordinary Least Square) is better methodology than optimization tools in DNS because running a standard optimization technique could not achieve complete price equality between theoretical and realized dirty prices as a result of local minima problem.

Yield curve that reflects the interest expectations of market participants is one of the cornerstones of the financial analysis because it can be used as a technical device in order to forecast performance of the economy. **In Chapter-2 of the thesis**, we simply measure the forecasting capability of the estimated Turkey yield curve on Turkish recessions, bear market, real GDP, industrial production, bist100 and consumer price indexes. We apply term spread and level (β_1), slope (β_2) and curvature (β_3) parameters as independent variables, that represent yield curves, are extracted via Diebold&Li's (2006) OLS methodology.

Graphically, we conclude that the term spread or slope parameter (β_2) extracted from the estimated yield curve of Turkey can be a good predictor for recessions and bear markets in Turkey. Some negative term spreads are followed with a recession and bear markets.

Empirically, we found several relationships such that

- There is a significant relationship between the first difference of level parameter and bist100 index.
- First difference of level and slope series may have important clues regarding the changes in the consumer price index.

We question what all these studies contribute to the literature or academia of Turkey. Using our own estimated yield curves that created via the most contemporary Turkish data and combining all forecasting results of Turkish macroeconomic indicators in a single thesis make our work as a large-scale guide that can be applied in this field. Therefore, we firmly believe that the thesis will contribute to the literature about yield curve estimation and forecasting performance of Turkish economy.

The models, which estimate the yield curve, can be still developed. Besides, more qualified forecasting models can be also applied for regression analysis. Therefore, I hope that more comprehensive works, which are inspired by the thesis, are combined in a forecasting tool that guides investors about the course of economy.

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CURRICULUM VITAE

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Name Surname	: Teoman Samet TEMUÇİN
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Education

Graduate Education	: Ph.D in *Finance and Banking* *Kadir Has University* English; GPA: **3.71 / 4**; graduation: June 2019
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Center of Interests

Finance and Banking; Yield Curves; Forecast; Audit; Macroeconomics and Monetary Economics; Political Economy

Teaching Experience

- Teaching Assistant, *Mathematics for Economics*, Bogaziçi University, Fall 2010
- Teaching Assistant, *Macroeconomics*, Bogaziçi University, Spring 2010

Work Experience

- Auditor (July 2012 - ….)
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Awards and Honors

- TUBITAK Success Scholarship, 2014-2019
- Kadir Has University, Merit Based Scholarship, 2014-2019
- High Honorary Degree, Bogazici University, June 2012
- Ranked 207th out of 1,5 mio candidates in the university entrance exam of Turkey, 2007
- High Honorary Degree, Kadir Has Anatolian High School, 2007
- Honorary Degree, Mathematics Olympiads, Sabancı University, 2006

Certificates

- Various Seminars on Leadership and Communication Skills, 2012-2019
- TOEFL (English Language Certificate), Score: 99 / 120, March 2018
- Amateur Seaman's Certificate, Ministry of Transport, Maritime Affairs and Communications, August 2017
- One Star Diver, Turkish Underwater Sports Federation, May 2017
- Credit Rating License, Capital Markets Board of Turkey, March 2017
- Corporate Governance Rating License, Capital Markets Board of Turkey, March 2017
- Derivative Instruments License, Capital Markets Board of Turkey, March 2015
- Capital Market Activities Level 3 License, Capital Markets Board of Turkey, March 2015
- Web Design Certificate, ISMEK, June 2013
- Russian Intermediate Language Certificate, the Russian Education, Culture and Cooperation Association, September 2009

Skills

- Computer: Proficient use of MS Word, Excel, and Powerpoint
- Statistical computing: E-Views
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APPENDICES

Appendix A. ENS Estimation Results of GRG NonLinear Methodology

Table A.1 ENS Estimation Results of GRG NonLinear Methodology

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
28.02.2005	0.16818	0.16698	0.16518	0.1616	0.15802	0.15445	0.1509	0.14734	0.1438	0.1403	0.13675	0.1332	0.12973	0.1262	0.12275	0.1193	0.11581	0.11236	0.10891	0.10547	0.102	0.0986	0.171531	-0.00275	-51.4569	8636.983	957.2069	219480.1	0.29
31.03.2005	0.17299	0.17209	0.17073	0.168	0.16533	0.16264	0.16	0.15729	0.1546	0.152	0.14933	0.1467	0.14406	0.1414	0.13883	0.1362	0.13363	0.13104	0.12846	0.12589	0.1233	0.1208	0.176199	-0.00275	-50.3761	8725.257	991.3849	218465.5	3.26
29.04.2005	0.17594	0.17531	0.17436	0.1725	0.17057	0.1687	0.1668	0.16496	0.1631	0.1613	0.15943	0.1576	0.15579	0.154	0.15217	0.1504	0.14859	0.14682	0.14505	0.14329	0.1415	0.1398	0.179026	-0.00277	-49.5458	9030.273	983.5197	211276.3	4.90
31.05.2005	0.1667	0.16559	0.16393	0.1606	0.15734	0.15407	0.1508	0.1476	0.1444	0.1412	0.13806	0.1349	0.13181	0.1287	0.12564	0.1226	0.11955	0.11654	0.11354	0.11057	0.1076	0.1047	0.170087	-0.00283	-48.4162	11183.57	616.6475	171641	2.72
30.06.2005	0.15855	0.15776	0.15658	0.1542	0.15193	0.14964	0.1474	0.1451	0.1429	0.1407	0.13846	0.1363	0.13413	0.132	0.12988	0.1278	0.12571	0.12366	0.12162	0.11961	0.1176	0.1156	0.161775	-0.00283	-47.774	11319.89	624.8426	168990.6	1.82
29.07.2005	0.15834	0.15773	0.15681	0.155	0.1532	0.15143	0.1497	0.14795	0.1462	0.1445	0.14287	0.1412	0.13958	0.138	0.13637	0.1348	0.13324	0.13171	0.13019	0.1287	0.1272	0.1258	0.161479	-0.00283	-47.5607	11366.16	627.6436	166174.4	1.99
31.08.2005	0.15768	0.15717	0.15641	0.1549	0.15342	0.15195	0.1505	0.14908	0.1477	0.1463	0.14491	0.1436	0.14223	0.1409	0.13963	0.1384	0.13711	0.13587	0.13466	0.13347	0.1323	0.1311	0.160775	-0.00283	-47.3256	11418.97	630.7313	165774.6	1.69
30.09.2005	0.15063	0.14967	0.14823	0.1454	0.14254	0.13972	0.1369	0.13415	0.1314	0.1287	0.12596	0.1233	0.12061	0.118	0.11534	0.1127	0.11015	0.10759	0.10505	0.10253	0.1	0.0976	0.153951	-0.00284	-47.9921	11848.01	609.8434	176501.2	0.81
31.10.2005	0.14333	0.14224	0.14061	0.1374	0.13414	0.13094	0.1278	0.12461	0.1215	0.1184	0.11528	0.1122	0.10917	0.1062	0.10316	0.1002	0.09723	0.0943	0.0914	0.08851	0.0856	0.0828	0.146714	-0.00284	-48.1796	11892.83	592.5788	174430	0.35
30.11.2005	0.14107	0.13976	0.13779	0.1339	0.12996	0.12608	0.1222	0.1184	0.1146	0.1108	0.10705	0.1033	0.0996	0.0959	0.09224	0.0886	0.08497	0.08138	0.0778	0.07425	0.0707	0.0672	0.144575	-0.00284	-48.7122	11789.99	586.0694	175258.5	0.27
30.12.2005	0.13925	0.1382	0.13662	0.1335	0.13038	0.1273	0.1242	0.12119	0.1182	0.1152	0.1122	0.1092	0.10632	0.1034	0.10053	0.0977	0.09483	0.09201	0.08921	0.08644	0.0837	0.081	0.14262	-0.00284	-48.067	11925.02	594.0409	174731.9	0.08
31.01.2006	0.13778	0.13623	0.13403	0.1301	0.12681	0.12411	0.122	0.12047	0.1195	0.1191	0.11918	0.1198	0.12095	0.1226	0.12471	0.1273	0.13036	0.13386	0.13781	0.14219	0.147	0.1522	0.142468	-0.00388	-2.13095	11389.46	23.38688	159403.1	0.11
28.02.2006	0.13917	0.13659	0.13301	0.1269	0.12199	0.11836	0.1159	0.1146	0.1144	0.1152	0.11693	0.1196	0.12326	0.1277	0.13303	0.1391	0.14593	0.15346	0.16168	0.17054	0.18	0.1901	0.144491	-0.00397	-1.34232	11588.05	12.56961	157324.7	0.66
31.03.2006	0.1387	0.13667	0.1339	0.1293	0.1258	0.12346	0.1222	0.12198	0.1227	0.1244	0.12706	0.1305	0.13485	0.14	0.14582	0.1524	0.15969	0.16764	0.17623	0.18542	0.1952	0.2055	0.143736	-0.00397	-1.32062	11442.15	13.0965	153491.4	0.42
28.04.2006	0.13914	0.13717	0.13446	0.13	0.12662	0.1244	0.1232	0.12313	0.124	0.1258	0.12849	0.132	0.13643	0.1416	0.14754	0.1542	0.16153	0.16954	0.17817	0.18741	0.1972	0.2076	0.144157	-0.00397	-1.31711	11470.02	13.12414	153657.2	0.84
31.05.2006	0.14183	0.14398	0.14702	0.1524	0.15695	0.16065	0.1635	0.16568	0.1671	0.1678	0.16782	0.1672	0.166	0.1642	0.16183	0.1589	0.15552	0.15162	0.14725	0.14244	0.1372	0.1316	0.141265	-0.00056	0.955261	-1829.65	12.94291	39154.37	0.82
30.06.2006	0.20281	0.20163	0.19987	0.1964	0.19304	0.18974	0.1865	0.18337	0.1803	0.1773	0.17438	0.1715	0.16875	0.166	0.16342	0.1609	0.15837	0.15596	0.15361	0.15134	0.1491	0.147	0.203982	-0.00058	-4.77648	1010.859	101.0978	30664.3	0.98
31.07.2006	0.18846	0.18734	0.18567	0.1824	0.17918	0.17605	0.173	0.17001	0.1671	0.1643	0.16151	0.1588	0.15621	0.1537	0.15119	0.1488	0.14646	0.1442	0.14201	0.13989	0.1378	0.1359	0.189609	-0.00058	-4.75253	1013.791	101.6206	30557.56	0.32
31.08.2006	0.1719	0.1731	0.17465	0.1769	0.17792	0.17778	0.1765	0.17402	0.1704	0.1656	0.15972	0.1527	0.14448	0.1352	0.12474	0.1132	0.10054	0.08678	0.07192	0.05597	0.0389	0.0208	0.171827	-0.00058	85.5474	-25356.1	109.1667	33031.47	0.82
29.09.2006	0.1775	0.18	0.18341	0.189	0.19308	0.19555	0.1965	0.19582	0.1936	0.1899	0.18469	0.1779	0.1697	0.16	0.14876	0.1361	0.12195	0.10636	0.08934	0.07089	0.051	0.0297	0.176764	-0.00058	64.99803	-21068.6	82.01232	27705.62	1.77

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.10.2006	0.17222	0.17475	0.17821	0.1839	0.18802	0.19052	0.1914	0.19077	0.1885	0.1848	0.17944	0.1726	0.1642	0.1543	0.14292	0.13	0.11567	0.09983	0.08254	0.0638	0.0436	0.022	0.171466	-0.00058	65.46698	-20985.3	81.66805	27286.68	1.57
30.11.2006	0.1748	0.17684	0.17957	0.1838	0.18636	0.18732	0.1867	0.18442	0.1806	0.1752	0.16819	0.1597	0.14957	0.138	0.12483	0.1102	0.09403	0.07639	0.05727	0.03668	0.0146	-0.0089	0.174291	-0.00058	66.13968	-21040.1	81.49273	26806.55	1.19
29.12.2006	0.17789	0.17966	0.182	0.1855	0.18753	0.18802	0.187	0.1845	0.1805	0.175	0.16811	0.1597	0.14989	0.1386	0.12592	0.1118	0.09628	0.07935	0.06103	0.04134	0.0203	-0.0022	0.177516	-0.00058	70.53532	-21076.8	87.13943	26810.66	0.84
31.01.2007	0.16695	0.16905	0.17191	0.1766	0.17983	0.18169	0.1822	0.18128	0.179	0.1754	0.17044	0.1641	0.1565	0.1475	0.13726	0.1257	0.11279	0.09861	0.08315	0.06641	0.0484	0.0291	0.166425	-0.00058	70.85688	-20682	91.12039	27556.6	0.78
28.02.2007	0.18489	0.18417	0.18317	0.1814	0.17991	0.17875	0.1779	0.17735	0.1771	0.1772	0.17753	0.1782	0.17915	0.1804	0.18195	0.1838	0.18592	0.18834	0.19105	0.19405	0.1973	0.2009	0.185845	-0.00058	-18.4475	5418.061	98.59869	30425.92	0.26
30.03.2007	0.17844	0.17847	0.17847	0.1783	0.17796	0.17738	0.1766	0.17562	0.1744	0.173	0.17146	0.1697	0.16772	0.1656	0.16322	0.1607	0.15798	0.15509	0.15202	0.14878	0.1454	0.1418	0.179037	-0.00063	2.726831	-822.794	45.69324	13942.39	0.32
30.04.2007	0.17502	0.17493	0.17475	0.1743	0.1736	0.17275	0.1717	0.17051	0.1691	0.1676	0.16584	0.1639	0.16188	0.1597	0.15726	0.1547	0.15198	0.14911	0.14607	0.14289	0.1395	0.1361	0.175679	-0.00063	2.863974	-784.447	50.34624	13589.41	0.26
31.05.2007	0.1666	0.16731	0.16821	0.1694	0.16994	0.16972	0.1688	0.16716	0.1648	0.1619	0.1582	0.1539	0.14896	0.1434	0.1372	0.1304	0.12303	0.11506	0.10651	0.0974	0.0877	0.0775	0.166845	-0.00063	4.759607	-1229.33	32.21219	8887.496	0.17
29.06.2007	0.16673	0.167	0.1673	0.1675	0.16717	0.16632	0.165	0.1631	0.1607	0.1579	0.15456	0.1507	0.14647	0.1417	0.13654	0.1309	0.12483	0.11831	0.11137	0.10401	0.0962	0.088	0.167193	-0.00063	4.768275	-1260.5	38.19054	10429.73	0.45
31.07.2007	0.16315	0.1632	0.16322	0.1631	0.1628	0.16228	0.1616	0.16063	0.1595	0.1582	0.15663	0.1549	0.15296	0.1508	0.14851	0.146	0.14329	0.14038	0.13729	0.13401	0.1305	0.1269	0.163749	-0.00063	11.21131	-1316.06	93.91153	11100.23	0.19
31.08.2007	0.16437	0.16472	0.16521	0.166	0.1666	0.16696	0.1671	0.16703	0.1667	0.1662	0.16552	0.1646	0.16344	0.1621	0.16054	0.1588	0.1568	0.15462	0.15225	0.14967	0.1469	0.1439	0.16481	-0.00063	11.37745	-1407.1	91.62119	11761.89	0.09
28.09.2007	0.15808	0.15808	0.15803	0.1578	0.15732	0.15664	0.1557	0.15465	0.1533	0.1518	0.1501	0.1482	0.14604	0.1437	0.14117	0.1384	0.1355	0.13237	0.12904	0.12551	0.1218	0.1179	0.158695	-0.00063	11.51144	-1410.11	93.72227	11507.04	0.23
31.10.2007	0.15117	0.15135	0.15156	0.1517	0.15158	0.15111	0.1503	0.14922	0.1478	0.1461	0.14404	0.1417	0.13905	0.1361	0.13284	0.1293	0.12544	0.12129	0.11685	0.11211	0.1071	0.1018	0.151696	-0.00063	16.86585	-2047.05	92.67591	11411.76	0.10
30.11.2007	0.15202	0.15277	0.15378	0.1554	0.15652	0.1571	0.1572	0.15671	0.1558	0.1543	0.15233	0.1499	0.14693	0.1435	0.13959	0.1352	0.13035	0.12502	0.11924	0.113	0.1063	0.0992	0.152245	-0.00063	11.3965	-2394.97	59.26948	13118.94	0.04
31.12.2007	0.15712	0.15699	0.15679	0.1564	0.15598	0.15556	0.1551	0.15472	0.1543	0.1538	0.1534	0.1529	0.15249	0.152	0.15156	0.1511	0.1506	0.15011	0.14962	0.14912	0.1486	0.1481	0.158535	-0.00135	1.992943	-465.037	231.5363	45646.82	0.20
31.01.2008	0.15066	0.15091	0.15127	0.152	0.15272	0.15343	0.1541	0.15483	0.1555	0.1562	0.15686	0.1575	0.15817	0.1588	0.15944	0.1601	0.16068	0.16129	0.16189	0.16248	0.1631	0.1636	0.151885	-0.00135	2.294215	-415.703	208.5797	51702.36	0.27
29.02.2008	0.15556	0.15584	0.15626	0.1571	0.15792	0.15874	0.1595	0.16035	0.1611	0.1619	0.1627	0.1635	0.16423	0.165	0.16573	0.1665	0.1672	0.16792	0.16863	0.16934	0.17	0.1707	0.156767	-0.00135	2.365377	-388.368	218.4972	52155.03	0.30
31.03.2008	0.17642	0.17644	0.17648	0.1765	0.1766	0.17666	0.1767	0.17675	0.1768	0.1768	0.17683	0.1769	0.17687	0.1769	0.17687	0.1769	0.17686	0.17684	0.17682	0.17679	0.1768	0.1767	0.177755	-0.00135	2.180298	-416.222	245.2921	48421.91	1.54
30.04.2008	0.17642	0.17644	0.17648	0.1765	0.1766	0.17666	0.1767	0.17675	0.1768	0.1768	0.17683	0.1769	0.17687	0.1769	0.17687	0.1769	0.17686	0.17684	0.17682	0.17679	0.1768	0.1767	0.177755	-0.00135	2.180298	-416.222	245.2921	48421.91	0.55
30.05.2008	0.17787	0.17841	0.17921	0.1808	0.1824	0.18398	0.1856	0.18711	0.1887	0.1902	0.19173	0.1933	0.19477	0.1963	0.19776	0.1992	0.20071	0.20217	0.20363	0.20507	0.2065	0.2079	0.17895	-0.00135	2.724889	-371	212.0062	57992.61	0.30
30.06.2008	0.19777	0.19804	0.19844	0.1992	0.20002	0.2008	0.2016	0.20234	0.2031	0.2038	0.20459	0.2053	0.20606	0.2068	0.20749	0.2082	0.2089	0.20959	0.21028	0.21096	0.2116	0.2123	0.198988	-0.00135	2.473733	-399.521	235.9146	54958.13	3.21
31.07.2008	0.17591	0.17565	0.17529	0.1746	0.17404	0.17354	0.1731	0.1728	0.1725	0.1724	0.17227	0.1722	0.17229	0.1724	0.1726	0.1729	0.17318	0.17357	0.17402	0.17454	0.1751	0.1758	0.178497	-0.00245	-0.39646	340.8552	27.05491	29998.68	0.40
29.08.2008	0.17197	0.17238	0.1729	0.1736	0.17398	0.17396	0.1736	0.17291	0.1719	0.1707	0.16914	0.1674	0.16539	0.1632	0.1608	0.1582	0.1555	0.15261	0.14958	0.14641	0.1431	0.1397	0.174243	-0.0025	0.178658	-177.365	8.133451	10593.05	0.18
29.09.2008	0.1787	0.17877	0.17886	0.179	0.17911	0.17915	0.1792	0.1791	0.179	0.1789	0.17869	0.1785	0.17821	0.1779	0.17757	0.1772	0.17678	0.17634	0.17586	0.17534	0.1748	0.1742	0.18119	-0.00253	0.120458	-165.271	19.39246	30396.23	0.51

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.10.2008	0.19441	0.19938	0.20618	0.2175	0.22596	0.23177	0.2351	0.23624	0.2352	0.2323	0.22758	0.2212	0.21329	0.204	0.19336	0.1815	0.16862	0.15468	0.1398	0.12407	0.1075	0.0903	0.194306	-0.00252	1.091087	-1184.74	7.397716	14145.98	0.06
28.11.2008	0.17842	0.17945	0.18092	0.1835	0.18573	0.18754	0.189	0.19003	0.1907	0.1911	0.19109	0.1908	0.19016	0.1892	0.188	0.1865	0.18471	0.18266	0.18035	0.17779	0.175	0.172	0.180408	-0.00253	0.793245	-1022.03	17.43357	31307.26	0.40
31.12.2008	0.14595	0.14715	0.14885	0.1519	0.15443	0.15651	0.1581	0.15935	0.1601	0.1605	0.16051	0.1601	0.15937	0.1583	0.15683	0.1551	0.15299	0.1506	0.14793	0.14496	0.1417	0.1382	0.147865	-0.00254	0.819982	-1054.94	16.30497	29860.85	0.19
30.01.2009	0.11251	0.1163	0.12162	0.131	0.13886	0.14517	0.15	0.15347	0.1556	0.1564	0.15604	0.1545	0.15182	0.1481	0.14331	0.1376	0.13089	0.12332	0.11489	0.10565	0.0956	0.0849	0.113101	-0.00255	1.757456	-2185.65	13.00202	24936.88	0.17
27.02.2009	0.10916	0.11407	0.121	0.1333	0.14356	0.15195	0.1585	0.16337	0.1666	0.1682	0.1684	0.1672	0.16458	0.1607	0.15567	0.1495	0.14216	0.13382	0.12449	0.11423	0.1031	0.0911	0.109163	-0.00255	1.727845	-2326.08	11.42702	25975.57	0.65
31.03.2009	0.11071	0.11353	0.11758	0.1251	0.13174	0.13764	0.1428	0.1472	0.1509	0.1539	0.1563	0.158	0.15914	0.1596	0.15957	0.1589	0.15776	0.15606	0.15385	0.15116	0.148	0.1444	0.11182	-0.00255	1.556139	-2002.37	17.39046	36619.31	0.09
30.04.2009	0.08691	0.09084	0.09638	0.1063	0.11461	0.12147	0.1269	0.13096	0.1337	0.1352	0.13556	0.1347	0.13282	0.1299	0.12588	0.121	0.11511	0.10839	0.10083	0.09246	0.0833	0.0735	0.087448	-0.00257	1.740089	-2377.68	13.1005	28424.29	0.38
29.05.2009	0.09396	0.09748	0.10241	0.1111	0.11817	0.1238	0.128	0.13088	0.1324	0.1328	0.13189	0.1299	0.12679	0.1227	0.11753	0.1114	0.10446	0.0966	0.08791	0.07843	0.0682	0.0572	0.094702	-0.00257	1.707058	-2465.69	12.99532	28292.32	0.53
30.06.2009	0.09186	0.09422	0.09764	0.1041	0.10999	0.11542	0.1204	0.12498	0.1292	0.133	0.13652	0.1397	0.14266	0.1453	0.14778	0.15	0.15204	0.15388	0.15556	0.15708	0.1585	0.1597	0.215103	-0.12445	-0.03088	-66.0151	2.972666	27762.3	0.07
31.07.2009	0.08277	0.08459	0.0874	0.093	0.09817	0.10274	0.1066	0.10979	0.1123	0.1142	0.11563	0.1166	0.11707	0.1172	0.11712	0.1167	0.11615	0.11536	0.11441	0.11333	0.1121	0.1108	0.17624	-0.09436	-0.05547	-141.459	1.284451	15295.78	0.03
31.08.2009	0.08506	0.08341	0.08284	0.0858	0.09108	0.09662	0.1015	0.10546	0.1084	0.1104	0.11154	0.112	0.11193	0.1114	0.1104	0.1091	0.10758	0.10581	0.10386	0.10175	0.0995	0.0972	0.184568	-0.09818	-0.11881	-177.132	0.905049	13060.6	0.08
30.09.2009	0.07612	0.07332	0.07207	0.0754	0.08158	0.08771	0.0927	0.09644	0.0989	0.1002	0.10061	0.1003	0.09946	0.0981	0.09646	0.0945	0.09226	0.08984	0.08726	0.08454	0.0817	0.0788	0.172238	-0.09392	-0.12806	-186.958	0.762877	12208.24	0.00
30.10.2009	0.07202	0.07039	0.07139	0.0777	0.08397	0.08862	0.0918	0.09389	0.0953	0.0961	0.09663	0.0969	0.09698	0.0969	0.09676	0.0965	0.0962	0.09583	0.09542	0.09497	0.0945	0.094	0.113508	-0.03952	-0.06419	-42.1856	0.440125	14095.17	0.73
26.11.2009	0.06697	0.06702	0.07005	0.0783	0.08477	0.08918	0.0921	0.09414	0.0956	0.0966	0.09743	0.0981	0.09854	0.0989	0.09924	0.0995	0.0997	0.09987	0.1	0.10011	0.1002	0.1003	0.105643	-0.03755	-0.05179	-8.15371	0.365428	19236.8	0.47
31.12.2009	0.07875	0.06966	0.06794	0.077	0.08601	0.09219	0.0963	0.09905	0.101	0.1025	0.10355	0.1044	0.10508	0.1056	0.10605	0.1064	0.1067	0.10694	0.10713	0.10729	0.1074	0.1075	0.114545	-0.0268	-0.11109	-7.74635	0.320363	14843.67	0.37
29.01.2010	0.06501	0.06747	0.07089	0.0768	0.08183	0.08601	0.0895	0.09254	0.0951	0.0973	0.09917	0.1008	0.10225	0.1035	0.10463	0.1056	0.10651	0.10731	0.10804	0.1087	0.1093	0.1099	0.116722	-0.053	-0.00772	0.071415	1.462643	171.8097	0.09
26.02.2010	0.0636	0.06579	0.06943	0.0768	0.08322	0.08846	0.0926	0.09572	0.0981	0.1	0.10141	0.1025	0.10333	0.104	0.10444	0.1048	0.10506	0.10525	0.10536	0.10542	0.1054	0.1054	0.120777	-0.05816	-0.0413	-0.17006	0.703865	94.83916	0.17
31.03.2010	0.07211	0.07054	0.07084	0.0759	0.08234	0.08798	0.0924	0.09568	0.0981	0.0997	0.1009	0.1017	0.10216	0.1024	0.10251	0.1025	0.10232	0.10208	0.10177	0.1014	0.101	0.1005	0.127077	-0.05339	-0.07798	-0.33602	0.597318	82.98649	0.15
30.04.2010	0.0723	0.07369	0.07603	0.0809	0.08518	0.08866	0.0913	0.09338	0.0949	0.0961	0.09702	0.0978	0.09851	0.0992	0.09981	0.1005	0.10114	0.10184	0.10257	0.10332	0.1041	0.1049	0.161615	-0.08992	-0.05278	-0.15063	0.841718	4.941264	0.18
31.05.2010	0.10135	0.09089	0.08296	0.0805	0.08385	0.08784	0.0912	0.09387	0.0959	0.0975	0.09874	0.0997	0.10057	0.1013	0.10184	0.1023	0.10277	0.10315	0.10348	0.10378	0.104	0.1043	0.108832	0.124288	0.124295	-0.09596	1E-05	0.473824	0.29
30.06.2010	0.08847	0.07984	0.07689	0.0807	0.08486	0.08762	0.0894	0.0906	0.0915	0.0921	0.09263	0.093	0.09337	0.0936	0.09388	0.0941	0.09425	0.0944	0.09454	0.09466	0.0948	0.0949	0.096683	0.124292	0.1243	-0.06636	1E-05	0.27489	0.10
30.07.2010	0.08285	0.07616	0.07345	0.0759	0.07909	0.08132	0.0828	0.0838	0.0845	0.0851	0.0855	0.0858	0.08612	0.0864	0.08655	0.0867	0.08686	0.08699	0.0871	0.0872	0.0873	0.0874	0.088899	0.124299	0.124306	-0.05185	1E-05	0.295015	0.11
31.08.2010	0.08314	0.0759	0.07256	0.0747	0.07809	0.0806	0.0823	0.08347	0.0843	0.085	0.08545	0.0858	0.08617	0.0864	0.08668	0.0869	0.08704	0.08719	0.08732	0.08744	0.0875	0.0876	0.089427	0.124308	0.124315	-0.05685	1E-05	0.314736	0.05
30.09.2010	0.08404	0.07678	0.07249	0.0731	0.07628	0.079	0.081	0.0824	0.0834	0.0842	0.08485	0.0853	0.08575	0.0861	0.08637	0.0866	0.08683	0.08701	0.08718	0.08732	0.0875	0.0876	0.089796	0.124342	0.124349	-0.05986	1E-05	0.371729	0.07

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
28.10.2010	0.0853	0.08086	0.07633	0.0722	0.0715	0.0723	0.0736	0.07505	0.0764	0.0776	0.07857	0.0794	0.08017	0.0808	0.08134	0.0818	0.08222	0.08258	0.0829	0.08319	0.0834	0.0837	0.088015	0.124358	0.124365	-0.05544	1E-05	0.784191	0.99
30.11.2010	0.09061	0.08447	0.07839	0.0732	0.07278	0.07418	0.0761	0.07812	0.0799	0.0814	0.08274	0.0838	0.08476	0.0856	0.08623	0.0868	0.08731	0.08776	0.08815	0.0885	0.0888	0.0891	0.094446	0.12436	0.124368	-0.07315	1E-05	0.731471	0.90
31.12.2010	0.08459	0.07563	0.06769	0.0628	0.06411	0.06711	0.0702	0.07288	0.0751	0.0769	0.07835	0.0795	0.08053	0.0814	0.08206	0.0827	0.08319	0.08364	0.08405	0.08441	0.0847	0.085	0.090524	0.124369	0.124377	-0.09303	1E-05	0.591665	1.41
31.01.2011	0.09087	0.08024	0.07314	0.0726	0.07682	0.0809	0.0841	0.0864	0.0881	0.0895	0.09053	0.0914	0.09205	0.0926	0.09311	0.0935	0.09388	0.0942	0.09447	0.09472	0.0949	0.0951	0.098917	0.124371	0.124378	-0.09147	1E-05	0.41292	1.21
28.02.2011	0.0585	0.075	0.07725	0.0799	0.08271	0.08497	0.0866	0.08779	0.0887	0.0893	0.08985	0.0903	0.09061	0.0909	0.09114	0.0913	0.09152	0.09168	0.09182	0.09194	0.092	0.0921	0.094023	-62.1597	-62.1599	-0.0403	2.14E-05	0.399681	0.27
31.03.2011	0.05284	0.07532	0.08019	0.0837	0.0859	0.08735	0.0883	0.08899	0.0895	0.0898	0.09013	0.0904	0.09055	0.0907	0.09084	0.091	0.09105	0.09114	0.09121	0.09128	0.0913	0.0914	0.092427	-67.4751	-67.4753	-0.02048	2.32E-05	0.351389	0.17
29.04.2011	0.0658	0.07642	0.07738	0.0794	0.08195	0.08398	0.0854	0.08651	0.0873	0.0879	0.08834	0.0887	0.08901	0.0893	0.08947	0.0897	0.08982	0.08995	0.09008	0.09019	0.0903	0.0904	0.092034	-56.5034	-56.5036	-0.03796	1.67E-05	0.388512	0.35
31.05.2011	0.06247	0.07754	0.08035	0.0834	0.08586	0.08753	0.0887	0.08945	0.09	0.0904	0.09078	0.091	0.09126	0.0914	0.0916	0.0917	0.09184	0.09194	0.09203	0.09211	0.0922	0.0922	0.093441	-60.566	-60.5662	-0.02865	1.92E-05	0.337267	0.23
30.06.2011	0.07316	0.08015	0.08153	0.0847	0.08709	0.08861	0.0896	0.09024	0.0907	0.0911	0.09134	0.0916	0.09174	0.0919	0.09201	0.0921	0.09222	0.0923	0.09237	0.09244	0.0925	0.0925	0.093538	-50.183	-50.1831	-0.03101	1.37E-05	0.274993	0.08
29.07.2011	0.09143	0.08616	0.08279	0.0828	0.08497	0.08698	0.0885	0.08961	0.0904	0.0911	0.09154	0.0919	0.09226	0.0925	0.09275	0.0929	0.09312	0.09326	0.09339	0.09351	0.0936	0.0937	0.095474	0.11541	0.115416	-0.04456	1E-05	0.396947	0.26
29.08.2011	0.09064	0.08647	0.08203	0.0775	0.07627	0.07663	0.0777	0.07896	0.0802	0.0814	0.08248	0.0834	0.08421	0.0849	0.08551	0.086	0.08651	0.08692	0.08728	0.0876	0.0879	0.0882	0.093128	0.115417	0.115423	-0.05656	1E-05	0.879595	0.22
30.09.2011	0.09678	0.09168	0.08623	0.0807	0.07919	0.07964	0.0809	0.08249	0.0841	0.0855	0.0868	0.0879	0.08891	0.0898	0.09051	0.0912	0.09173	0.09223	0.09267	0.09307	0.0934	0.0937	0.099829	0.11542	0.115426	-0.06925	1E-05	0.879244	0.53
31.10.2011	0.09914	0.10011	0.09768	0.0953	0.09449	0.09407	0.0938	0.09364	0.0935	0.0934	0.09336	0.0933	0.09326	0.0932	0.09319	0.0932	0.09314	0.09311	0.0931	0.09308	0.0931	0.0931	0.092796	0.125866	0.125873	0.025724	1E-05	0.09867	0.09
30.11.2011	0.09366	0.09579	0.09806	0.1003	0.10089	0.10065	0.1001	0.09941	0.0988	0.0981	0.09761	0.0971	0.09674	0.0964	0.09609	0.0958	0.0956	0.09539	0.09522	0.09505	0.0949	0.0948	0.092321	0.125642	0.125649	0.028725	1E-05	0.856834	0.12
30.12.2011	0.09074	0.09576	0.10086	0.1054	0.106	0.10498	0.1034	0.10179	0.1003	0.099	0.09786	0.0969	0.09609	0.0954	0.09481	0.0943	0.09385	0.09346	0.09311	0.0928	0.0925	0.0923	0.087551	0.125653	0.12566	0.062031	1E-05	0.761798	0.08
31.01.2012	0.09223	0.09107	0.09041	0.0906	0.09106	0.09148	0.0918	0.092	0.0922	0.0923	0.09238	0.0925	0.09251	0.0926	0.09261	0.0926	0.09268	0.09271	0.09273	0.09275	0.0928	0.0928	0.093128	0.125011	0.125019	-0.00935	1E-05	0.361838	0.19
29.02.2012	0.09274	0.09137	0.08981	0.088	0.08717	0.08699	0.0871	0.08746	0.0878	0.0883	0.08864	0.089	0.08933	0.0896	0.0899	0.0901	0.09035	0.09053	0.0907	0.09086	0.091	0.0911	0.093505	0.125093	0.1251	-0.02183	1E-05	1.094579	0.06
30.03.2012	0.09552	0.09458	0.09341	0.0917	0.09071	0.09014	0.0899	0.08982	0.0899	0.0901	0.09028	0.0905	0.09078	0.091	0.09129	0.0915	0.09176	0.09197	0.09217	0.09235	0.0925	0.0927	0.096007	0.125119	0.125127	-0.02075	1E-05	1.627338	0.17
30.04.2012	0.09104	0.09089	0.0907	0.0904	0.09008	0.08984	0.0896	0.08946	0.0893	0.0892	0.08909	0.089	0.08894	0.0889	0.08885	0.0888	0.08881	0.0888	0.0888	0.08881	0.0888	0.0888	0.091078	0.125194	0.125202	-0.00764	1E-05	4.64726	0.04
31.05.2012	0.09419	0.09371	0.09306	0.0919	0.091	0.09022	0.0896	0.08905	0.0886	0.0883	0.08804	0.0879	0.08771	0.0876	0.08757	0.0876	0.08756	0.08759	0.08765	0.08771	0.0878	0.0879	0.094397	0.125186	0.125194	-0.02294	1E-05	3.940073	0.21
29.06.2012	0.08244	0.08248	0.08257	0.0827	0.08292	0.08308	0.0832	0.08337	0.0835	0.0836	0.08375	0.0839	0.08397	0.0841	0.08417	0.0843	0.08434	0.08442	0.08449	0.08456	0.0846	0.0847	0.082378	0.122663	0.12267	0.009564	1E-05	12.33303	0.36
31.07.2012	0.07292	0.0732	0.07363	0.0744	0.0751	0.0757	0.0762	0.07667	0.0771	0.0774	0.07766	0.0779	0.07809	0.0783	0.07838	0.0785	0.07856	0.07861	0.07865	0.07866	0.0787	0.0787	0.072733	0.122586	0.122593	0.019886	1E-05	5.218056	0.14
31.08.2012	0.06858	0.06914	0.06996	0.0715	0.07284	0.07404	0.0751	0.07606	0.0769	0.0776	0.07825	0.0788	0.07928	0.0797	0.08003	0.0803	0.08056	0.08075	0.0809	0.08101	0.0811	0.0811	0.068249	0.122588	0.122595	0.043308	1E-05	6.00866	0.25
28.09.2012	0.06607	0.06669	0.06762	0.0693	0.07085	0.07222	0.0734	0.07452	0.0755	0.0763	0.07706	0.0777	0.07828	0.0788	0.07918	0.0795	0.07984	0.08008	0.08028	0.08043	0.0806	0.0806	0.065707	0.122592	0.122599	0.050281	1E-05	6.261648	0.35

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.10.2012	0.06383	0.06422	0.06482	0.066	0.06712	0.06821	0.0693	0.07025	0.0712	0.0721	0.07302	0.0739	0.07468	0.0755	0.07621	0.0769	0.07761	0.07826	0.07889	0.07949	0.0801	0.0806	0.063591	0.122681	0.122688	0.084634	1E-05	16.95451	0.12
30.11.2012	0.05145	0.05206	0.05295	0.0547	0.05623	0.05769	0.059	0.06029	0.0614	0.0625	0.06346	0.0644	0.06517	0.0659	0.06659	0.0672	0.06777	0.06827	0.06873	0.06914	0.0695	0.0698	0.051109	0.122676	0.122683	0.067916	1E-05	8.894085	0.42
31.12.2012	0.05717	0.05751	0.05803	0.059	0.05983	0.06059	0.0613	0.06185	0.0624	0.0628	0.06321	0.0636	0.06385	0.0641	0.06431	0.0645	0.06463	0.06475	0.06484	0.06491	0.065	0.065	0.056953	0.122672	0.122679	0.026943	1E-05	5.940443	0.07
31.01.2013	0.05109	0.05172	0.05266	0.0544	0.05597	0.05739	0.0587	0.0598	0.0608	0.0617	0.06253	0.0632	0.06386	0.0644	0.06489	0.0653	0.06565	0.06595	0.0662	0.0664	0.0666	0.0667	0.050721	0.122634	0.122641	0.054181	1E-05	6.674664	0.11
28.02.2013	0.04984	0.05035	0.05113	0.0526	0.05403	0.05537	0.0566	0.05783	0.059	0.06	0.06102	0.062	0.06286	0.0637	0.06449	0.0652	0.06592	0.06657	0.06718	0.06775	0.0683	0.0688	0.049544	0.122712	0.122719	0.079917	1E-05	12.32854	0.31
29.03.2013	0.05904	0.05927	0.05963	0.0603	0.06105	0.06173	0.0624	0.06303	0.0637	0.0643	0.06486	0.0654	0.06599	0.0665	0.06707	0.0676	0.06808	0.06857	0.06904	0.06949	0.0699	0.0704	0.058888	0.122728	0.122735	0.074077	1E-05	24.75594	0.27
30.04.2013	0.04542	0.04606	0.047	0.0488	0.05039	0.05187	0.0532	0.05445	0.0556	0.0566	0.05751	0.0583	0.05909	0.0598	0.06036	0.0609	0.06138	0.06179	0.06216	0.06248	0.0628	0.063	0.045059	0.122687	0.122694	0.062588	1E-05	7.756753	0.61
31.05.2013	0.06072	0.06083	0.06101	0.0614	0.06175	0.06212	0.0625	0.06286	0.0632	0.0636	0.06394	0.0643	0.06465	0.065	0.06535	0.0657	0.06604	0.06638	0.06672	0.06706	0.0674	0.0677	0.060628	0.123222	0.123229	0.16093	1E-05	106.4039	0.38
28.06.2013	0.07654	0.07662	0.07677	0.0771	0.07737	0.07766	0.078	0.07825	0.0785	0.0788	0.07913	0.0794	0.07972	0.08	0.08029	0.0806	0.08087	0.08115	0.08144	0.08172	0.082	0.0823	0.076464	0.123939	0.123946	0.222663	1E-05	184.6298	0.79
31.07.2013	0.08562	0.08566	0.08575	0.0859	0.08611	0.08629	0.0865	0.08665	0.0868	0.087	0.08719	0.0874	0.08755	0.0877	0.08791	0.0881	0.08827	0.08845	0.08862	0.0888	0.089	0.0892	0.08556	0.125873	0.125881	0.283598	1E-05	387.6921	0.24
29.08.2013	0.09051	0.09084	0.09134	0.0922	0.09298	0.09363	0.0942	0.09464	0.095	0.0953	0.0956	0.0958	0.09598	0.0961	0.09619	0.0963	0.09629	0.09631	0.0963	0.09628	0.0962	0.0962	0.090299	0.127025	0.127033	0.020129	1E-05	4.528851	0.66
30.09.2013	0.07874	0.07915	0.07977	0.0809	0.08196	0.0829	0.0837	0.08451	0.0852	0.0858	0.08635	0.0868	0.08727	0.0876	0.08798	0.0883	0.08852	0.08873	0.08891	0.08906	0.0892	0.0893	0.078491	0.127061	0.127069	0.036785	1E-05	6.899576	0.20
31.10.2013	0.06791	0.06865	0.06974	0.0718	0.07357	0.0752	0.0766	0.07794	0.0791	0.0801	0.081	0.0818	0.08248	0.0831	0.08359	0.084	0.0844	0.08471	0.08496	0.08516	0.0853	0.0854	0.067493	0.127067	0.127074	0.060559	1E-05	6.402261	0.42
29.11.2013	0.08392	0.08409	0.08436	0.0849	0.08538	0.08586	0.0863	0.08675	0.0872	0.0876	0.08793	0.0883	0.08863	0.089	0.08926	0.0896	0.08983	0.09009	0.09034	0.09057	0.0908	0.091	0.0838	0.127098	0.127105	0.032565	1E-05	14.44062	0.44
31.12.2013	0.09378	0.09404	0.09443	0.0951	0.09576	0.0963	0.0968	0.09716	0.0975	0.0978	0.09803	0.0982	0.0984	0.0985	0.09864	0.0987	0.09877	0.09881	0.09883	0.09884	0.0988	0.0988	0.093607	0.127209	0.127216	0.017523	1E-05	5.007401	0.30
31.01.2014	0.10674	0.10651	0.1062	0.1056	0.10504	0.10448	0.1039	0.10337	0.1028	0.1023	0.10176	0.1012	0.10072	0.1002	0.09971	0.0992	0.09873	0.09825	0.09778	0.09731	0.0969	0.0964	0.106784	0.245721	0.245767	-0.11743	1E-05	49.46992	1.13
28.02.2014	0.10873	0.10823	0.10758	0.1064	0.10532	0.10437	0.1035	0.10279	0.1021	0.1016	0.10106	0.1006	0.10025	0.0999	0.09965	0.0994	0.09923	0.09908	0.09895	0.09886	0.0988	0.0988	0.108898	0.254219	0.254268	-0.0341	1E-05	6.058019	0.60
31.03.2014	0.10705	0.10631	0.10534	0.1037	0.10236	0.1013	0.1005	0.09982	0.0993	0.099	0.09873	0.0986	0.09849	0.0985	0.09849	0.0985	0.09864	0.09877	0.0989	0.09906	0.0992	0.0994	0.107355	0.254433	0.254483	-0.02981	1E-05	3.335779	0.49
30.04.2014	0.09493	0.09365	0.09212	0.09	0.08883	0.08825	0.0881	0.0881	0.0883	0.0886	0.08893	0.0893	0.08962	0.09	0.09027	0.0906	0.09084	0.0911	0.09133	0.09154	0.0917	0.0919	0.09556	0.254159	0.254208	-0.02519	1E-05	1.457118	0.17
30.05.2014	0.09174	0.08903	0.08601	0.0825	0.08117	0.08098	0.0814	0.08208	0.0829	0.0837	0.08441	0.0851	0.08572	0.0863	0.08676	0.0872	0.08758	0.08792	0.08823	0.0885	0.0887	0.089	0.093244	0.25413	0.25418	-0.04119	1E-05	1.037554	0.33
30.06.2014	0.08811	0.08553	0.08277	0.0798	0.07893	0.07904	0.0796	0.08037	0.0811	0.0819	0.08256	0.0831	0.08367	0.0841	0.08452	0.0849	0.08517	0.08544	0.08568	0.0859	0.0861	0.0863	0.089568	0.254143	0.254192	-0.0358	1E-05	0.923108	0.09
31.07.2014	0.08912	0.08664	0.08392	0.0809	0.07989	0.07988	0.0804	0.08104	0.0818	0.0825	0.08318	0.0838	0.08431	0.0848	0.08519	0.0856	0.08587	0.08616	0.08641	0.08664	0.0868	0.087	0.090516	0.254197	0.254246	-0.03593	1E-05	0.972832	0.14
29.08.2014	0.06295	0.08134	0.08526	0.0863	0.08622	0.086	0.0859	0.08579	0.0858	0.0859	0.08601	0.0862	0.08634	0.0865	0.08673	0.0869	0.08712	0.08731	0.08749	0.08767	0.0878	0.088	0.091833	-118.89	-118.937	-0.01796	1E-05	2.110196	0.10
30.09.2014	0.09724	0.09638	0.09538	0.094	0.0933	0.09297	0.0929	0.09295	0.0931	0.0933	0.09354	0.0938	0.094	0.0942	0.09442	0.0946	0.09478	0.09493	0.09508	0.09521	0.0953	0.0954	0.097635	0.254716	0.254765	-0.01593	1E-05	1.385987	0.68

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.10.2014	0.08591	0.08481	0.0835	0.0817	0.08075	0.08028	0.0801	0.08021	0.0804	0.0807	0.08095	0.0813	0.08155	0.0818	0.0821	0.0823	0.08258	0.08279	0.08298	0.08316	0.0833	0.0835	0.086448	0.254827	0.254877	-0.02113	1E-05	1.418852	0.36
28.11.2014	0.07609	0.07491	0.0737	0.0725	0.07221	0.07234	0.0726	0.07299	0.0733	0.0737	0.07394	0.0742	0.0744	0.0746	0.07474	0.0749	0.075	0.07511	0.0752	0.07529	0.0754	0.0754	0.076721	0.254834	0.254883	-0.01513	1E-05	0.85415	0.32
31.12.2014	0.07987	0.0796	0.07928	0.0787	0.07832	0.07797	0.0777	0.07749	0.0773	0.0772	0.07712	0.0771	0.07703	0.077	0.07703	0.077	0.07707	0.07711	0.07715	0.0772	0.0773	0.0773	0.079924	0.255156	0.255205	-0.00973	1E-05	3.394494	0.54
30.01.2015	0.07188	0.0709	0.06974	0.0682	0.0673	0.06688	0.0668	0.06682	0.067	0.0672	0.06746	0.0677	0.06799	0.0682	0.06848	0.0687	0.0689	0.06909	0.06926	0.06942	0.0696	0.0697	0.072342	0.253786	0.253835	-0.01872	1E-05	1.42386	0.27
27.02.2015	0.09314	0.09134	0.08902	0.0853	0.08272	0.08089	0.0797	0.07895	0.0786	0.0784	0.07852	0.0787	0.07906	0.0794	0.07987	0.0803	0.08079	0.08126	0.08173	0.08218	0.0826	0.083	0.094023	0.253867	0.253916	-0.0522	1E-05	2.246431	0.15
31.03.2015	0.0974	0.08717	0.08457	0.0832	0.08267	0.08236	0.0821	0.08195	0.0818	0.0816	0.08151	0.0814	0.08127	0.0811	0.08103	0.0809	0.08081	0.0807	0.08059	0.08049	0.0804	0.0803	0.082116	63.73195	63.75798	-26.8231	1E-05	68166.85	0.41
30.04.2015	0.09752	0.09712	0.0966	0.0956	0.09478	0.094	0.0933	0.09268	0.0921	0.0916	0.09116	0.0908	0.09042	0.0901	0.08984	0.0896	0.0894	0.08923	0.08909	0.08897	0.0889	0.0888	0.097639	0.253951	0.254	-0.0301	1E-05	6.818632	0.26
29.05.2015	0.09503	0.09467	0.09419	0.0933	0.09256	0.09187	0.0913	0.09071	0.0902	0.0898	0.08941	0.0891	0.08879	0.0885	0.08832	0.0881	0.08798	0.08786	0.08775	0.08767	0.0876	0.0876	0.095137	0.253853	0.253903	-0.02558	1E-05	6.365227	0.27
30.06.2015	0.0977	0.09724	0.09663	0.0955	0.09459	0.09374	0.093	0.09237	0.0918	0.0913	0.09091	0.0906	0.09026	0.09	0.08981	0.0896	0.08952	0.08942	0.08935	0.0893	0.0893	0.0893	0.097852	0.253844	0.253893	-0.02875	1E-05	5.51284	0.14
31.07.2015	0.09864	0.0982	0.09763	0.0966	0.09576	0.09502	0.0944	0.09388	0.0934	0.0931	0.09279	0.0926	0.09238	0.0922	0.09214	0.0921	0.09203	0.09201	0.09202	0.09204	0.0921	0.0921	0.09879	0.253806	0.253855	-0.02271	1E-05	4.506026	0.06
31.08.2015	0.10778	0.10714	0.1063	0.1048	0.10346	0.10232	0.1013	0.1005	0.0998	0.0992	0.09866	0.0982	0.09788	0.0976	0.09738	0.0972	0.09709	0.09701	0.09697	0.09696	0.097	0.097	0.10802	0.253826	0.253876	-0.03707	1E-05	5.00837	0.40
30.09.2015	0.11061	0.11045	0.11025	0.1099	0.10948	0.10911	0.1087	0.10835	0.108	0.1076	0.10722	0.1068	0.10646	0.1061	0.10571	0.1053	0.10496	0.10458	0.10421	0.10383	0.1035	0.1031	0.110618	0.236322	0.236364	-1.59256	1E-05	1049.722	0.16
30.10.2015	0.09739	0.09729	0.09719	0.097	0.0968	0.09661	0.0964	0.09624	0.096	0.0959	0.09567	0.0955	0.09529	0.0951	0.09492	0.0947	0.09454	0.09435	0.09416	0.09398	0.0938	0.0936	0.097368	0.236314	0.236356	-1.05258	1E-05	1390.117	0.39
30.11.2015	0.10211	0.10198	0.10182	0.1015	0.1012	0.1009	0.1006	0.10028	0.1	0.0997	0.09937	0.0991	0.09875	0.0984	0.09814	0.0978	0.09753	0.09722	0.09692	0.09661	0.0963	0.096	0.102121	0.175801	0.175857	-19.9938	1E-05	16321.38	0.24
31.12.2015	0.10507	0.10498	0.10489	0.1047	0.10454	0.10436	0.1042	0.10401	0.1038	0.1037	0.10349	0.1033	0.10315	0.103	0.1028	0.1026	0.10245	0.10228	0.1021	0.10193	0.1018	0.1016	0.105055	0.175778	0.175834	-14.0262	1E-05	20190.62	0.27
29.01.2016	0.10325	0.10322	0.10319	0.1032	0.10313	0.1031	0.1031	0.10304	0.103	0.103	0.10295	0.1029	0.1029	0.1029	0.10284	0.1028	0.10278	0.10275	0.10272	0.10269	0.1027	0.1026	0.103216	0.175689	0.175745	-2.60716	1E-05	22329.35	0.19
29.02.2016	0.103	0.10295	0.10289	0.1028	0.10272	0.10263	0.1025	0.10246	0.1024	0.1023	0.1022	0.1021	0.10202	0.1019	0.10185	0.1018	0.10168	0.10159	0.1015	0.10142	0.1013	0.1012	0.102974	0.175711	0.175768	-4.37799	1E-05	12635.69	0.11
31.03.2016	0.09364	0.09364	0.09368	0.0938	0.09386	0.09395	0.094	0.09414	0.0942	0.0943	0.09442	0.0945	0.0946	0.0947	0.09479	0.0949	0.09497	0.09506	0.09516	0.09525	0.0953	0.0954	0.093583	0.174003	0.174058	106.5649	1E-05	287867.8	0.18
29.04.2016	0.08714	0.08714	0.08719	0.0873	0.08739	0.08749	0.0876	0.08769	0.0878	0.0879	0.08799	0.0881	0.0882	0.0883	0.0884	0.0885	0.0886	0.0887	0.08881	0.08891	0.089	0.0891	0.087079	0.174008	0.174063	109.8255	1E-05	270410.1	0.09
31.05.2016	0.0907	0.09078	0.09094	0.0913	0.09159	0.09192	0.0922	0.09258	0.0929	0.0932	0.09357	0.0939	0.09423	0.0946	0.09489	0.0952	0.09555	0.09588	0.09621	0.09654	0.0969	0.0972	0.0906	0.173949	0.174004	161.5085	1E-05	122449.2	0.50
30.06.2016	0.08376	0.08384	0.084	0.0843	0.08465	0.08498	0.0853	0.08563	0.086	0.0863	0.08661	0.0869	0.08727	0.0876	0.08792	0.0883	0.08858	0.08891	0.08923	0.08956	0.0899	0.0902	0.083664	0.173949	0.174004	160.9535	1E-05	122842.8	0.10
29.07.2016	0.08883	0.0889	0.08904	0.0893	0.08963	0.08993	0.0902	0.09052	0.0908	0.0911	0.0914	0.0917	0.092	0.0923	0.09259	0.0929	0.09318	0.09348	0.09377	0.09407	0.0944	0.0947	0.088741	0.173943	0.173997	153.6635	1E-05	129808.1	0.69
31.08.2016	0.08658	0.08671	0.08695	0.0874	0.0879	0.08837	0.0889	0.08933	0.0898	0.0903	0.09077	0.0912	0.09172	0.0922	0.09268	0.0932	0.09363	0.09411	0.09459	0.09507	0.0955	0.096	0.08646	0.173854	0.173909	235.5719	1E-05	123131.6	0.72
30.09.2016	0.08161	0.08184	0.08223	0.083	0.08378	0.08456	0.0853	0.08613	0.0869	0.0877	0.08847	0.0893	0.09003	0.0908	0.0916	0.0924	0.09316	0.09394	0.09472	0.0955	0.0963	0.0971	0.081437	0.173827	0.173882	336.8368	1E-05	107768.4	0.72

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.10.2016	0.08926	0.08938	0.08959	0.09	0.09046	0.0909	0.0913	0.09178	0.0922	0.0927	0.0931	0.0935	0.09397	0.0944	0.09485	0.0953	0.09573	0.09617	0.09661	0.09704	0.0975	0.0979	0.089146	0.173822	0.173877	212.6094	1E-05	121143.7	0.87
30.11.2016	0.09846	0.09858	0.09878	0.0992	0.09965	0.10008	0.1005	0.10094	0.1014	0.1018	0.10224	0.1027	0.10311	0.1035	0.10397	0.1044	0.10484	0.10527	0.1057	0.10614	0.1066	0.107	0.098345	0.173818	0.173873	211.4122	1E-05	122104.3	0.74
30.12.2016	0.10027	0.10043	0.1007	0.1013	0.10182	0.10238	0.1029	0.1035	0.1041	0.1046	0.10519	0.1058	0.10631	0.1069	0.10744	0.108	0.10856	0.10912	0.10968	0.11024	0.1108	0.1114	0.100133	0.173789	0.173844	240.4956	1E-05	107034	2.29
31.01.2017	0.10561	0.10556	0.10551	0.1054	0.10535	0.10527	0.1052	0.10511	0.105	0.105	0.10488	0.1048	0.10472	0.1046	0.10456	0.1045	0.1044	0.10433	0.10425	0.10417	0.1041	0.104	0.105585	0.173804	0.173859	-38.5338	1E-05	122449.6	0.06
28.02.2017	0.10452	0.10447	0.10442	0.1043	0.10426	0.10418	0.1041	0.10403	0.104	0.1039	0.1038	0.1037	0.10364	0.1036	0.10349	0.1034	0.10333	0.10326	0.10318	0.1031	0.103	0.1029	0.104491	0.173789	0.173844	-38.263	1E-05	123994.2	0.38
31.03.2017	0.10845	0.10833	0.10818	0.1079	0.10762	0.10734	0.1071	0.10678	0.1065	0.1062	0.10595	0.1057	0.10539	0.1051	0.10483	0.1046	0.10428	0.104	0.10372	0.10344	0.1032	0.1029	0.108453	0.173908	0.173963	-79.3814	1E-05	71244.48	0.48
28.04.2017	0.10821	0.10798	0.10768	0.1071	0.10647	0.10587	0.1053	0.10467	0.1041	0.1035	0.10288	0.1023	0.10168	0.1011	0.10048	0.0999	0.09928	0.09868	0.09808	0.09748	0.0969	0.0963	0.10827	0.173936	0.173991	-121.354	1E-05	50614.25	1.49
31.05.2017	0.10442	0.10429	0.10412	0.1038	0.10349	0.10318	0.1029	0.10255	0.1022	0.1019	0.10162	0.1013	0.10099	0.1007	0.10036	0.1001	0.09974	0.09942	0.09911	0.0988	0.0985	0.0982	0.104431	0.174002	0.174057	-65.262	1E-05	52133.19	0.41
30.06.2017	0.10441	0.10429	0.10414	0.1038	0.10356	0.10327	0.103	0.10269	0.1024	0.1021	0.10182	0.1015	0.10124	0.101	0.10067	0.1004	0.10009	0.0998	0.09951	0.09922	0.0989	0.0986	0.10442	0.174024	0.174079	-62.3776	1E-05	53984.33	0.65
31.07.2017	0.10671	0.10654	0.10632	0.1059	0.10547	0.10505	0.1046	0.10421	0.1038	0.1034	0.10294	0.1025	0.1021	0.1017	0.10125	0.1008	0.10041	0.09999	0.09957	0.09914	0.0987	0.0983	0.106735	0.174289	0.174344	-79.6467	1E-05	47210.98	1.69
31.08.2017	0.10689	0.10672	0.10651	0.1061	0.1057	0.10529	0.1049	0.10448	0.1041	0.1037	0.10326	0.1028	0.10244	0.102	0.10163	0.1012	0.10082	0.10041	0.1	0.0996	0.0992	0.0988	0.106914	0.174316	0.174371	-78.1581	1E-05	48047.01	1.21
29.09.2017	0.10944	0.10929	0.10911	0.1087	0.10839	0.10803	0.1077	0.10732	0.107	0.1066	0.10625	0.1059	0.10553	0.1052	0.10482	0.1045	0.10411	0.10375	0.10339	0.10304	0.1027	0.1023	0.109459	0.174333	0.174389	-72.7823	1E-05	50985.66	1.01
31.10.2017	0.11961	0.1194	0.11913	0.1186	0.11807	0.11754	0.117	0.11648	0.1159	0.1154	0.11489	0.1144	0.11383	0.1133	0.11277	0.1122	0.11171	0.11118	0.11065	0.11012	0.1096	0.1091	0.119656	0.174347	0.174402	-88.1056	1E-05	41552.59	1.21
30.11.2017	0.10688	0.11321	0.12041	0.1289	0.13227	0.13288	0.132	0.13044	0.1286	0.1267	0.1249	0.1232	0.12173	0.1204	0.11919	0.1181	0.11717	0.11633	0.11557	0.1149	0.1143	0.1137	0.103156	0.03861	0.03861	0.099693	0.00001	1.061904	2.45
29.12.2017	0.1075	0.11704	0.12562	0.1311	0.12991	0.12678	0.1235	0.12059	0.1182	0.1162	0.1146	0.1133	0.1122	0.1113	0.11051	0.1098	0.10926	0.10876	0.10831	0.10791	0.1076	0.1072	0.10115	0.03861	0.03861	0.100688	0.00001	0.604277	0.97
31.01.2018	0.11063	0.11622	0.1213	0.1247	0.12403	0.12222	0.1203	0.11858	0.1171	0.116	0.11501	0.1142	0.11357	0.113	0.11255	0.1121	0.1118	0.11149	0.11123	0.11099	0.1108	0.1106	0.106919	0.038611	0.038611	0.059635	0.00001	0.61383	0.27
28.02.2018	0.10867	0.11359	0.1186	0.1231	0.12379	0.12283	0.1213	0.11974	0.1183	0.117	0.11586	0.1149	0.11411	0.1134	0.11283	0.1123	0.11188	0.11148	0.11114	0.11083	0.1106	0.1103	0.105586	0.038616	0.038615	0.061147	1E-05	0.77191	0.73
30.03.2018	0.11091	0.11807	0.12557	0.1328	0.13443	0.13344	0.1314	0.12917	0.127	0.125	0.12327	0.1218	0.12048	0.1194	0.11841	0.1176	0.11685	0.1162	0.11564	0.11513	0.1147	0.1143	0.106505	0.038616	0.038616	0.093575	1E-05	0.829817	1.46
30.04.2018	0.11238	0.12028	0.12826	0.1353	0.13626	0.13465	0.1322	0.12965	0.1273	0.1253	0.12351	0.122	0.12075	0.1197	0.11875	0.1179	0.11725	0.11664	0.1161	0.11562	0.1152	0.1148	0.107425	0.038619	0.038619	0.096993	1E-05	0.760184	1.35
31.05.2018	0.1232	0.13754	0.15161	0.1632	0.16383	0.1603	0.1556	0.15101	0.1469	0.1434	0.14041	0.1379	0.13583	0.134	0.13253	0.1312	0.13008	0.12908	0.1282	0.12742	0.1267	0.1261	0.114072	0.058305	0.059129	0.168471	0.00001	0.712943	2.12
29.06.2018	0.15675	0.15824	0.16695	0.1757	0.17674	0.17441	0.171	0.16737	0.1641	0.1612	0.15869	0.1566	0.15478	0.1533	0.15194	0.1508	0.14981	0.14894	0.14817	0.14749	0.1469	0.1463	0.135838	0.279457	0.176835	0.134828	0.002577	0.769007	0.12
31.07.2018	0.22543	0.17775	0.175	0.1835	0.18987	0.19281	0.1933	0.1922	0.1902	0.1876	0.18482	0.182	0.17922	0.1766	0.17413	0.1718	0.16974	0.1678	0.16603	0.16441	0.1629	0.1616	0.134468	0.617717	0.312277	0.187571	0.007676	1.416879	1.83
31.08.2018	0.27544	0.27375	0.27122	0.2662	0.26112	0.25607	0.251	0.246	0.241	0.236	0.23094	0.2259	0.22093	0.2159	0.21094	0.206	0.20097	0.196	0.19103	0.18607	0.1811	0.1762	0.252466	0.023819	-9.8674	-420.679	530.2132	262496.7	29.05
28.09.2018	0.24671	0.24395	0.24002	0.2328	0.22623	0.22016	0.2144	0.209	0.2037	0.1986	0.19365	0.1887	0.18389	0.1791	0.17432	0.1696	0.16486	0.16017	0.15548	0.15081	0.1461	0.1415	0.233616	0.014528	-0.01061	-25.6062	1.564031	1373.682	3.40

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.10.2018	0.24296	0.23967	0.23491	0.2259	0.21771	0.21014	0.2032	0.19687	0.1911	0.1858	0.18107	0.1768	0.1729	0.1694	0.16635	0.1636	0.16122	0.15914	0.15734	0.15582	0.1546	0.1535	0.273726	-0.02909	-0.42593	217.3423	9.180527	79523.1	2.80
30.11.2018	0.20133	0.1989	0.19538	0.1888	0.18274	0.17725	0.1723	0.16786	0.1639	0.1605	0.15749	0.155	0.15288	0.1512	0.14998	0.1491	0.14869	0.14862	0.1489	0.14955	0.1505	0.1518	0.262439	-0.05987	-1.23993	1536.8	18.2751	44389.92	0.39
31.12.2018	0.20071	0.19859	0.19551	0.1897	0.18425	0.17924	0.1746	0.17039	0.1665	0.163	0.15991	0.1571	0.15466	0.1525	0.15071	0.1492	0.148	0.14708	0.14645	0.14609	0.146	0.1462	0.259092	-0.05731	-1.13311	1295.276	20.36713	48236.14	0.10
																													129.2

area refers that since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yields which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period. Therefore, estimated values in the area should not be taken into consideration.

Appendix B. DNS Estimation Results of GRG NonLinear Methodology

Table B.1 DNS Estimation Results of GRG NonLinear Methodology

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
28.02.2005	0.17078	0.1692	0.16687	0.1624	0.15813	0.15408	0.1502	0.14655	0.1431	0.1397	0.13657	0.1336	0.13068	0.1279	0.12532	0.1228	0.12044	0.11817	0.11599	0.11391	0.1119	0.11	0.046375	0.125209	0.009096199	0.166618	0.30
31.03.2005	0.13934	0.1454	0.15269	0.162	0.16623	0.16693	0.1653	0.16221	0.1582	0.1538	0.14911	0.1444	0.13989	0.1355	0.13141	0.1275	0.12392	0.12056	0.11746	0.11458	0.1119	0.1095	0.058113	0.077796	0.225553924	0.581303	0.70
29.04.2005	0.13329	0.14116	0.15091	0.1643	0.17149	0.17432	0.1741	0.17186	0.1683	0.1638	0.15897	0.1539	0.14878	0.1438	0.13894	0.1343	0.12997	0.12587	0.12203	0.11845	0.1151	0.112	0.044532	0.084354	0.287697068	0.538387	0.32
31.05.2005	0.13507	0.14047	0.14689	0.1548	0.15799	0.15787	0.1556	0.15195	0.1475	0.1426	0.13759	0.1326	0.12772	0.1231	0.11867	0.1145	0.11069	0.10712	0.1038	0.10073	0.0979	0.0953	0.040126	0.091871	0.22727431	0.568825	0.42
30.06.2005	0.13351	0.13776	0.14289	0.1495	0.15248	0.15285	0.1515	0.14891	0.1456	0.1419	0.13794	0.1339	0.13	0.1262	0.1225	0.119	0.11575	0.11268	0.10981	0.10713	0.1046	0.1023	0.052006	0.0791	0.192765576	0.527172	0.52
29.07.2005	0.13237	0.13693	0.14253	0.15	0.15374	0.15478	0.154	0.15186	0.149	0.1455	0.14185	0.1381	0.13426	0.1306	0.12698	0.1236	0.12034	0.11729	0.11444	0.11177	0.1093	0.107	0.055882	0.073927	0.197357027	0.516726	0.59
31.08.2005	0.13347	0.13784	0.14325	0.1506	0.15442	0.15565	0.155	0.15317	0.1504	0.1471	0.14353	0.1398	0.13596	0.1322	0.12854	0.125	0.12167	0.11849	0.11549	0.11266	0.11	0.1075	0.051297	0.079733	0.20423414	0.487601	0.51
30.09.2005	0.12978	0.13327	0.13729	0.1419	0.14309	0.14212	0.1397	0.13653	0.1329	0.129	0.12515	0.1214	0.11778	0.1144	0.1112	0.1082	0.10551	0.10299	0.10067	0.09853	0.0966	0.0948	0.057416	0.070344	0.155432153	0.596817	0.35
31.10.2005	0.14466	0.1433	0.14131	0.1375	0.13385	0.1304	0.1271	0.12401	0.121	0.1182	0.11556	0.113	0.1106	0.1083	0.10612	0.104	0.10206	0.10018	0.09839	0.09669	0.0951	0.0935	0.055165	0.090177	-0.05835067	0.111323	0.44
30.11.2005	0.12707	0.12918	0.13123	0.1323	0.13072	0.12757	0.1236	0.11929	0.1149	0.1107	0.10675	0.103	0.09965	0.0965	0.09373	0.0912	0.08886	0.08677	0.08487	0.08314	0.0816	0.0801	0.051905	0.073848	0.122637567	0.692114	0.06
30.12.2005	0.13541	0.13537	0.13496	0.1332	0.13065	0.12765	0.1245	0.12124	0.1181	0.1151	0.1123	0.1097	0.10727	0.105	0.10301	0.1012	0.09945	0.0979	0.09648	0.09518	0.094	0.0929	0.070814	0.064541	0.067975214	0.593337	0.06
31.01.2006	0.12061	0.12774	0.13159	0.1304	0.12713	0.12456	0.1228	0.12148	0.1206	0.1199	0.11931	0.1189	0.11852	0.1182	0.11797	0.1178	0.11757	0.1174	0.11726	0.11713	0.117	0.1169	0.11495	-0.00027	0.057200896	2.899791	0.22
28.02.2006	0.12036	0.12722	0.12926	0.1259	0.12265	0.12056	0.1192	0.11833	0.1177	0.1172	0.11683	0.1165	0.11628	0.1161	0.1159	0.1158	0.11563	0.11551	0.11541	0.11533	0.1152	0.1152	0.113822	-0.00027	0.052219144	3.838744	2.41
31.03.2006	0.13051	0.13029	0.12924	0.1278	0.1271	0.12676	0.1265	0.12641	0.1263	0.1262	0.12617	0.1261	0.12609	0.1261	0.12603	0.126	0.12599	0.12597	0.12596	0.12594	0.1259	0.1259	0.12571	0.004288	0.007915099	5.830694	1.57
28.04.2006	0.11391	0.12225	0.12654	0.1277	0.12754	0.12739	0.1273	0.12723	0.1272	0.1272	0.12713	0.1271	0.12709	0.1271	0.12706	0.1271	0.12704	0.12704	0.12703	0.12702	0.127	0.127	0.126916	-0.0208	0.025556606	4.966636	2.20
31.05.2006	0.12312	0.13204	0.14165	0.1528	0.1586	0.16192	0.164	0.16541	0.1664	0.1672	0.16778	0.1683	0.16864	0.169	0.16924	0.1695	0.16968	0.16985	0.17001	0.17015	0.1703	0.1704	0.172519	-0.05488	4.38121E-06	2.573583	0.67
30.06.2006	0.14654	0.17506	0.19472	0.2002	0.19459	0.18876	0.1843	0.18112	0.1787	0.177	0.17555	0.1744	0.17351	0.1727	0.1721	0.1715	0.17106	0.17064	0.17027	0.16994	0.1696	0.1694	0.164319	-0.03958	0.178631635	2.750559	0.26
31.07.2006	0.16877	0.1761	0.18213	0.1843	0.18112	0.17673	0.1726	0.16907	0.1662	0.1639	0.16201	0.1605	0.15919	0.1581	0.15722	0.1564	0.15576	0.15517	0.15465	0.15418	0.1538	0.1534	0.146289	0.017451	0.098929735	1.638095	0.16
31.08.2006	0.17954	0.17983	0.17998	0.1794	0.178	0.17598	0.1736	0.17094	0.1682	0.1654	0.16259	0.1599	0.15724	0.1547	0.15232	0.1501	0.14791	0.14589	0.144	0.14222	0.1406	0.139	0.103341	0.075994	0.088559121	0.442738	0.29
29.09.2006	0.15815	0.16711	0.17746	0.19	0.19546	0.1969	0.1961	0.19421	0.1918	0.1893	0.18678	0.1845	0.18232	0.1804	0.17867	0.1771	0.17574	0.17451	0.1734	0.1724	0.1715	0.1707	0.155054	-0.00212	0.143493206	0.903003	1.27

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2006	0.14609	0.15823	0.17163	0.1865	0.19206	0.19289	0.1915	0.18922	0.1867	0.1842	0.18194	0.1799	0.17813	0.1766	0.17521	0.174	0.17297	0.17205	0.17123	0.17049	0.1698	0.1692	0.157962	-0.01913	0.145537447	1.120239	0.78
30.11.2006	0.1498	0.16095	0.17318	0.1863	0.19027	0.18956	0.1866	0.18279	0.1788	0.175	0.17145	0.1683	0.16554	0.1631	0.16095	0.1591	0.1574	0.15593	0.15462	0.15345	0.1524	0.1514	0.133312	0.009819	0.175692959	1.022807	0.40
29.12.2006	0.15974	0.1676	0.17657	0.1869	0.19043	0.18999	0.1873	0.18353	0.1793	0.1749	0.17071	0.1668	0.16315	0.1598	0.15687	0.1542	0.15176	0.14958	0.14761	0.14584	0.1442	0.1428	0.114423	0.040726	0.186031967	0.797797	0.43
31.01.2007	0.14805	0.15766	0.16798	0.1789	0.18245	0.18265	0.1814	0.17965	0.1778	0.1761	0.17462	0.1733	0.17216	0.1712	0.17032	0.1696	0.16894	0.16837	0.16787	0.16742	0.167	0.1667	0.159777	-0.01755	0.102746687	1.238392	0.48
28.02.2007	0.16461	0.17399	0.18043	0.1825	0.18104	0.17952	0.1784	0.17756	0.177	0.1765	0.17615	0.1759	0.17563	0.1754	0.17528	0.1751	0.17501	0.17491	0.17481	0.17473	0.1747	0.1746	0.173308	-0.01593	0.05297994	2.896221	0.17
30.03.2007	0.15709	0.16544	0.17341	0.1798	0.18028	0.17882	0.1769	0.17509	0.1735	0.1722	0.17114	0.1703	0.16952	0.1689	0.16837	0.1679	0.16752	0.16718	0.16687	0.1666	0.1664	0.1661	0.161999	-0.0103	0.077061194	1.611313	0.06
30.04.2007	0.16067	0.16618	0.17147	0.1756	0.17547	0.17384	0.1719	0.16995	0.1683	0.1669	0.16567	0.1647	0.16385	0.1631	0.16254	0.162	0.16158	0.16118	0.16083	0.16052	0.1602	0.16	0.155252	0.001893	0.06598738	1.430818	0.16
31.05.2007	0.1593	0.16206	0.16536	0.1694	0.17096	0.17071	0.1692	0.16697	0.1642	0.1611	0.15795	0.1547	0.1516	0.1486	0.14564	0.1429	0.14028	0.13784	0.13556	0.13344	0.1315	0.1296	0.089357	0.068369	0.144702696	0.515533	0.10
29.06.2007	0.14593	0.15331	0.16104	0.1684	0.16964	0.16807	0.1654	0.16236	0.1595	0.1568	0.15451	0.1525	0.15073	0.1492	0.1479	0.1468	0.14575	0.14487	0.14409	0.14339	0.1428	0.1422	0.131457	0.00995	0.112053484	1.135843	0.13
31.07.2007	0.16513	0.16496	0.16468	0.164	0.16316	0.16224	0.1612	0.16018	0.1591	0.1579	0.15678	0.1556	0.15446	0.1533	0.15216	0.151	0.14992	0.14883	0.14777	0.14674	0.1457	0.1448	0.11013	0.055081	0.047642294	0.239573	0.18
31.08.2007	0.163	0.16365	0.16451	0.1658	0.16665	0.16709	0.1672	0.16706	0.1667	0.1661	0.16545	0.1646	0.16375	0.1628	0.16178	0.1607	0.15967	0.1586	0.15752	0.15645	0.1554	0.1543	0.115152	0.047494	0.080361411	0.264654	0.09
28.09.2007	0.15789	0.15802	0.1581	0.158	0.15744	0.15664	0.1556	0.15445	0.1531	0.1518	0.15031	0.1488	0.14735	0.1459	0.14438	0.1429	0.14151	0.14013	0.13879	0.13749	0.1362	0.135	0.098635	0.059169	0.066612435	0.301574	0.26
31.10.2007	0.15122	0.15161	0.15203	0.1523	0.15203	0.15128	0.1502	0.14884	0.1473	0.1457	0.14392	0.1421	0.14035	0.1386	0.13681	0.1351	0.13343	0.13181	0.13025	0.12876	0.1273	0.126	0.088301	0.062681	0.080115404	0.343412	0.08
30.11.2007	0.14938	0.1509	0.1528	0.1555	0.15698	0.15751	0.1573	0.15655	0.1554	0.1539	0.15224	0.1504	0.14851	0.1466	0.1446	0.1427	0.14075	0.13889	0.13709	0.13536	0.1337	0.1321	0.08894	0.059612	0.115227279	0.371024	0.06
31.12.2007	0.1503	0.15127	0.15253	0.1544	0.15551	0.15603	0.1561	0.15573	0.1551	0.1542	0.15317	0.152	0.15072	0.1494	0.14801	0.1466	0.14523	0.14385	0.14249	0.14116	0.1399	0.1386	0.099306	0.050455	0.092156446	0.316097	0.04
31.01.2008	0.14735	0.14813	0.1492	0.151	0.15243	0.15358	0.1545	0.15524	0.1558	0.1563	0.15672	0.157	0.15731	0.1575	0.15772	0.1579	0.15801	0.15813	0.15823	0.15831	0.1584	0.1584	0.159509	-0.01257	0.007398242	0.507071	0.22
29.02.2008	0.15007	0.15141	0.15315	0.1559	0.1578	0.15922	0.1603	0.16103	0.1616	0.1621	0.16241	0.1627	0.16291	0.1631	0.16325	0.1634	0.16348	0.16358	0.16366	0.16373	0.1638	0.1639	0.16493	-0.01558	0.00706233	0.793992	0.18
31.03.2008	0.15863	0.1612	0.1644	0.1691	0.17219	0.17431	0.1758	0.17684	0.1776	0.1782	0.17868	0.179	0.17934	0.1796	0.17979	0.18	0.18013	0.18026	0.18038	0.18048	0.1806	0.1807	0.182255	-0.02505	0.007685642	1.087844	0.23
30.04.2008	0.16777	0.16965	0.17195	0.1751	0.17686	0.17767	0.1779	0.1777	0.1773	0.1767	0.17611	0.1755	0.17483	0.1742	0.17363	0.1731	0.17258	0.17211	0.17168	0.17129	0.1709	0.1706	0.163786	0.002935	0.042536551	0.662155	0.40
30.05.2008	0.16829	0.17069	0.17387	0.1789	0.18254	0.18517	0.1871	0.18841	0.1893	0.19	0.19044	0.1907	0.1909	0.191	0.19103	0.191	0.19101	0.19097	0.19092	0.19086	0.1908	0.1907	0.189007	-0.02202	0.03274761	0.585578	0.08
30.06.2008	0.15593	0.16541	0.17701	0.1928	0.20165	0.20585	0.2071	0.20651	0.2048	0.2025	0.19993	0.1972	0.19459	0.192	0.18965	0.1874	0.18536	0.18346	0.18172	0.18013	0.1787	0.1773	0.150568	2.42E-05	0.189442197	0.702758	0.52
31.07.2008	0.17228	0.17397	0.17502	0.175	0.17425	0.17361	0.1731	0.17278	0.1725	0.1723	0.17217	0.172	0.17194	0.1719	0.17179	0.1717	0.17167	0.17163	0.17159	0.17155	0.1715	0.1715	0.170935	2.44E-05	0.014221879	2.570333	0.40
29.08.2008	0.16635	0.16893	0.17157	0.174	0.17445	0.17401	0.1732	0.17242	0.1716	0.1709	0.17035	0.1698	0.1694	0.169	0.16871	0.1684	0.16818	0.16797	0.16778	0.16761	0.1675	0.1673	0.164738	2.41E-05	0.032552121	1.259739	0.22
29.09.2008	0.17326	0.17468	0.17637	0.1785	0.17952	0.17987	0.1798	0.17958	0.1792	0.1788	0.17839	0.178	0.17761	0.1773	0.17695	0.1767	0.17641	0.17617	0.17596	0.17577	0.1756	0.1754	0.172412	2.41E-05	0.025038251	0.82376	0.44

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2008	0.17809	0.18853	0.20136	0.219	0.22891	0.23377	0.2353	0.23485	0.2331	0.2306	0.22781	0.2249	0.22194	0.2191	0.21645	0.214	0.21165	0.20952	0.20756	0.20577	0.2041	0.2026	0.172206	2.41E-05	0.211655721	0.690667	0.65
28.11.2008	0.17299	0.17522	0.17816	0.1828	0.18601	0.18821	0.1896	0.19046	0.1908	0.1909	0.19074	0.1904	0.18996	0.1894	0.18886	0.1883	0.18767	0.18707	0.18649	0.18592	0.1854	0.1849	0.171757	2.41E-05	0.064182979	0.463602	0.30
31.12.2008	0.14543	0.14687	0.14884	0.1521	0.15467	0.15662	0.1581	0.15914	0.1599	0.1604	0.16064	0.1607	0.16072	0.1606	0.1604	0.1601	0.15983	0.15949	0.15914	0.15877	0.1584	0.158	0.144634	2.41E-05	0.053963715	0.347956	0.23
30.01.2009	0.10777	0.11296	0.11992	0.1312	0.13969	0.14587	0.1502	0.15318	0.155	0.156	0.15631	0.1561	0.15553	0.1547	0.15361	0.1524	0.15111	0.14976	0.14839	0.14702	0.1457	0.1443	0.104975	2.41E-05	0.171968743	0.395628	0.28
27.02.2009	0.10584	0.11189	0.1201	0.1338	0.1444	0.15248	0.1585	0.16289	0.1659	0.1679	0.16897	0.1694	0.16924	0.1687	0.16783	0.1667	0.16542	0.16401	0.16251	0.16095	0.1594	0.1578	0.102611	2.41E-05	0.223722163	0.35074	0.91
31.03.2009	0.10985	0.11293	0.11728	0.1251	0.13193	0.1378	0.1428	0.14714	0.1508	0.1539	0.15642	0.1585	0.16024	0.1616	0.16264	0.1634	0.16396	0.1643	0.16445	0.16445	0.1643	0.1641	0.108231	2.41E-05	0.18840357	0.20522	0.10
30.04.2009	0.08443	0.08918	0.09567	0.1066	0.11517	0.12181	0.1269	0.13061	0.1333	0.1351	0.13622	0.1368	0.13687	0.1366	0.13607	0.1353	0.1344	0.13336	0.13224	0.13105	0.1298	0.1286	0.081889	2.41E-05	0.184229095	0.333737	0.51
29.05.2009	0.09227	0.09659	0.10238	0.1118	0.1189	0.12409	0.1278	0.1303	0.1319	0.1327	0.13305	0.1329	0.13248	0.1318	0.13093	0.1299	0.12888	0.12777	0.12663	0.12549	0.1244	0.1232	0.089946	2.41E-05	0.144421659	0.39113	0.78
30.06.2009	0.09137	0.09384	0.0974	0.104	0.11003	0.1155	0.1205	0.125	0.1291	0.1329	0.13638	0.1396	0.14247	0.1451	0.1476	0.1499	0.15197	0.15391	0.1557	0.15736	0.1589	0.1603	0.193269	-0.10317	-0.00011363	0.297549	0.07
31.07.2009	0.07982	0.08263	0.0865	0.0931	0.0985	0.10292	0.1066	0.10961	0.1121	0.1143	0.1161	0.1177	0.11899	0.1201	0.12115	0.122	0.1228	0.12349	0.12411	0.12465	0.1251	0.1256	0.134174	-0.05584	-0.00011333	0.651223	0.03
31.08.2009	0.07325	0.07599	0.07981	0.0866	0.09227	0.09715	0.1013	0.10489	0.108	0.1106	0.11296	0.115	0.11677	0.1183	0.11973	0.121	0.12206	0.12304	0.12393	0.12472	0.1254	0.1261	0.139032	-0.06721	-0.00011348	0.517816	0.20
30.09.2009	0.06023	0.06376	0.06856	0.0766	0.08301	0.08814	0.0923	0.09568	0.0985	0.1008	0.10271	0.1043	0.10573	0.1069	0.10795	0.1088	0.10964	0.11033	0.11095	0.1115	0.112	0.1124	0.12096	-0.06261	-0.00011339	0.735512	0.16
30.10.2009	0.05907	0.06412	0.07032	0.0792	0.08489	0.08875	0.0914	0.09339	0.0948	0.096	0.09683	0.0975	0.09811	0.0986	0.099	0.0994	0.09966	0.09993	0.10016	0.10037	0.1006	0.1007	0.103917	-0.04769	-0.00011132	1.496841	1.05
26.11.2009	0.05926	0.06426	0.07043	0.0793	0.08516	0.08912	0.0919	0.09392	0.0954	0.0966	0.09751	0.0983	0.09886	0.0994	0.0998	0.1002	0.10048	0.10076	0.10101	0.10123	0.1014	0.1016	0.104951	-0.0485	-0.00011133	1.450304	0.58
31.12.2009	0.0484	0.05593	0.06514	0.0782	0.08656	0.09216	0.096	0.09884	0.1009	0.1025	0.10375	0.1048	0.10558	0.1063	0.10685	0.1074	0.10779	0.10817	0.1085	0.1088	0.1091	0.1093	0.113855	-0.06972	-0.00011129	1.534182	0.59
29.01.2010	0.0653	0.0677	0.07104	0.0769	0.08182	0.08597	0.0895	0.09251	0.0951	0.0973	0.09921	0.1009	0.10232	0.1036	0.10472	0.1057	0.10659	0.10738	0.10809	0.10873	0.1093	0.1098	0.12003	-0.05598	-0.0001125	0.547426	0.08
26.02.2010	0.0533	0.05916	0.06649	0.0773	0.08452	0.08956	0.0931	0.09578	0.0978	0.0993	0.10054	0.1015	0.10233	0.103	0.10358	0.1041	0.1045	0.10488	0.10521	0.1055	0.1058	0.106	0.110494	-0.06046	-0.00011109	1.34838	0.32
31.03.2010	0.04841	0.05652	0.06595	0.0783	0.08549	0.08999	0.093	0.09503	0.0965	0.0977	0.09855	0.0993	0.09985	0.1003	0.10074	0.1011	0.1014	0.10166	0.1019	0.10211	0.1023	0.1025	0.105666	-0.062	-0.00011094	1.939867	1.82
30.04.2010	0.0719	0.07392	0.07668	0.0814	0.08522	0.08835	0.0909	0.09306	0.0948	0.0963	0.0976	0.0987	0.09961	0.1004	0.10111	0.1017	0.10225	0.10273	0.10315	0.10353	0.1039	0.1042	0.110095	-0.03926	-0.00011407	0.665008	0.22
31.05.2010	0.07351	0.07537	0.07793	0.0823	0.08596	0.08895	0.0914	0.09352	0.0953	0.0968	0.09802	0.0991	0.10005	0.1009	0.10157	0.1022	0.10275	0.10323	0.10367	0.10406	0.1044	0.1047	0.110883	-0.03835	-0.0001141	0.624247	0.11
30.06.2010	0.06817	0.07163	0.07582	0.0816	0.0853	0.08771	0.0894	0.09054	0.0914	0.0921	0.09259	0.093	0.09335	0.0936	0.09388	0.0941	0.09427	0.09442	0.09456	0.09469	0.0948	0.0949	0.096787	-0.03059	-0.00011366	1.624448	0.13
30.07.2010	0.06756	0.06987	0.07272	0.0769	0.07959	0.08146	0.0828	0.08373	0.0845	0.085	0.08544	0.0858	0.08608	0.0863	0.08653	0.0867	0.08686	0.08699	0.08711	0.08722	0.0873	0.0874	0.088993	-0.02272	-0.00011371	1.42701	0.14
31.08.2010	0.06704	0.06915	0.07183	0.0759	0.07872	0.08074	0.0822	0.08331	0.0842	0.0848	0.08534	0.0858	0.08612	0.0864	0.08667	0.0869	0.08707	0.08723	0.08738	0.08751	0.0876	0.0877	0.08969	-0.02381	-0.00011418	1.217657	0.06
30.09.2010	0.0666	0.06838	0.07072	0.0745	0.07724	0.07935	0.081	0.08222	0.0832	0.084	0.08467	0.0852	0.08565	0.086	0.08635	0.0866	0.08687	0.08709	0.08728	0.08744	0.0876	0.0877	0.090289	-0.02465	-0.00011487	0.966099	0.04

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
28.10.2010	0.06783	0.06839	0.0692	0.0707	0.0721	0.07337	0.0745	0.07558	0.0765	0.0774	0.07826	0.079	0.07971	0.0803	0.08094	0.0815	0.08199	0.08246	0.08289	0.0833	0.0837	0.084	0.092299	-0.02476	-0.00011775	0.282775	1.03
30.11.2010	0.06981	0.07039	0.07124	0.0729	0.07438	0.0758	0.0771	0.07841	0.0796	0.0807	0.08179	0.0828	0.08373	0.0846	0.08546	0.0862	0.087	0.08771	0.08838	0.08902	0.0896	0.0902	0.106984	-0.03747	-0.00011823	0.190375	0.24
31.12.2010	0.05408	0.05577	0.05812	0.0622	0.0657	0.06862	0.0711	0.07321	0.075	0.0766	0.07791	0.0791	0.08009	0.081	0.08177	0.0825	0.08308	0.08363	0.08413	0.08457	0.085	0.0853	0.092475	-0.03928	-0.00011761	0.550149	1.51
31.01.2011	0.06058	0.06348	0.06731	0.0734	0.078	0.08147	0.0841	0.08623	0.0879	0.0892	0.09028	0.0912	0.09192	0.0925	0.09308	0.0935	0.09395	0.09431	0.09462	0.0949	0.0951	0.0954	0.099641	-0.04063	-0.00011747	0.9542	1.07
28.02.2011	0.07232	0.07419	0.07662	0.0804	0.08307	0.08505	0.0865	0.08764	0.0885	0.0892	0.08975	0.0902	0.09058	0.0909	0.09116	0.0914	0.09159	0.09176	0.09192	0.09205	0.0922	0.0923	0.094389	-0.02309	-0.00011721	1.104134	0.25
31.03.2011	0.07526	0.07749	0.08014	0.0837	0.08593	0.08734	0.0883	0.08896	0.0895	0.0898	0.09012	0.0904	0.09055	0.0907	0.09084	0.091	0.09106	0.09115	0.09123	0.0913	0.0914	0.0914	0.092473	-0.01849	-0.00011592	1.757104	0.17
29.04.2011	0.07147	0.07347	0.076	0.0798	0.08237	0.0842	0.0855	0.08651	0.0873	0.0878	0.08829	0.0887	0.08898	0.0892	0.08945	0.0896	0.0898	0.08995	0.09007	0.09019	0.0903	0.0904	0.092089	-0.02172	-0.0001165	1.274665	0.39
31.05.2011	0.07517	0.07732	0.07995	0.0836	0.08598	0.08754	0.0886	0.08939	0.09	0.0904	0.09075	0.091	0.09125	0.0914	0.0916	0.0917	0.09186	0.09196	0.09205	0.09213	0.0922	0.0923	0.093523	-0.01958	-0.00011636	1.575055	0.23
30.06.2011	0.07872	0.08033	0.08234	0.0852	0.08716	0.08847	0.0894	0.09008	0.0906	0.091	0.09128	0.0915	0.09174	0.0919	0.09205	0.0922	0.09228	0.09238	0.09246	0.09253	0.0926	0.0927	0.093791	-0.01597	-8.6762E-07	1.412561	0.06
29.07.2011	0.07728	0.0786	0.08037	0.0832	0.08544	0.08712	0.0884	0.08945	0.0903	0.0909	0.09144	0.0919	0.09223	0.0925	0.09279	0.093	0.0932	0.09337	0.09351	0.09364	0.0938	0.0939	0.09581	-0.01925	0.005449315	0.709132	0.22
29.08.2011	0.07468	0.07496	0.07538	0.0762	0.07703	0.07785	0.0787	0.07945	0.0802	0.081	0.0818	0.0826	0.08333	0.0841	0.08483	0.0856	0.0863	0.08702	0.08773	0.08844	0.0891	0.0898	0.060043	0.014493	0.247925526	0.01447	0.08
30.09.2011	0.07704	0.07739	0.07792	0.079	0.07999	0.08101	0.082	0.08302	0.084	0.085	0.08596	0.0869	0.08787	0.0888	0.08974	0.0907	0.09158	0.09248	0.09337	0.09425	0.0951	0.096	0.062582	0.014282	0.298663835	0.014885	0.04
31.10.2011	0.09496	0.09491	0.09483	0.0947	0.09454	0.09439	0.0943	0.09412	0.094	0.0939	0.09374	0.0936	0.0935	0.0934	0.09327	0.0932	0.09306	0.09296	0.09286	0.09276	0.0927	0.0926	0.088605	0.006382	-0.00408094	0.059935	0.09
30.11.2011	0.10157	0.10143	0.10121	0.1008	0.10037	0.09996	0.0996	0.09915	0.0987	0.0984	0.09796	0.0976	0.09719	0.0968	0.09644	0.0961	0.0957	0.09534	0.09498	0.09463	0.0943	0.0939	0.067029	0.034611	-0.04766458	0.020874	0.14
30.12.2011	0.10858	0.10813	0.10746	0.1062	0.10494	0.10376	0.1026	0.10157	0.1005	0.0996	0.09863	0.0977	0.09689	0.0961	0.0953	0.0946	0.09385	0.09317	0.09252	0.09191	0.0913	0.0907	0.075753	0.033062	-0.02242406	0.099802	0.05
31.01.2012	0.09152	0.09154	0.09158	0.0917	0.09172	0.09179	0.0919	0.09193	0.092	0.0921	0.09214	0.0922	0.09228	0.0924	0.09242	0.0925	0.09256	0.09262	0.09269	0.09276	0.0928	0.0929	0.116946	-0.02544	1.60361E-05	0.011298	0.24
29.02.2012	0.08642	0.08651	0.08664	0.0869	0.08717	0.08742	0.0877	0.08794	0.0882	0.0884	0.08869	0.0889	0.08918	0.0894	0.08967	0.0899	0.09015	0.09038	0.09062	0.09085	0.0911	0.0913	0.135444	-0.04906	1.60386E-05	0.021579	0.02
30.03.2012	0.08891	0.08898	0.08908	0.0893	0.08948	0.08968	0.0899	0.09007	0.0903	0.0905	0.09064	0.0908	0.09102	0.0912	0.09139	0.0916	0.09176	0.09194	0.09213	0.09231	0.0925	0.0927	0.131748	-0.04287	1.60378E-05	0.018773	0.24
30.04.2012	0.09309	0.0924	0.09161	0.0906	0.09005	0.08971	0.0895	0.08933	0.0892	0.0891	0.08907	0.089	0.08898	0.0889	0.08891	0.0889	0.08887	0.08885	0.08883	0.08881	0.0888	0.0888	0.088552	0.004953	1.87195E-05	2.115177	0.03
31.05.2012	0.10327	0.09969	0.09613	0.0924	0.09072	0.08979	0.0892	0.08885	0.0886	0.0884	0.08821	0.0881	0.08798	0.0879	0.08782	0.0878	0.08771	0.08766	0.08762	0.08758	0.0875	0.0875	0.086944	0.018651	1.8663E-05	3.272106	0.09
29.06.2012	0.08243	0.0825	0.08259	0.0828	0.08294	0.08309	0.0832	0.08338	0.0835	0.0836	0.08375	0.0839	0.08396	0.0841	0.08415	0.0842	0.08432	0.08439	0.08447	0.08454	0.0846	0.0847	0.086465	-0.00406	1.98999E-05	0.191851	0.37
31.07.2012	0.07122	0.07186	0.0727	0.074	0.07503	0.07578	0.0764	0.07681	0.0772	0.0775	0.07768	0.0779	0.07804	0.0782	0.07828	0.0784	0.07847	0.07855	0.07861	0.07867	0.0787	0.0788	0.079686	-0.00881	1.99975E-05	0.963892	0.12
31.08.2012	0.06816	0.06886	0.06983	0.0715	0.07298	0.07421	0.0753	0.07615	0.0769	0.0776	0.07817	0.0787	0.07912	0.0795	0.07985	0.0802	0.08043	0.08067	0.08089	0.08109	0.0813	0.0814	0.084611	-0.01681	1.97082E-05	0.524797	0.29
28.09.2012	0.0659	0.06663	0.06765	0.0695	0.07105	0.0724	0.0736	0.07458	0.0755	0.0762	0.07691	0.0775	0.07803	0.0785	0.07892	0.0793	0.07962	0.07992	0.08019	0.08043	0.0807	0.0809	0.084891	-0.01937	1.97034E-05	0.475674	0.42

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2012	0.06356	0.064	0.06464	0.0659	0.06705	0.06817	0.0692	0.07026	0.0712	0.0722	0.07305	0.0739	0.0747	0.0755	0.07622	0.0769	0.0776	0.07825	0.07887	0.07946	0.08	0.0806	0.099735	-0.03639	1.92775E-05	0.145681	0.12
30.11.2012	0.0516	0.05224	0.05315	0.0549	0.05642	0.05785	0.0592	0.06036	0.0615	0.0625	0.0634	0.0643	0.06504	0.0658	0.06644	0.0671	0.06764	0.06818	0.06868	0.06914	0.0696	0.07	0.079491	-0.02821	1.92856E-05	0.277876	0.48
31.12.2012	0.05706	0.05749	0.05808	0.0591	0.06	0.06074	0.0614	0.06192	0.0624	0.0628	0.06315	0.0635	0.06373	0.064	0.06417	0.0644	0.06452	0.06467	0.0648	0.06492	0.065	0.0651	0.067054	-0.01021	1.93552E-05	0.525938	0.10
31.01.2013	0.05055	0.05133	0.05243	0.0544	0.05607	0.05754	0.0588	0.05991	0.0609	0.0617	0.06248	0.0631	0.06373	0.0642	0.06471	0.0651	0.0655	0.06584	0.06614	0.06642	0.0667	0.0669	0.071503	-0.02135	1.92835E-05	0.45891	0.16
28.02.2013	0.04984	0.05038	0.05117	0.0527	0.0541	0.05543	0.0567	0.05787	0.059	0.06	0.06101	0.0619	0.06282	0.0636	0.06443	0.0652	0.06587	0.06653	0.06716	0.06775	0.0683	0.0689	0.084487	-0.03492	1.81869E-05	0.189812	0.33
29.03.2013	0.05871	0.05899	0.05939	0.0602	0.06093	0.06165	0.0624	0.06303	0.0637	0.0643	0.06491	0.0655	0.06606	0.0666	0.06712	0.0676	0.06812	0.06859	0.06905	0.06948	0.0699	0.0703	0.087796	-0.02922	1.81779E-05	0.113366	0.28
30.04.2013	0.04557	0.04625	0.04722	0.049	0.05061	0.05206	0.0534	0.05452	0.0556	0.0565	0.0574	0.0582	0.05891	0.0596	0.06015	0.0607	0.0612	0.06165	0.06208	0.06246	0.0628	0.0632	0.070397	-0.02517	1.81936E-05	0.335075	0.69
31.05.2013	0.05806	0.05841	0.05892	0.0599	0.06069	0.06145	0.0621	0.06276	0.0633	0.0638	0.06429	0.0647	0.06509	0.0654	0.06576	0.0661	0.06632	0.06657	0.06679	0.06701	0.0672	0.0674	0.071358	-0.01348	1.81927E-05	0.325298	0.25
28.06.2013	0.06937	0.07035	0.07165	0.0738	0.07535	0.07658	0.0775	0.07829	0.0789	0.0794	0.07977	0.0801	0.08038	0.0806	0.08082	0.081	0.08114	0.08128	0.08139	0.0815	0.0816	0.0817	0.083285	-0.01444	1.82061E-05	0.896842	0.25
31.07.2013	0.06734	0.07777	0.0828	0.0856	0.0865	0.08697	0.0872	0.08744	0.0876	0.0877	0.08775	0.0878	0.08786	0.0879	0.08794	0.088	0.08799	0.08802	0.08804	0.08806	0.0881	0.0881	0.088366	-0.03309	1.82112E-05	11.84322	0.49
29.08.2013	0.07318	0.0807	0.08667	0.0914	0.09322	0.09413	0.0947	0.09505	0.0953	0.0955	0.09566	0.0958	0.09588	0.096	0.09603	0.0961	0.09614	0.09619	0.09623	0.09626	0.0963	0.0963	0.096872	-0.02938	1.81899E-05	5.361471	0.42
30.09.2013	0.07731	0.07795	0.07884	0.0804	0.08174	0.08286	0.0838	0.08462	0.0853	0.0859	0.08644	0.0869	0.08729	0.0876	0.08795	0.0882	0.08846	0.08868	0.08887	0.08904	0.0892	0.0893	0.092149	-0.01518	1.76731E-05	0.538237	0.18
31.10.2013	0.06733	0.06825	0.06954	0.0718	0.07377	0.07545	0.0769	0.07813	0.0792	0.0801	0.08097	0.0817	0.08232	0.0829	0.08337	0.0838	0.08421	0.08456	0.08488	0.08517	0.0854	0.0857	0.090341	-0.02349	0.00217354	0.453226	0.50
29.11.2013	0.08394	0.08412	0.0844	0.0849	0.08542	0.08589	0.0863	0.08677	0.0872	0.0876	0.08793	0.0883	0.08862	0.0889	0.08924	0.0895	0.08981	0.09008	0.09033	0.09057	0.0908	0.091	0.098339	-0.01449	0.001745312	0.139113	0.44
31.12.2013	0.07272	0.08354	0.09033	0.0947	0.09618	0.09693	0.0974	0.09768	0.0979	0.0981	0.09818	0.0983	0.09836	0.0984	0.09849	0.0985	0.09858	0.09862	0.09865	0.09868	0.0987	0.0987	0.099182	-0.03623	-0.0039508	8.930524	0.26
31.01.2014	0.10659	0.1064	0.10611	0.1056	0.105	0.10445	0.1039	0.10336	0.1028	0.1023	0.10178	0.1013	0.10075	0.1002	0.09974	0.0992	0.09875	0.09827	0.09779	0.09731	0.0968	0.0964	0.040027	0.066654	0.016323105	0.045322	1.13
28.02.2014	0.10896	0.10851	0.10786	0.1067	0.10555	0.10455	0.1036	0.10284	0.1021	0.1015	0.10093	0.1005	0.10004	0.0997	0.09943	0.0992	0.09907	0.09897	0.09892	0.09892	0.099	0.0991	0.208963	-0.09978	-0.17196842	0.076626	0.53
31.03.2014	0.10672	0.10606	0.10516	0.1036	0.10234	0.10131	0.1005	0.09986	0.0994	0.099	0.09876	0.0986	0.09849	0.0985	0.09847	0.0985	0.09862	0.09874	0.09888	0.09903	0.0992	0.0994	0.108391	-0.00133	-0.03117681	0.279487	0.50
30.04.2014	0.09383	0.09283	0.09158	0.0898	0.08881	0.08829	0.0881	0.08815	0.0883	0.0886	0.08891	0.0892	0.08958	0.0899	0.09024	0.0905	0.09082	0.09109	0.09133	0.09156	0.0918	0.092	0.095977	-0.00158	-0.02384855	0.625329	0.16
30.05.2014	0.09039	0.08809	0.08546	0.0824	0.08121	0.08106	0.0815	0.08211	0.0829	0.0836	0.08439	0.0851	0.08569	0.0862	0.08674	0.0872	0.08757	0.08792	0.08824	0.08852	0.0888	0.089	0.093407	-0.00167	-0.03883997	0.918499	0.32
30.06.2014	0.083	0.08194	0.08076	0.0795	0.07918	0.07939	0.0799	0.08052	0.0812	0.0818	0.08246	0.083	0.08355	0.084	0.08444	0.0848	0.08514	0.08544	0.08571	0.08596	0.0862	0.0864	0.090207	-0.00658	-0.0255833	0.837643	0.06
31.07.2014	0.08156	0.08114	0.08068	0.0802	0.08015	0.08038	0.0808	0.0813	0.0819	0.0824	0.08299	0.0835	0.08405	0.0845	0.08499	0.0854	0.08579	0.08614	0.08646	0.08676	0.087	0.0873	0.092431	-0.01062	-0.02090474	0.605582	0.06
29.08.2014	0.08637	0.08624	0.08607	0.0858	0.0857	0.08565	0.0857	0.08572	0.0858	0.0859	0.08609	0.0863	0.08642	0.0866	0.08678	0.087	0.08714	0.08731	0.08748	0.08765	0.0878	0.088	0.092422	-0.00598	-0.01112185	0.343938	0.14
30.09.2014	0.096	0.09543	0.09474	0.0938	0.09325	0.093	0.0929	0.09301	0.0931	0.0933	0.09355	0.0938	0.09398	0.0942	0.0944	0.0946	0.09477	0.09493	0.09508	0.09523	0.0954	0.0955	0.09795	-0.00164	-0.01410916	0.628669	0.64

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2014	0.08478	0.08396	0.08294	0.0815	0.08072	0.08033	0.0802	0.08027	0.0804	0.0807	0.08095	0.0812	0.08152	0.0818	0.08207	0.0823	0.08256	0.08278	0.08299	0.08318	0.0833	0.0835	0.086817	-0.00158	-0.01960472	0.632834	0.36
28.11.2014	0.0748	0.07403	0.07322	0.0724	0.07225	0.0724	0.0727	0.07302	0.0733	0.0737	0.07393	0.0742	0.07439	0.0746	0.07473	0.0749	0.075	0.07511	0.07521	0.0753	0.0754	0.0754	0.076792	-0.00153	-0.01272464	1.057384	0.32
31.12.2014	0.09237	0.0887	0.08474	0.0803	0.07832	0.07747	0.0771	0.07701	0.077	0.077	0.07703	0.0771	0.07709	0.0771	0.07714	0.0772	0.07718	0.07719	0.07721	0.07722	0.0772	0.0772	0.07743	0.017162	-0.02004709	1.531089	0.30
30.01.2015	0.07811	0.07559	0.07268	0.0691	0.06736	0.06665	0.0665	0.06663	0.0669	0.0672	0.06752	0.0678	0.06809	0.0683	0.06856	0.0688	0.06893	0.06908	0.06922	0.06935	0.0695	0.0696	0.071488	0.008083	-0.02790524	1.027085	0.22
27.02.2015	0.0949	0.09276	0.08998	0.0857	0.08272	0.08075	0.0795	0.0788	0.0785	0.0784	0.07855	0.0788	0.07916	0.0796	0.08	0.0804	0.08088	0.08131	0.08173	0.08213	0.0825	0.0829	0.091284	0.004784	-0.05031594	0.520962	0.14
31.03.2015	0.09377	0.09004	0.08678	0.0839	0.08273	0.08213	0.0818	0.08153	0.0814	0.0812	0.08113	0.081	0.08098	0.0809	0.08088	0.0808	0.08081	0.08078	0.08075	0.08072	0.0807	0.0807	0.080323	0.01609	1.17212E-05	4.448839	0.35
30.04.2015	0.09877	0.09822	0.09744	0.0961	0.09497	0.09403	0.0932	0.09256	0.092	0.0915	0.09108	0.0907	0.0904	0.0901	0.08988	0.0897	0.08947	0.0893	0.08915	0.08902	0.0889	0.0888	0.086615	0.012451	1.20179E-05	0.573654	0.25
29.05.2015	0.09789	0.09709	0.09603	0.0943	0.09298	0.09195	0.0911	0.09051	0.09	0.0896	0.08923	0.0889	0.08871	0.0885	0.08833	0.0882	0.08805	0.08793	0.08783	0.08774	0.0877	0.0876	0.08618	0.012138	1.20129E-05	0.866376	0.22
30.06.2015	0.09759	0.09718	0.0966	0.0955	0.09458	0.09375	0.093	0.09237	0.0918	0.0913	0.09091	0.0906	0.09026	0.09	0.0898	0.0896	0.08951	0.08941	0.08934	0.0893	0.0893	0.0893	0.100301	-0.0025	-0.03290364	0.167913	0.14
31.07.2015	0.1012	0.10026	0.09905	0.0972	0.09582	0.09486	0.0942	0.09365	0.0933	0.093	0.09278	0.0926	0.09248	0.0924	0.09229	0.0922	0.09216	0.09211	0.09207	0.09203	0.092	0.092	0.091437	0.010272	-0.00621115	0.765098	0.03
31.08.2015	0.10747	0.10694	0.10618	0.1048	0.10353	0.10242	0.1014	0.10058	0.0998	0.0992	0.09862	0.0982	0.09778	0.0975	0.09724	0.0971	0.09695	0.0969	0.09689	0.09693	0.097	0.0971	0.145994	-0.03825	-0.09432066	0.117309	0.39
30.09.2015	0.1103	0.11018	0.10999	0.1096	0.10924	0.10888	0.1085	0.10815	0.1078	0.1074	0.10709	0.1067	0.1064	0.1061	0.10573	0.1054	0.10506	0.10474	0.10441	0.10409	0.1038	0.1035	0.122375	-0.01201	-0.12301033	0.013697	0.16
30.10.2015	0.10048	0.10007	0.0995	0.0985	0.09776	0.09713	0.0966	0.09619	0.0958	0.0955	0.0953	0.0951	0.09491	0.0948	0.09462	0.0945	0.0944	0.09431	0.09423	0.09416	0.0941	0.094	0.092911	0.007794	-1.676E-05	0.691351	0.33
30.11.2015	0.10237	0.10224	0.10206	0.1017	0.10133	0.10098	0.1006	0.1003	0.1	0.0996	0.09933	0.099	0.09871	0.0984	0.09812	0.0978	0.09754	0.09727	0.09699	0.09673	0.0965	0.0962	0.078461	0.023967	0.00497129	0.079071	0.27
31.12.2015	0.10506	0.105	0.10491	0.1047	0.10454	0.10436	0.1042	0.104	0.1038	0.1036	0.10347	0.1033	0.10313	0.103	0.10279	0.1026	0.10245	0.10228	0.10212	0.10195	0.1018	0.1016	0.078336	0.02676	-0.02508406	0.01435	0.28
29.01.2016	0.10324	0.10323	0.10321	0.1032	0.10314	0.10311	0.1031	0.10305	0.103	0.103	0.10295	0.1029	0.10289	0.1029	0.10283	0.1028	0.10277	0.10274	0.10272	0.10269	0.1027	0.1026	0.100118	0.003126	-0.00295748	0.022408	0.19
29.02.2016	0.10308	0.10304	0.10298	0.1029	0.10277	0.10266	0.1026	0.10246	0.1024	0.1023	0.10217	0.1021	0.10199	0.1019	0.10182	0.1017	0.10165	0.10157	0.10149	0.10142	0.1013	0.1013	0.09787	0.005225	-0.0049858	0.044213	0.11
31.03.2016	0.09478	0.09478	0.09478	0.0948	0.09478	0.09478	0.0948	0.09478	0.0948	0.0948	0.09478	0.0948	0.09478	0.0948	0.09478	0.0948	0.09478	0.09478	0.09478	0.09478	0.0948	0.0948	0.093492	0.001285	-0.00203492	1E-05	0.46
29.04.2016	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.0884	0.087114	0.001284	-0.00203492	1E-05	0.33
31.05.2016	0.08571	0.08626	0.08704	0.0884	0.08966	0.09071	0.0916	0.09239	0.0931	0.0936	0.09413	0.0946	0.09492	0.0952	0.0955	0.0957	0.09592	0.09609	0.09623	0.09634	0.0964	0.0965	0.096235	-0.01082	0.014301972	0.278102	0.15
30.06.2016	0.08164	0.08192	0.08233	0.0831	0.08379	0.08443	0.085	0.08556	0.0861	0.0865	0.08693	0.0873	0.08767	0.088	0.0883	0.0886	0.08882	0.08905	0.08926	0.08946	0.0896	0.0898	0.091375	-0.00987	0.010830994	0.166797	0.02
29.07.2016	0.08194	0.08274	0.08384	0.0857	0.08731	0.08859	0.0896	0.0905	0.0912	0.0918	0.09223	0.0926	0.09289	0.0931	0.09331	0.0935	0.09357	0.09365	0.09371	0.09375	0.0938	0.0938	0.0927	-0.01118	0.01695968	0.361777	0.13
31.08.2016	0.07985	0.08063	0.08172	0.0837	0.08537	0.08682	0.0881	0.08914	0.0901	0.0909	0.09155	0.0921	0.09264	0.0931	0.09346	0.0938	0.09406	0.09431	0.09451	0.0947	0.0949	0.095	0.096049	-0.01661	0.015541759	0.305784	0.20
30.09.2016	0.07598	0.07672	0.07779	0.0798	0.08156	0.08318	0.0847	0.08599	0.0872	0.0883	0.08929	0.0902	0.09103	0.0918	0.09246	0.0931	0.09365	0.09417	0.09464	0.09508	0.0955	0.0958	0.101903	-0.0263	0.015621312	0.219354	0.21

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2016	0.08035	0.08138	0.08282	0.0853	0.08741	0.08916	0.0906	0.0918	0.0928	0.0936	0.09425	0.0948	0.09522	0.0956	0.09584	0.096	0.09621	0.09633	0.09641	0.09647	0.0965	0.0965	0.093656	-0.01384	0.027046454	0.320307	0.06
30.11.2016	0.09209	0.09284	0.09389	0.0958	0.09736	0.09873	0.0999	0.1009	0.1018	0.1025	0.10309	0.1036	0.10404	0.1044	0.10472	0.105	0.10519	0.10537	0.10552	0.10563	0.1057	0.1058	0.104572	-0.01287	0.020102586	0.285697	0.32
30.12.2016	0.07796	0.08186	0.08664	0.0934	0.09776	0.10068	0.1027	0.10415	0.1052	0.1061	0.10672	0.1072	0.10767	0.108	0.10833	0.1086	0.10882	0.10902	0.10919	0.10935	0.1095	0.1096	0.111986	-0.03624	3.17708E-05	1.525093	0.59
31.01.2017	0.10561	0.10558	0.10554	0.1054	0.10536	0.10527	0.1052	0.1051	0.105	0.1049	0.10486	0.1048	0.1047	0.1046	0.10455	0.1045	0.1044	0.10433	0.10426	0.10419	0.1041	0.1041	0.097838	0.007791	3.75535E-05	0.047264	0.07
28.02.2017	0.10455	0.10452	0.10447	0.1044	0.10429	0.1042	0.1041	0.10403	0.104	0.1039	0.10379	0.1037	0.10363	0.1036	0.10348	0.1034	0.10333	0.10325	0.10318	0.10311	0.103	0.103	0.096726	0.007837	3.7553E-05	0.047398	0.38
31.03.2017	0.10881	0.10869	0.1085	0.1081	0.1078	0.10746	0.1071	0.10681	0.1065	0.1062	0.10588	0.1056	0.1053	0.105	0.10474	0.1045	0.1042	0.10394	0.10369	0.10345	0.1032	0.103	0.087943	0.020925	3.74208E-05	0.070484	0.47
28.04.2017	0.11793	0.11674	0.11509	0.1122	0.10987	0.10789	0.1062	0.10485	0.1037	0.1027	0.1018	0.1011	0.10041	0.0998	0.09936	0.0989	0.09854	0.0982	0.0979	0.09762	0.0974	0.0972	0.092821	0.02573	3.65595E-05	0.593509	0.55
31.05.2017	0.10966	0.10898	0.10806	0.1065	0.10519	0.10413	0.1033	0.10254	0.1019	0.1014	0.10099	0.1006	0.1003	0.1	0.09978	0.0996	0.09939	0.09923	0.09908	0.09895	0.0988	0.0987	0.09668	0.013333	3.64655E-05	0.65292	0.15
30.06.2017	0.10895	0.10837	0.10757	0.1062	0.10505	0.10411	0.1033	0.10267	0.1021	0.1017	0.10126	0.1009	0.10062	0.1004	0.10014	0.0999	0.09977	0.09962	0.09948	0.09936	0.0992	0.0991	0.097207	0.012053	3.64717E-05	0.622574	0.36
31.07.2017	0.11924	0.11747	0.11514	0.1115	0.10881	0.10681	0.1053	0.10413	0.1032	0.1025	0.1019	0.1014	0.10101	0.1007	0.10039	0.1001	0.09992	0.09973	0.09956	0.09942	0.0993	0.0992	0.09688	0.023328	3.632E-05	1.023913	0.33
31.08.2017	0.11375	0.11296	0.11186	0.1099	0.10832	0.10697	0.1058	0.10486	0.104	0.1033	0.10271	0.1022	0.10172	0.1013	0.10096	0.1006	0.10037	0.10012	0.0999	0.0997	0.0995	0.0994	0.096167	0.018001	3.63923E-05	0.564015	0.50
29.09.2017	0.11972	0.11836	0.11656	0.1137	0.11146	0.10978	0.1085	0.10744	0.1066	0.106	0.10542	0.105	0.1046	0.1043	0.10401	0.1038	0.10357	0.10339	0.10323	0.10309	0.103	0.1028	0.100676	0.019773	3.63304E-05	0.911939	0.21
31.10.2017	0.12617	0.12538	0.12427	0.1223	0.12058	0.1191	0.1178	0.11671	0.1157	0.1149	0.11415	0.1135	0.11291	0.1124	0.11193	0.1115	0.11115	0.11082	0.11051	0.11024	0.11	0.1098	0.105252	0.021323	3.63576E-05	0.468571	0.54
30.11.2017	0.11918	0.12225	0.12585	0.1302	0.13196	0.13212	0.1313	0.13002	0.1284	0.1268	0.12513	0.1235	0.12206	0.1207	0.11943	0.1183	0.11724	0.1163	0.11544	0.11466	0.114	0.1133	0.100632	0.016768	0.077263835	0.738387	2.18
29.12.2017	0.12127	0.12521	0.12872	0.1305	0.12884	0.1261	0.1232	0.1206	0.1183	0.1164	0.11481	0.1135	0.11233	0.1114	0.11055	0.1098	0.10922	0.10868	0.10821	0.10778	0.1074	0.1071	0.100559	0.018109	0.068966568	1.339228	0.88
31.01.2018	0.11745	0.1205	0.12322	0.1247	0.12372	0.12199	0.1202	0.11856	0.1172	0.116	0.11506	0.1143	0.1136	0.113	0.11256	0.1121	0.11179	0.11147	0.1112	0.11095	0.1107	0.1105	0.106748	0.008691	0.045518247	1.433891	0.25
28.02.2018	0.12112	0.12233	0.12347	0.1241	0.12351	0.12232	0.1209	0.11952	0.1182	0.117	0.11595	0.115	0.1142	0.1135	0.11287	0.1123	0.11184	0.11141	0.11103	0.1107	0.1104	0.1101	0.10487	0.015483	0.035798455	0.97699	0.61
30.03.2018	0.11943	0.12388	0.12859	0.1332	0.13395	0.1329	0.1311	0.129	0.127	0.1251	0.12339	0.1219	0.1206	0.1195	0.11848	0.1176	0.11686	0.11619	0.11559	0.11506	0.1146	0.1141	0.105931	0.010791	0.076190541	1.058494	1.39
30.04.2018	0.1213	0.12618	0.13115	0.1355	0.13573	0.13415	0.1319	0.12955	0.1273	0.1254	0.12364	0.1221	0.12086	0.1198	0.1188	0.118	0.11724	0.1166	0.11603	0.11553	0.1151	0.1147	0.106902	0.011373	0.078564794	1.158264	1.29
31.05.2018	0.14745	0.15308	0.15863	0.1628	0.16187	0.15869	0.1547	0.15075	0.147	0.1437	0.14084	0.1383	0.13617	0.1343	0.13268	0.1313	0.13003	0.12894	0.12797	0.12711	0.1263	0.1256	0.112373	0.031548	0.114417516	1.100038	1.77
29.06.2018	0.1451	0.1558	0.16656	0.176	0.17696	0.17454	0.171	0.16737	0.164	0.1611	0.15866	0.1566	0.15476	0.1532	0.15193	0.1508	0.14982	0.14895	0.14819	0.14751	0.1469	0.1464	0.135939	0.002453	0.13434773	1.313457	0.14
31.07.2018	0.15845	0.16532	0.17368	0.1849	0.19079	0.19319	0.1933	0.19208	0.19	0.1875	0.18472	0.1819	0.17924	0.1767	0.17422	0.172	0.16987	0.16794	0.16617	0.16454	0.1631	0.1617	0.134045	0.020524	0.165584972	0.667452	2.02
31.08.2018	0.27482	0.27316	0.27068	0.2657	0.26074	0.25577	0.2508	0.24584	0.2409	0.2359	0.23094	0.226	0.22101	0.216	0.21108	0.2061	0.20115	0.19618	0.19122	0.18626	0.1813	0.1763	0.274829	0.000817	-234.795454	8.46E-05	28.76
28.09.2018	0.24247	0.2405	0.23757	0.2318	0.22607	0.22045	0.2149	0.2095	0.2042	0.1989	0.19372	0.1886	0.18363	0.1787	0.17387	0.1691	0.16442	0.15982	0.1553	0.15084	0.1465	0.1422	0.243075	0.000386	-0.98278512	0.024168	3.45

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2018	0.24328	0.23992	0.23507	0.226	0.21765	0.21004	0.2031	0.19679	0.191	0.1858	0.18112	0.1769	0.17303	0.1696	0.16652	0.1638	0.16136	0.15922	0.15735	0.15573	0.1543	0.1531	0.244634	0.000362	-0.31967568	0.129557	2.90
30.11.2018	0.20466	0.20159	0.19724	0.1894	0.18256	0.17665	0.1715	0.16718	0.1634	0.1603	0.15765	0.1555	0.15366	0.1522	0.15108	0.1502	0.14961	0.1492	0.14898	0.14892	0.149	0.1492	0.20588	0.000361	-0.19144082	0.200675	0.74
31.12.2018	0.20306	0.20057	0.19698	0.1904	0.18439	0.17904	0.1743	0.16998	0.1662	0.1628	0.15983	0.1572	0.15491	0.1529	0.15119	0.1497	0.14846	0.14741	0.14654	0.14584	0.1453	0.1449	0.203983	0.000362	-0.2003517	0.154454	0.13
																											101.3

area refers that since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yields which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period. Therefore, estimated values in the area should not be taken into consideration.

Appendix C. ENS Estimation Results of Matlab Opt. Methodology

Applied Matlab "Fmincon" Optimization Code Details

```
function [Parameters, Error] = NSCalibrated(i)
A = [];
b = [];
Aeq = [];
beq = [];
nonlcon = [];
load InitialValue;

x0 = InitialValue(i,:);
lb = [-Inf -Inf -Inf 0.9];
ub = [Inf Inf Inf 1.2];
Month=i;

%fun = @(Beta) PricingError(Month, Beta(1), Beta(2), Beta(3), Lambda)
%Diebold
fun = @(Beta) PricingError(Month, Beta(1), Beta(2), Beta(3), Beta(4));
%NS
%fun = @(Beta) PricingError(Month, Beta(1), Beta(2), Beta(3), Beta(4),
Beta(5), Beta(6)); %ENS

options =
optimoptions(@fmincon,'Algorithm','sqp','MaxIterations',1500,'StepTolerance',
1e-10);
options.MaxFunctionEvaluations = 4000;

%[x, fval]=fmincon(fun,x0,A,b,Aeq,beq,lb,ub)
[x, fval]=fmincon(fun,x0,A,b,Aeq,beq,lb,ub,nonlcon,options);

Parameters=x;
Error=fval;
```

Table C.1 ENS Estimation Results of Matlab Opt. Methodology

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
28.02.2005	0.19296	0.15896	0.1595	0.1626	0.15997	0.15512	0.1501	0.14555	0.1417	0.1386	0.13597	0.1338	0.13203	0.1305	0.12924	0.1281	0.12718	0.12634	0.1256	0.12494	0.1244	0.1238	0.113743	4659.856	4780.828	0.145356	6.24E-07	0.652718	0.03
31.03.2005	0.26234	0.16507	0.15366	0.1605	0.16586	0.16702	0.1653	0.16194	0.1578	0.1533	0.1489	0.1447	0.1408	0.1372	0.13398	0.1311	0.12841	0.12603	0.12389	0.12195	0.1202	0.1186	0.087687	1851.223	1921.642	0.243282	3.68E-06	1.216748	0.78
29.04.2005	0.17554	0.14317	0.14832	0.1638	0.17219	0.17484	0.174	0.17112	0.1673	0.163	0.15871	0.1546	0.15073	0.1472	0.14396	0.141	0.13839	0.13601	0.13386	0.13192	0.1302	0.1286	0.097503	133.5406	134.0088	0.250213	2.18E-05	1.221136	0.49
31.05.2005	0.23181	0.15197	0.14527	0.1537	0.15842	0.15843	0.1556	0.15143	0.1467	0.1419	0.13733	0.1331	0.12929	0.1259	0.12279	0.1201	0.11762	0.11545	0.1135	0.11176	0.1102	0.1088	0.081371	3209.217	3119.674	0.238443	1.87E-06	1.100141	0.59
30.06.2005	0.13547	0.139	0.14338	0.1493	0.15224	0.15288	0.1518	0.14943	0.1462	0.1423	0.13794	0.1334	0.12867	0.1239	0.11926	0.1147	0.11022	0.10592	0.10179	0.09785	0.0941	0.0905	1.71E-06	0.133502	0.255144	0.001234	2.493131	6781.549	0.46
29.07.2005	0.16672	0.13842	0.14037	0.1496	0.15415	0.15498	0.1536	0.15112	0.1481	0.145	0.14203	0.1392	0.13664	0.1343	0.13223	0.1304	0.12869	0.1272	0.12586	0.12465	0.1236	0.1226	0.10359	4665.624	5344.205	0.164205	4.78E-07	1.128758	0.74
31.08.2005	0.15434	0.13877	0.14248	0.151	0.15485	0.15538	0.1541	0.15185	0.1493	0.1466	0.14413	0.1418	0.13969	0.1378	0.1361	0.1346	0.13326	0.13206	0.13099	0.13002	0.1292	0.1284	0.113308	14118.44	13630.26	0.135979	1.08E-07	1.086755	0.68
30.09.2005	0.1106	0.13718	0.14344	0.1408	0.14185	0.1429	0.1421	0.13929	0.1351	0.1299	0.12416	0.1182	0.1123	0.1065	0.10098	0.0957	0.09082	0.08622	0.08195	0.07799	0.0743	0.0709	4.15E-05	0.079326	0.227425	0.39779	0.200911	1.655102	0.14
31.10.2005	0.16605	0.14052	0.13035	0.1223	0.11933	0.11782	0.1169	0.11631	0.1159	0.1156	0.11531	0.1151	0.11494	0.1148	0.11469	0.1146	0.11451	0.11443	0.11436	0.1143	0.1143	0.1142	0.113299	4257.999	4258.058	0.042681	4.27E-07	0.126858	31.68
30.11.2005	0.12176	0.13111	0.1335	0.1313	0.13016	0.12869	0.1259	0.12172	0.1166	0.111	0.10523	0.0994	0.09384	0.0885	0.08351	0.0789	0.07454	0.07057	0.06691	0.06355	0.0605	0.0576	1.4E-07	0.111655	0.133787	0.338626	0.256421	1.532823	0.01
30.12.2005	0.18821	0.13927	0.13348	0.1332	0.13088	0.12733	0.1236	0.12028	0.1174	0.115	0.11301	0.1113	0.10995	0.1088	0.10777	0.1069	0.10616	0.1055	0.10492	0.1044	0.1039	0.1035	0.095611	3095.283	3284.702	0.103467	1.13E-06	0.694578	0.09
31.01.2006	0.12158	0.12795	0.13159	0.1303	0.12714	0.12457	0.1228	0.12149	0.1206	0.1199	0.11931	0.1189	0.11851	0.1182	0.11796	0.1177	0.11756	0.11739	0.11725	0.11712	0.117	0.1169	0.11493	589.0922	545.4132	0.056387	6.52E-08	0.348286	0.22
28.02.2006	0.12363	0.12776	0.12923	0.1259	0.12266	0.12057	0.1192	0.11834	0.1177	0.1172	0.11683	0.1165	0.11628	0.1161	0.1159	0.1157	0.11562	0.11551	0.11541	0.11532	0.1152	0.1152	0.113807	1036.391	1039	0.049743	1.41E-07	0.267478	2.41
31.03.2006	0.13155	0.13005	0.12922	0.1279	0.12716	0.12679	0.1266	0.12642	0.1263	0.1262	0.12617	0.1261	0.12608	0.126	0.12602	0.126	0.12597	0.12595	0.12593	0.12592	0.1259	0.1259	0.125672	13172.83	3618.814	0.010345	2.05E-08	0.182584	1.58
28.04.2006	0.15948	0.1346	0.12863	0.1261	0.12566	0.12573	0.126	0.12641	0.1269	0.1273	0.12785	0.1284	0.12892	0.1295	0.13002	0.1306	0.13115	0.13171	0.13228	0.13285	0.1334	0.134	0.121762	263.0159	319.5839	1.686296	5.38E-06	700.2881	2.05
31.05.2006	0.16513	0.16464	0.16452	0.1645	0.16443	0.16442	0.1644	0.16441	0.1644	0.1644	0.16441	0.1644	0.1644	0.1644	0.1644	0.1644	0.1644	0.1644	0.1644	0.1644	0.1644	0.1644	0.164392	0.061171	0.061342	0.001655	0.000273	0.01788	4.45
30.06.2006	0.14315	0.17403	0.19531	0.2005	0.19392	0.1881	0.1843	0.18178	0.1797	0.1775	0.17511	0.1723	0.1692	0.1658	0.16206	0.1582	0.15416	0.15007	0.14594	0.14183	0.1377	0.1337	0.000178	0.119552	0.326366	0.4522	0.420528	3.005546	0.16
31.07.2006	0.17217	0.17753	0.18216	0.184	0.18119	0.17699	0.1728	0.16913	0.1661	0.1638	0.162	0.1607	0.15974	0.1591	0.15871	0.1585	0.15851	0.15862	0.15885	0.15917	0.1596	0.16	0.126654	0.041941	0.110499	77.36495	0.766366	17811.92	0.17
31.08.2006	0.13879	0.1687	0.18224	0.18	0.17606	0.17449	0.1734	0.1717	0.1691	0.1658	0.16179	0.1574	0.15267	0.1479	0.14303	0.1383	0.13363	0.12916	0.12487	0.12079	0.1169	0.1133	0.026431	0.084864	0.257366	0.387169	0.28027	2.097741	0.02
29.09.2006	0.19522	0.17353	0.17764	0.1891	0.19528	0.19734	0.1968	0.19486	0.1921	0.1891	0.18606	0.1831	0.18032	0.1778	0.17542	0.1733	0.17138	0.16965	0.16809	0.16667	0.1654	0.1642	0.141561	41.07397	30.91481	0.180956	5.54E-05	1.233974	1.24
31.10.2006	0.18678	0.18647	0.18639	0.1864	0.18634	0.18633	0.1863	0.18633	0.1863	0.1863	0.18632	0.1863	0.18632	0.1863	0.18632	0.1863	0.18632	0.18632	0.18632	0.18632	0.1863	0.1863	0.186315	0.339604	0.234107	0.425226	3.54E-05	4.39E-05	2.87
30.11.2006	0.17481	0.1641	0.17273	0.1858	0.19034	0.18985	0.1869	0.18298	0.1788	0.1748	0.17112	0.1678	0.16491	0.1623	0.16009	0.1581	0.15636	0.15481	0.15344	0.15221	0.1511	0.1501	0.131073	2370.003	2264.109	0.193503	6.45E-07	0.968364	0.35

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
29.12.2006	0.19474	0.18503	0.1826	0.1814	0.18098	0.18078	0.1807	0.18058	0.1805	0.1805	0.18044	0.1804	0.1804	0.1804	0.18036	0.1803	0.18034	0.18033	0.18032	0.18031	0.1803	0.1803	0.180175	596.6491	1242.469	8.5E-05	6.6E-07	20748.44	3.79
31.01.2007	0.17078	0.16239	0.16777	0.1774	0.18194	0.18309	0.1823	0.18039	0.1781	0.1756	0.17314	0.1708	0.16874	0.1668	0.16509	0.1635	0.16215	0.16091	0.15979	0.15878	0.1579	0.157	0.141147	5821.199	6540.563	0.137103	1.68E-07	1.146536	0.51
28.02.2007	0.17477	0.17825	0.18099	0.182	0.18101	0.1797	0.1785	0.17762	0.1769	0.1763	0.1759	0.1755	0.17525	0.175	0.1748	0.1746	0.17446	0.17433	0.17421	0.1741	0.174	0.1739	0.172297	49374913	44718559	0.032772	8.02E-15	0.495822	0.19
30.03.2007	0.16302	0.16853	0.17414	0.1792	0.17992	0.17885	0.1772	0.17538	0.1737	0.1723	0.17105	0.17	0.16909	0.1683	0.16766	0.1671	0.16659	0.16615	0.16577	0.16542	0.1651	0.1648	0.159568	12000566	12318195	0.068382	3.63E-14	0.770757	0.08
30.04.2007	0.15538	0.16455	0.17222	0.1763	0.17515	0.17313	0.1714	0.17005	0.1688	0.1675	0.16593	0.1641	0.16195	0.1595	0.15681	0.1539	0.1508	0.14757	0.14425	0.14087	0.1375	0.1341	5.04E-05	0.149022	0.17462	0.425618	0.601858	3.394958	0.10
31.05.2007	0.2053	0.16494	0.16297	0.1689	0.17162	0.17135	0.1694	0.16664	0.1636	0.1607	0.15791	0.1554	0.15311	0.1511	0.14929	0.1477	0.1463	0.14504	0.14392	0.14292	0.142	0.1412	0.125569	5487.409	4883.048	0.143241	5.97E-07	1.048677	0.15
29.06.2007	0.15348	0.15316	0.16043	0.1684	0.16981	0.16814	0.1653	0.16226	0.1594	0.1568	0.15453	0.1526	0.15095	0.1495	0.14831	0.1473	0.14632	0.14551	0.14479	0.14415	0.1436	0.1431	0.133218	5212.526	5020.98	0.119962	1.18E-07	0.810109	0.13
31.07.2007	0.08911	0.15814	0.17078	0.1624	0.1624	0.16367	0.163	0.16021	0.1557	0.1501	0.14377	0.1372	0.13051	0.124	0.11769	0.1117	0.10608	0.1008	0.09588	0.0913	0.0871	0.0831	7.8E-09	1.57E-07	0.432678	0.456617	0.166066	1.695127	1.35
31.08.2007	0.16025	0.16184	0.1637	0.166	0.16703	0.16733	0.1672	0.16689	0.1665	0.166	0.16553	0.1651	0.16468	0.1643	0.16398	0.1637	0.16341	0.16317	0.16295	0.16275	0.1626	0.1624	0.159321	874039.2	158791.1	0.026865	1.34E-13	1.154129	0.08
28.09.2007	0.16481	0.15635	0.15707	0.1585	0.15801	0.1567	0.1552	0.15385	0.1527	0.1517	0.15085	0.1502	0.14959	0.1491	0.14868	0.1483	0.14801	0.14774	0.1475	0.14729	0.1471	0.1469	0.143649	8607.545	8789.913	0.045372	8.92E-08	0.687556	0.41
31.10.2007	0.17001	0.15069	0.15007	0.1526	0.15297	0.15194	0.1503	0.1485	0.1468	0.1452	0.14381	0.1426	0.14157	0.1407	0.13989	0.1392	0.13862	0.13809	0.13763	0.13722	0.1368	0.1365	0.130162	4530.036	4536.389	0.069623	3.37E-07	0.868297	0.09
30.11.2007	0.36863	0.18271	0.1508	0.1509	0.15694	0.1599	0.1598	0.15761	0.154	0.1497	0.14506	0.1403	0.13571	0.1313	0.12716	0.1233	0.11975	0.11647	0.11347	0.11071	0.1082	0.1059	0.059174	7364.811	7032.128	0.303971	1.74E-06	1.465815	4.53
31.12.2007	0.16365	0.15722	0.15561	0.1548	0.15454	0.1544	0.1543	0.15427	0.1542	0.1542	0.15418	0.1542	0.15415	0.1541	0.15413	0.1541	0.15411	0.1541	0.1541	0.15409	0.1541	0.1541	0.154002	10211.28	4696.098	4717.799	1.87E-08	1.11E-07	0.38
31.01.2008	0.16136	0.15324	0.1513	0.1505	0.15039	0.15044	0.1506	0.15073	0.1509	0.1511	0.1513	0.1515	0.15171	0.1519	0.15214	0.1524	0.15257	0.15279	0.15301	0.15323	0.1535	0.1537	0.149019	3099.298	1417.21	8.628902	2.27E-07	9473.622	11.30
29.02.2008	0.36479	0.17842	0.14753	0.1501	0.1584	0.16319	0.1645	0.16324	0.1603	0.1563	0.15167	0.1469	0.14201	0.1373	0.13276	0.1285	0.12451	0.1208	0.11737	0.1142	0.1113	0.1086	0.052924	38.95569	13.44445	0.341973	0.000482	1.573366	3.30
31.03.2008	0.17638	0.17637	0.17637	0.1764	0.17637	0.17637	0.1764	0.17637	0.1764	0.1764	0.17637	0.1764	0.17637	0.1764	0.17637	0.1764	0.17637	0.17637	0.17637	0.17637	0.1764	0.1764	0.176369	4.926393	11.45935	3.221677	3.48E-08	1.77E-07	1.59
30.04.2008	0.19174	0.18133	0.17873	0.1774	0.177	0.17678	0.1767	0.17656	0.1765	0.1765	0.17642	0.1764	0.17637	0.1763	0.17633	0.1763	0.1763	0.17629	0.17628	0.17628	0.1763	0.1763	0.176131	75.49522	6.88253	18.37025	7.89E-06	3.54E-05	0.66
30.05.2008	0.1836	0.18358	0.18358	0.1836	0.18357	0.18357	0.1836	0.18357	0.1836	0.1836	0.18357	0.1836	0.18357	0.1836	0.18357	0.1836	0.18357	0.18357	0.18357	0.18357	0.1836	0.1836	0.18357	0.414263	0.348073	0.405229	1.8E-06	3.37E-06	4.78
30.06.2008	0.20359	0.20286	0.20268	0.2026	0.20256	0.20254	0.2025	0.20253	0.2025	0.2025	0.20252	0.2025	0.20251	0.2025	0.20251	0.2025	0.20251	0.20251	0.20251	0.20251	0.2025	0.2025	0.202498	0.031122	0.030596	0.008956	0.000778	0.004785	3.53
31.07.2008	0.19019	0.17831	0.17638	0.1756	0.17479	0.17397	0.1732	0.17263	0.1721	0.1718	0.17144	0.1712	0.17098	0.1708	0.17065	0.1705	0.17041	0.17031	0.17022	0.17015	0.1701	0.17	0.168838	0.089589	0.090821	0.016982	0.009369	0.593758	0.47
29.08.2008	0.1562	0.16106	0.16693	0.1744	0.17743	0.17724	0.1748	0.17071	0.1656	0.1598	0.15365	0.1474	0.14105	0.1349	0.12887	0.1231	0.11762	0.1124	0.10748	0.10284	0.0985	0.0944	3.36E-07	0.153459	0.150725	0.150716	2.160857	2.160824	2.75
29.09.2008	0.18015	0.17698	0.17647	0.1786	0.18008	0.18066	0.1806	0.18012	0.1794	0.1787	0.17784	0.177	0.17627	0.1756	0.1749	0.1743	0.17375	0.17325	0.17279	0.17238	0.172	0.1717	0.164921	0.015725	0.017207	0.049747	0.063793	1.318157	0.53
31.10.2008	0.27441	0.20537	0.20217	0.217	0.22847	0.23421	0.2352	0.2328	0.2279	0.2214	0.2138	0.2056	0.19722	0.1888	0.18049	0.1724	0.16473	0.15738	0.15042	0.14385	0.1377	0.1319	4.57E-06	0.14239	0.526951	2.114787	2.025957	0.0049	1.69
28.11.2008	0.18951	0.18951	0.18951	0.1895	0.18951	0.18951	0.1895	0.18951	0.1895	0.1895	0.18951	0.1895	0.18951	0.1895	0.18951	0.1895	0.18951	0.18951	0.18951	0.18951	0.1895	0.1895	0.189513	0.107119	0.099561	0.081513	1.69E-07	4.27E-07	1.01

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.12.2008	0.16784	0.16165	0.16008	0.1593	0.15903	0.1589	0.1588	0.15877	0.1587	0.1587	0.15868	0.1587	0.15865	0.1586	0.15863	0.1586	0.15861	0.1586	0.1586	0.15859	0.1586	0.1586	0.158505	0.375827	0.423443	0.029453	0.000458	0.014289	1.36
30.01.2009	0.15154	0.14829	0.14745	0.147	0.14689	0.14682	0.1468	0.14675	0.1467	0.1467	0.14671	0.1467	0.14669	0.1467	0.14668	0.1467	0.14667	0.14667	0.14666	0.14666	0.1467	0.1467	0.146615	0.120783	0.126546	0.010995	0.000925	0.017306	12.81
27.02.2009	0.163	0.1618	0.16145	0.1613	0.16121	0.16118	0.1612	0.16115	0.1611	0.1611	0.16113	0.1611	0.16113	0.1611	0.16112	0.1611	0.16112	0.16112	0.16111	0.16111	0.1611	0.1611	0.161093	0.133174	0.147347	0.003115	0.000319	0.027882	17.32
31.03.2009	0.14735	0.14735	0.14735	0.1474	0.14735	0.14735	0.1474	0.14735	0.1474	0.1474	0.14735	0.1474	0.14735	0.1474	0.14735	0.1474	0.14735	0.14735	0.14735	0.14735	0.1474	0.1474	0.147353	0.081568	0.083818	3.48E-06	1.36E-08	0.000647	12.62
30.04.2009	0.12772	0.12576	0.12527	0.125	0.12494	0.1249	0.1249	0.12486	0.1248	0.1248	0.12483	0.1248	0.12482	0.1248	0.12481	0.1248	0.12481	0.12481	0.12481	0.1248	0.1248	0.1248	0.124777	0.056439	0.056608	0.023334	0.001032	0.005508	23.54
29.05.2009	0.12917	0.12871	0.12859	0.1285	0.12852	0.12851	0.1285	0.1285	0.1285	0.1285	0.12849	0.1285	0.12849	0.1285	0.12849	0.1285	0.12849	0.12849	0.12848	0.12848	0.1285	0.1285	0.128478	0.040252	0.040232	0.002429	0.000416	0.010151	7.96
30.06.2009	0.12671	0.12515	0.12476	0.1246	0.1245	0.12447	0.1245	0.12444	0.1244	0.1244	0.12442	0.1244	0.12441	0.1244	0.1244	0.1244	0.1244	0.1244	0.1244	0.1244	0.1244	0.1244	0.124374	0.119738	0.120013	0.017069	0.000405	0.005729	14.37
31.07.2009	0.1027	0.1026	0.10257	0.1026	0.10256	0.10256	0.1026	0.10255	0.1026	0.1026	0.10255	0.1026	0.10255	0.1026	0.10255	0.1026	0.10255	0.10255	0.10255	0.10255	0.1026	0.1026	0.102549	0.046763	0.053405	0.000509	6.34E-05	0.012159	8.36
31.08.2009	0.10353	0.10351	0.10351	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.103503	0.014013	0.013704	0.000951	4.65E-05	0.001252	9.93
30.09.2009	0.08731	0.08725	0.08723	0.0872	0.08722	0.08722	0.0872	0.08722	0.0872	0.0872	0.08722	0.0872	0.08722	0.0872	0.08722	0.0872	0.08722	0.08722	0.08722	0.08722	0.0872	0.0872	0.087219	0.025951	0.025972	0.000698	8E-05	0.005041	10.35
30.10.2009	0.09009	0.09008	0.09007	0.0901	0.09007	0.09007	0.0901	0.09007	0.0901	0.0901	0.09007	0.0901	0.09007	0.0901	0.09007	0.0901	0.09007	0.09007	0.09007	0.09007	0.0901	0.0901	0.090067	0.016457	0.016452	0.000337	3.43E-05	0.002842	30.29
26.11.2009	0.09347	0.09345	0.09345	0.0934	0.09344	0.09344	0.0934	0.09344	0.0934	0.0934	0.09344	0.0934	0.09344	0.0934	0.09344	0.0934	0.09344	0.09344	0.09344	0.09344	0.0934	0.0934	0.093442	0.006165	0.006159	0.000154	9.96E-05	0.009163	7.53
31.12.2009	0.0898	0.08976	0.08975	0.0897	0.08974	0.08974	0.0897	0.08974	0.0897	0.0897	0.08974	0.0897	0.08974	0.0897	0.08974	0.0897	0.08974	0.08974	0.08974	0.08974	0.0897	0.0897	0.089737	0.016203	0.016077	0.00039	8.12E-05	0.006111	13.91
29.01.2010	0.10006	0.10006	0.10006	0.1001	0.10005	0.10005	0.1001	0.10005	0.1001	0.1001	0.10005	0.1001	0.10005	0.1001	0.10005	0.1001	0.10005	0.10005	0.10005	0.10005	0.1001	0.1001	0.100054	0.004314	0.004311	0.000117	5.09E-05	0.003541	42.73
26.02.2010	0.09986	0.09985	0.09984	0.0998	0.09984	0.09984	0.0998	0.09984	0.0998	0.0998	0.09984	0.0998	0.09984	0.0998	0.09984	0.0998	0.09984	0.09984	0.09984	0.09984	0.0998	0.0998	0.099842	0.0093	0.009331	0.00142	3.72E-05	0.000403	23.54
31.03.2010	0.09549	0.09548	0.09548	0.0955	0.09548	0.09548	0.0955	0.09548	0.0955	0.0955	0.09548	0.0955	0.09548	0.0955	0.09548	0.0955	0.09548	0.09548	0.09548	0.09548	0.0955	0.0955	0.095476	0.011178	0.011146	0.000262	2E-05	0.001704	52.17
30.04.2010	0.09626	0.09625	0.09625	0.0963	0.09625	0.09625	0.0963	0.09625	0.0963	0.0963	0.09625	0.0963	0.09625	0.0963	0.09625	0.0963	0.09625	0.09625	0.09625	0.09625	0.0963	0.0963	0.096252	0.010984	0.01094	0.001803	1.54E-05	0.000205	71.63
31.05.2010	0.09826	0.09825	0.09824	0.0982	0.09824	0.09824	0.0982	0.09824	0.0982	0.0982	0.09824	0.0982	0.09824	0.0982	0.09824	0.0982	0.09824	0.09824	0.09824	0.09824	0.0982	0.0982	0.098242	0.011465	0.011465	0.001722	2.77E-05	0.000284	19.93
30.06.2010	0.09051	0.0905	0.0905	0.0905	0.0905	0.09049	0.0905	0.09049	0.0905	0.0905	0.09049	0.0905	0.09049	0.0905	0.09049	0.0905	0.09049	0.09049	0.09049	0.09049	0.0905	0.0905	0.090494	0.011898	0.011905	0.004015	3.87E-05	0.000137	44.40
30.07.2010	0.08545	0.08542	0.08541	0.0854	0.08541	0.08541	0.0854	0.08541	0.0854	0.0854	0.08541	0.0854	0.08541	0.0854	0.08541	0.0854	0.08541	0.08541	0.08541	0.08541	0.0854	0.0854	0.085405	0.015029	0.01527	0.00373	6.29E-05	0.000389	3.13
31.08.2010	0.0854	0.08538	0.08537	0.0854	0.08537	0.08537	0.0854	0.08537	0.0854	0.0854	0.08537	0.0854	0.08537	0.0854	0.08537	0.0854	0.08537	0.08537	0.08537	0.08537	0.0854	0.0854	0.085369	0.018445	0.018305	0.002675	4.46E-05	0.000454	3.82
30.09.2010	0.08296	0.08295	0.08295	0.0829	0.08295	0.08295	0.0829	0.08295	0.0829	0.0829	0.08295	0.0829	0.08295	0.0829	0.08295	0.0829	0.08295	0.08295	0.08295	0.08295	0.0829	0.0829	0.082948	0.011253	0.011431	0.01904	2.32E-05	3.5E-05	53.86
28.10.2010	0.07755	0.07752	0.07751	0.0775	0.07751	0.07751	0.0775	0.07751	0.0775	0.0775	0.07751	0.0775	0.07751	0.0775	0.07751	0.0775	0.07751	0.07751	0.07751	0.07751	0.0775	0.0775	0.077507	0.101201	0.101208	0.004142	8.53E-06	0.000412	3.72
30.11.2010	0.0836	0.08359	0.08359	0.0836	0.08359	0.08358	0.0836	0.08358	0.0836	0.0836	0.08358	0.0836	0.08358	0.0836	0.08358	0.0836	0.08358	0.08358	0.08358	0.08358	0.0836	0.0836	0.083584	0.013573	0.013317	0.001677	3.6E-05	0.000451	14.90

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.12.2010	0.07889	0.07888	0.07888	0.0789	0.07888	0.07888	0.0789	0.07888	0.0789	0.0789	0.07888	0.0789	0.07888	0.0789	0.07888	0.0789	0.07888	0.07888	0.07888	0.07888	0.0789	0.0789	0.078878	0.002916	0.002908	0.001632	0.000107	0.000438	21.98
31.01.2011	0.08786	0.08785	0.08785	0.0878	0.08784	0.08784	0.0878	0.08784	0.0878	0.0878	0.08784	0.0878	0.08784	0.0878	0.08784	0.0878	0.08784	0.08784	0.08784	0.08784	0.0878	0.0878	0.087842	0.009966	0.009738	0.003776	5.5E-05	0.000204	10.84
28.02.2011	0.08957	0.08955	0.08955	0.0895	0.08954	0.08954	0.0895	0.08954	0.0895	0.0895	0.08954	0.0895	0.08954	0.0895	0.08954	0.0895	0.08954	0.08954	0.08954	0.08954	0.0895	0.0895	0.089541	0.015388	0.015441	0.000756	3.95E-05	0.001653	4.20
31.03.2011	0.08825	0.08824	0.08824	0.0882	0.08823	0.08823	0.0882	0.08823	0.0882	0.0882	0.08823	0.0882	0.08823	0.0882	0.08823	0.0882	0.08823	0.08823	0.08823	0.08823	0.0882	0.0882	0.088234	0.013851	0.013856	0.005355	2.74E-05	0.000119	44.66
29.04.2011	0.08801	0.08798	0.08798	0.088	0.08797	0.08797	0.088	0.08797	0.088	0.088	0.08797	0.088	0.08797	0.088	0.08797	0.088	0.08797	0.08797	0.08797	0.08797	0.088	0.088	0.08797	0.01374	0.013746	0.001656	6.52E-05	0.000781	3.65
31.05.2011	0.09048	0.09045	0.09044	0.0904	0.09044	0.09044	0.0904	0.09044	0.0904	0.0904	0.09044	0.0904	0.09044	0.0904	0.09044	0.0904	0.09044	0.09044	0.09044	0.09044	0.0904	0.0904	0.090437	0.025112	0.025364	0.000862	3.79E-05	0.002074	2.20
30.06.2011	0.08941	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.089396	0.016726	0.016846	0.008293	1.63E-05	8.44E-05	47.90
29.07.2011	0.09113	0.09111	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.0911	0.091098	0.013186	0.013169	0.000395	5.94E-05	0.0035	3.78
29.08.2011	0.08311	0.08309	0.08309	0.0831	0.08309	0.08308	0.0831	0.08308	0.0831	0.0831	0.08308	0.0831	0.08308	0.0831	0.08308	0.0831	0.08308	0.08308	0.08308	0.08308	0.0831	0.0831	0.083084	0.01253	0.0126	0.002541	5.55E-05	0.000421	8.28
30.09.2011	0.08602	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.085996	0.019526	0.019504	0.001232	2.33E-05	0.000842	25.13
31.10.2011	0.09021	0.0954	0.09786	0.0961	0.09368	0.09275	0.0929	0.09348	0.0941	0.0945	0.09468	0.0945	0.09398	0.0932	0.09213	0.0909	0.08944	0.08787	0.0862	0.08444	0.0826	0.0808	0.000564	0.08526	0.10609	0.264115	0.434568	3.494589	0.01
30.11.2011	0.09533	0.09626	0.09832	0.1006	0.10114	0.1009	0.1003	0.0996	0.0989	0.0983	0.09769	0.0972	0.09676	0.0964	0.09607	0.0958	0.09554	0.09532	0.09512	0.09495	0.0948	0.0947	0.092006	3177.602	3217.219	0.03027	2.56E-08	0.870652	0.08
30.12.2011	0.09468	0.10185	0.10698	0.108	0.10543	0.10266	0.1004	0.09872	0.0974	0.0964	0.09566	0.095	0.09452	0.0941	0.09373	0.0934	0.09315	0.09291	0.0927	0.09252	0.0924	0.0922	0.089375	985633.1	1000806	0.063819	1.39E-13	0.443248	5.70
31.01.2012	0.09261	0.09248	0.09244	0.0924	0.09242	0.09242	0.0924	0.09241	0.0924	0.0924	0.09241	0.0924	0.09241	0.0924	0.09241	0.0924	0.09241	0.09241	0.09241	0.09241	0.0924	0.0924	0.092407	0.034477	0.034523	0.013194	0.000151	0.000506	0.35
29.02.2012	0.08308	0.08334	0.08372	0.0844	0.08509	0.08569	0.0862	0.08673	0.0872	0.0876	0.08795	0.0883	0.08858	0.0888	0.08908	0.0893	0.08948	0.08965	0.08979	0.08991	0.09	0.0901	0.082943	603.6951	71.35118	0.024935	1.21E-10	7.645338	9.69
30.03.2012	0.09148	0.09137	0.09134	0.0913	0.09132	0.09132	0.0913	0.09131	0.0913	0.0913	0.09131	0.0913	0.09131	0.0913	0.09131	0.0913	0.09131	0.09131	0.09131	0.09131	0.0913	0.0913	0.09131	0.031584	0.031605	0.013683	0.000138	0.000406	0.96
30.04.2012	0.08864	0.09045	0.09162	0.0913	0.09008	0.08915	0.0888	0.08877	0.089	0.0894	0.08968	0.0899	0.08996	0.0899	0.08959	0.0892	0.08856	0.08783	0.08698	0.08602	0.085	0.0838	4.27E-06	0.08729	0.075007	0.248398	0.675848	4.536281	0.15
31.05.2012	0.10171	0.09195	0.08951	0.0883	0.08789	0.08769	0.0876	0.08748	0.0874	0.0874	0.08735	0.0873	0.0873	0.0873	0.08726	0.0873	0.08724	0.08723	0.08722	0.08721	0.0872	0.0872	0.087076	327.9034	368.6994	0.098956	7.06E-07	0.007354	9.62
29.06.2012	0.08444	0.08418	0.08411	0.0841	0.08407	0.08406	0.0841	0.08406	0.0841	0.0841	0.08405	0.0841	0.08405	0.0841	0.08405	0.0841	0.08405	0.08405	0.08405	0.08405	0.0841	0.0841	0.084047	0.03649	0.037363	0.007977	0.000254	0.00176	0.56
31.07.2012	0.07702	0.07699	0.07698	0.077	0.07697	0.07697	0.077	0.07697	0.077	0.077	0.07697	0.077	0.07697	0.077	0.07697	0.077	0.07697	0.07697	0.07697	0.07697	0.077	0.077	0.076969	0.015056	0.015025	0.003323	6.66E-05	0.000632	11.79
31.08.2012	0.07823	0.07822	0.07821	0.0782	0.07821	0.07821	0.0782	0.07821	0.0782	0.0782	0.07821	0.0782	0.07821	0.0782	0.07821	0.0782	0.07821	0.07821	0.07821	0.07821	0.0782	0.0782	0.078209	0.01785	0.01788	0.001049	2.5E-05	0.000712	20.50
28.09.2012	0.07825	0.07825	0.07824	0.0782	0.07824	0.07824	0.0782	0.07824	0.0782	0.0782	0.07824	0.0782	0.07824	0.0782	0.07824	0.0782	0.07824	0.07824	0.07824	0.07824	0.0782	0.0782	0.078243	0.008291	0.008335	0.000238	2.04E-05	0.001561	73.24
31.10.2012	0.07661	0.0766	0.07659	0.0766	0.07659	0.07659	0.0766	0.07659	0.0766	0.0766	0.07659	0.0766	0.07659	0.0766	0.07659	0.0766	0.07659	0.07659	0.07659	0.07659	0.0766	0.0766	0.076589	0.016342	0.016714	0.000498	2.88E-05	0.001724	13.68
30.11.2012	0.06655	0.06654	0.06654	0.0665	0.06654	0.06654	0.0665	0.06654	0.0665	0.0665	0.06654	0.0665	0.06654	0.0665	0.06654	0.0665	0.06654	0.06654	0.06654	0.06654	0.0665	0.0665	0.066536	0.011022	0.011009	0.002731	3.23E-05	0.000278	13.79

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.12.2012	0.06321	0.06315	0.06314	0.0631	0.06313	0.06313	0.0631	0.06313	0.0631	0.0631	0.06313	0.0631	0.06312	0.0631	0.06312	0.0631	0.06312	0.06312	0.06312	0.06312	0.0631	0.0631	0.063124	0.07613	0.07612	0.000646	2.18E-05	0.005985	3.73
31.01.2013	0.06355	0.06354	0.06354	0.0635	0.06354	0.06354	0.0635	0.06354	0.0635	0.0635	0.06354	0.0635	0.06354	0.0635	0.06354	0.0635	0.06354	0.06354	0.06354	0.06354	0.0635	0.0635	0.06354	0.003383	0.003395	0.000125	7.42E-05	0.003597	52.69
28.02.2013	0.063	0.06299	0.06299	0.063	0.06299	0.06299	0.063	0.06299	0.063	0.063	0.06299	0.063	0.06299	0.063	0.06299	0.063	0.06299	0.06299	0.06299	0.06299	0.063	0.063	0.062988	0.006671	0.006675	0.000206	4.34E-05	0.002824	42.06
29.03.2013	0.06651	0.06649	0.06648	0.0665	0.06648	0.06648	0.0665	0.06648	0.0665	0.0665	0.06648	0.0665	0.06648	0.0665	0.06648	0.0665	0.06648	0.06648	0.06648	0.06648	0.0665	0.0665	0.066477	0.021223	0.021229	0.000536	3.17E-05	0.002412	6.39
30.04.2013	0.05995	0.05993	0.05993	0.0599	0.05993	0.05993	0.0599	0.05993	0.0599	0.0599	0.05993	0.0599	0.05993	0.0599	0.05993	0.0599	0.05993	0.05993	0.05993	0.05993	0.0599	0.0599	0.059927	0.005058	0.005064	0.000164	8.12E-05	0.0045	13.83
31.05.2013	0.06523	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.06519	0.0652	0.0652	0.06519	0.0652	0.06519	0.0652	0.06519	0.0652	0.06519	0.06519	0.06519	0.06519	0.0652	0.0652	0.065194	0.016642	0.016647	0.000537	4.37E-05	0.002258	3.74
28.06.2013	0.07914	0.07909	0.07908	0.0791	0.07908	0.07908	0.0791	0.07908	0.0791	0.0791	0.07907	0.0791	0.07907	0.0791	0.07907	0.0791	0.07907	0.07907	0.07907	0.07907	0.0791	0.0791	0.079074	0.508007	0.592043	0.002009	2.32E-06	0.001279	2.23
31.07.2013	0.08784	0.08776	0.08774	0.0877	0.08773	0.08773	0.0877	0.08773	0.0877	0.0877	0.08773	0.0877	0.08772	0.0877	0.08772	0.0877	0.08772	0.08772	0.08772	0.08772	0.0877	0.0877	0.087723	0.022536	0.020985	0.003269	0.000133	0.001254	0.71
29.08.2013	0.09473	0.09471	0.09471	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.094701	0.003472	0.003457	0.000311	0.000216	0.004149	12.98
30.09.2013	0.08737	0.08734	0.08734	0.0873	0.08733	0.08733	0.0873	0.08733	0.0873	0.0873	0.08733	0.0873	0.08733	0.0873	0.08733	0.0873	0.08733	0.08733	0.08733	0.08733	0.0873	0.0873	0.087331	0.017562	0.017644	0.005579	5.95E-05	0.000246	2.99
31.10.2013	0.08265	0.08264	0.08263	0.0826	0.08263	0.08263	0.0826	0.08263	0.0826	0.0826	0.08263	0.0826	0.08263	0.0826	0.08263	0.0826	0.08263	0.08263	0.08263	0.08263	0.0826	0.0826	0.082629	0.021405	0.021678	0.003485	2.87E-05	0.000244	7.85
29.11.2013	0.08912	0.08908	0.08907	0.0891	0.08906	0.08906	0.0891	0.08906	0.0891	0.0891	0.08906	0.0891	0.08906	0.0891	0.08906	0.0891	0.08906	0.08906	0.08906	0.08906	0.0891	0.0891	0.089058	0.022925	0.023013	0.007114	6.43E-05	0.0003	2.18
31.12.2013	0.09796	0.09795	0.09794	0.0979	0.09794	0.09794	0.0979	0.09794	0.0979	0.0979	0.09794	0.0979	0.09794	0.0979	0.09794	0.0979	0.09794	0.09794	0.09794	0.09794	0.0979	0.0979	0.097941	0.019623	0.01981	0.001035	2.14E-05	0.000871	15.00
31.01.2014	0.09639	0.10101	0.10321	0.1038	0.10399	0.1041	0.104	0.10373	0.1033	0.1027	0.10215	0.1015	0.10089	0.1003	0.09968	0.0991	0.09858	0.09809	0.09762	0.09719	0.0968	0.0964	0.088647	0.0033	0.027337	0.042808	0.226027	1.686443	0.92
28.02.2014	0.16771	0.12726	0.11309	0.106	0.10362	0.10244	0.1017	0.10125	0.1009	0.1007	0.10046	0.1003	0.10018	0.1001	0.09998	0.0999	0.09983	0.09977	0.09972	0.09968	0.0996	0.0996	0.098887	0.014791	0.121218	0.118699	0.027588	0.028216	1.60
31.03.2014	0.09886	0.09882	0.09881	0.0988	0.09881	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.098803	0.03231	0.032374	0.014052	4.49E-05	0.000128	15.62
30.04.2014	0.09033	0.09025	0.09024	0.0902	0.09022	0.09022	0.0902	0.09022	0.0902	0.0902	0.09022	0.0902	0.09022	0.0902	0.09022	0.0902	0.09022	0.09022	0.09022	0.09022	0.0902	0.0902	0.090216	0.029146	0.029171	0.011817	0.000101	0.000309	1.52
30.05.2014	0.08505	0.08503	0.08502	0.085	0.08502	0.08502	0.085	0.08502	0.085	0.085	0.08502	0.085	0.08502	0.085	0.08502	0.085	0.08502	0.08502	0.08502	0.08502	0.085	0.085	0.085016	0.021715	0.021603	0.007527	4.19E-05	0.000164	21.28
30.06.2014	0.08316	0.08312	0.08311	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.083098	0.02637	0.026568	0.008364	5.89E-05	0.000263	4.74
31.07.2014	0.0833	0.08325	0.08323	0.0832	0.08322	0.08322	0.0832	0.08322	0.0832	0.0832	0.08322	0.0832	0.08322	0.0832	0.08322	0.0832	0.08322	0.08322	0.08322	0.08322	0.0832	0.0832	0.083219	0.014048	0.014288	0.004792	0.000142	0.000597	2.00
29.08.2014	0.08701	0.08693	0.0869	0.0869	0.08689	0.08689	0.0869	0.08689	0.0869	0.0869	0.08689	0.0869	0.08688	0.0869	0.08688	0.0869	0.08688	0.08688	0.08688	0.08688	0.0869	0.0869	0.086883	0.039319	0.038737	0.014096	8.19E-05	0.000309	0.69
30.09.2014	0.0944	0.09432	0.0943	0.0943	0.09429	0.09429	0.0943	0.09429	0.0943	0.0943	0.09428	0.0943	0.09428	0.0943	0.09428	0.0943	0.09428	0.09428	0.09428	0.09428	0.0943	0.0943	0.094282	0.031328	0.032069	0.010633	9.59E-05	0.000374	1.15
31.10.2014	0.08217	0.08209	0.08206	0.0821	0.08205	0.08205	0.082	0.08205	0.082	0.082	0.08205	0.082	0.08205	0.082	0.08204	0.082	0.08204	0.08204	0.08204	0.08204	0.082	0.082	0.082043	0.030428	0.030984	0.01112	0.000106	0.000385	1.39
28.11.2014	0.07453	0.07447	0.07445	0.0744	0.07445	0.07444	0.0744	0.07444	0.0744	0.0744	0.07444	0.0744	0.07444	0.0744	0.07444	0.0744	0.07444	0.07444	0.07444	0.07444	0.0744	0.0744	0.074441	0.030596	0.030601	0.004953	5.46E-05	0.000765	0.99

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.12.2014	0.10573	0.0864	0.08157	0.0792	0.07835	0.07794	0.0777	0.07754	0.0774	0.0773	0.07727	0.0772	0.07718	0.0771	0.07711	0.0771	0.07706	0.07704	0.07702	0.077	0.077	0.077	0.076736	275.9332	291.7815	0.936993	1.86E-06	0.001454	0.42
30.01.2015	0.06851	0.0684	0.06837	0.0684	0.06835	0.06835	0.0683	0.06835	0.0683	0.0683	0.06835	0.0683	0.06834	0.0683	0.06834	0.0683	0.06834	0.06834	0.06834	0.06834	0.0683	0.0683	0.068342	0.054672	0.053934	0.001514	6.05E-05	0.004726	1.20
27.02.2015	0.08882	0.08324	0.08185	0.0812	0.08092	0.0808	0.0807	0.08069	0.0807	0.0806	0.08061	0.0806	0.08058	0.0806	0.08056	0.0806	0.08055	0.08054	0.08053	0.08053	0.0805	0.0805	0.080453	1384.353	1339.387	56.60112	4.53E-08	1.01E-05	2.36
31.03.2015	0.10657	0.08872	0.08426	0.082	0.08129	0.08092	0.0807	0.08054	0.0804	0.0804	0.0803	0.0802	0.08021	0.0802	0.08014	0.0801	0.0801	0.08008	0.08006	0.08005	0.08	0.08	0.079801	189.1705	527.1464	76.46464	1.24E-06	1.75E-05	5.39
30.04.2015	0.10071	0.10126	0.09646	0.0925	0.09117	0.09049	0.0901	0.0898	0.0896	0.0895	0.08935	0.0893	0.08918	0.0891	0.08907	0.089	0.08899	0.08895	0.08892	0.0889	0.0889	0.0888	0.08844	1406.098	2588.921	0.047196	6.26E-11	0.086752	10.68
29.05.2015	0.0894	0.09307	0.09531	0.0951	0.09353	0.09214	0.0911	0.09038	0.0898	0.0894	0.0891	0.0888	0.08863	0.0884	0.0883	0.0882	0.08806	0.08796	0.08788	0.0878	0.0877	0.0877	0.086505	332.4246	544.5387	0.030592	3.32E-10	0.381124	0.20
30.06.2015	0.08919	0.0891	0.08908	0.0891	0.08907	0.08907	0.0891	0.08907	0.0891	0.0891	0.08906	0.0891	0.08906	0.0891	0.08906	0.0891	0.08906	0.08906	0.08906	0.08906	0.0891	0.0891	0.089062	0.027185	0.028086	0.002206	0.000108	0.002066	15.47
31.07.2015	0.0939	0.09696	0.09832	0.0974	0.09591	0.09485	0.0941	0.09365	0.0933	0.093	0.09283	0.0927	0.09253	0.0924	0.09232	0.0922	0.09217	0.0921	0.09205	0.092	0.092	0.0919	0.091172	71.10864	68.77229	0.024056	1.16E-08	0.309558	0.03
31.08.2015	0.09763	0.10104	0.10381	0.1049	0.10397	0.10265	0.1015	0.10054	0.0998	0.0992	0.09877	0.0984	0.0981	0.0978	0.09763	0.0974	0.09728	0.09714	0.09702	0.09691	0.0968	0.0967	0.09504	27454.99	42072.91	0.033258	1.54E-10	0.505189	0.25
30.09.2015	0.10547	0.10542	0.1054	0.1054	0.1054	0.10539	0.1054	0.10539	0.1054	0.1054	0.10539	0.1054	0.10539	0.1054	0.10539	0.1054	0.10539	0.10539	0.10539	0.10539	0.1054	0.1054	0.105391	1.455101	5.342612	0.000754	4.81E-07	0.004231	13.51
30.10.2015	0.11091	0.10104	0.09939	0.0986	0.09793	0.09723	0.0966	0.09615	0.0958	0.0955	0.09522	0.095	0.09485	0.0947	0.0946	0.0945	0.09441	0.09434	0.09427	0.09421	0.0942	0.0941	0.093201	1149.67	1161.296	0.013542	6.06E-07	0.568122	0.34
30.11.2015	0.10497	0.10422	0.10325	0.1018	0.10078	0.10018	0.0999	0.09972	0.0997	0.0997	0.09965	0.0996	0.09949	0.0993	0.09901	0.0986	0.09818	0.09763	0.097	0.09629	0.0955	0.0947	0.01215	0.093217	0.026106	0.224961	1.294946	5.364709	0.04
31.12.2015	0.10164	0.10213	0.10267	0.1033	0.10352	0.10364	0.1037	0.10382	0.1039	0.104	0.10406	0.1041	0.10404	0.1039	0.10374	0.1035	0.10308	0.10262	0.10206	0.10143	0.1007	0.0999	0.000119	0.101232	0.051275	0.267919	1.30919	5.869406	0.04
29.01.2016	0.10271	0.10308	0.1034	0.1036	0.10348	0.10334	0.1032	0.10311	0.103	0.103	0.1029	0.1029	0.10282	0.1028	0.10276	0.1027	0.10272	0.1027	0.10269	0.10267	0.1027	0.1026	0.102446	327.4895	332.0017	0.00374	2.32E-11	0.542898	0.17
29.02.2016	0.10075	0.10045	0.10038	0.1003	0.10033	0.10032	0.1003	0.10032	0.1003	0.1003	0.10031	0.1003	0.10031	0.1003	0.10031	0.1003	0.10031	0.10031	0.10031	0.10031	0.1003	0.1003	0.100305	0.034834	0.035953	0.097624	0.000191	0.000238	7.78
31.03.2016	0.0944	0.09438	0.09438	0.0944	0.09438	0.09438	0.0944	0.09438	0.0944	0.0944	0.09438	0.0944	0.09438	0.0944	0.09438	0.0944	0.09438	0.09438	0.09438	0.09438	0.0944	0.0944	0.094376	0.006499	0.006486	0.000409	0.000101	0.002577	18.18
29.04.2016	0.08764	0.08761	0.0876	0.0876	0.08759	0.08759	0.0876	0.08759	0.0876	0.0876	0.08759	0.0876	0.08759	0.0876	0.08759	0.0876	0.08759	0.08759	0.08759	0.08759	0.0876	0.0876	0.087591	0.021923	0.021846	0.0063	5.39E-05	0.000272	17.41
31.05.2016	0.09465	0.09463	0.09463	0.0946	0.09463	0.09462	0.0946	0.09462	0.0946	0.0946	0.09462	0.0946	0.09462	0.0946	0.09462	0.0946	0.09462	0.09462	0.09462	0.09462	0.0946	0.0946	0.094624	0.011459	0.011418	0.002057	6.2E-05	0.00045	13.79
30.06.2016	0.08795	0.08791	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.08789	0.0879	0.08789	0.0879	0.08789	0.0879	0.08789	0.08789	0.08789	0.08789	0.0879	0.0879	0.087894	0.016854	0.015122	0.003786	9.4E-05	0.000494	2.18
29.07.2016	0.09254	0.09251	0.09251	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.0925	0.092502	0.028469	0.029435	0.001705	3.07E-05	0.00086	2.22
31.08.2016	0.09252	0.0925	0.09249	0.0925	0.09249	0.09249	0.0925	0.09249	0.0925	0.0925	0.09248	0.0925	0.09248	0.0925	0.09248	0.0925	0.09248	0.09248	0.09248	0.09248	0.0925	0.0925	0.092484	0.006658	0.00668	0.001486	0.000131	0.000742	4.54
30.09.2016	0.09002	0.09001	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.089997	0.010343	0.010327	0.000871	4.84E-05	0.001101	10.89
31.10.2016	0.09448	0.09446	0.09446	0.0945	0.09445	0.09445	0.0945	0.09445	0.0945	0.0945	0.09445	0.0945	0.09445	0.0945	0.09445	0.0945	0.09445	0.09445	0.09445	0.09445	0.0945	0.0945	0.09445	0.012597	0.012379	0.016019	5.82E-05	8.87E-05	4.21
30.11.2016	0.10264	0.10264	0.10264	0.1026	0.10264	0.10264	0.1026	0.10264	0.1026	0.1026	0.10264	0.1026	0.10264	0.1026	0.10264	0.1026	0.10264	0.10264	0.10264	0.10264	0.1026	0.1026	0.102642	131.2799	148.496	1.15E-06	5.46E-10	0.140897	32.23

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
30.12.2016	0.10664	0.10664	0.10663	0.1066	0.10663	0.10663	0.1066	0.10663	0.1066	0.1066	0.10663	0.1066	0.10663	0.1066	0.10663	0.1066	0.10663	0.10663	0.10663	0.10663	0.1066	0.1066	0.106632	1043.198	800.7632	4.37E-06	5.7E-10	1.947158	6.59
31.01.2017	0.10297	0.10403	0.10502	0.1057	0.10568	0.10537	0.105	0.10467	0.1044	0.1041	0.10395	0.1038	0.10365	0.1035	0.10344	0.1034	0.10328	0.10321	0.10316	0.10311	0.1031	0.103	0.10225	4.04E-05	0.00586	0.005865	0.654749	0.654753	2.25
28.02.2017	0.10308	0.10304	0.10303	0.103	0.10302	0.10302	0.103	0.10302	0.103	0.103	0.10302	0.103	0.10302	0.103	0.10302	0.103	0.10302	0.10302	0.10302	0.10302	0.103	0.103	0.103021	0.060859	0.082683	0.017577	1.82E-05	0.000107	12.02
31.03.2017	0.10731	0.10538	0.10629	0.1078	0.10822	0.10794	0.1074	0.10668	0.106	0.1054	0.10484	0.1043	0.10392	0.1035	0.10323	0.1029	0.1027	0.10248	0.10228	0.10211	0.102	0.1018	0.099144	0.00089	0.027748	0.026116	0.91259	0.021868	4.88
28.04.2017	0.10735	0.11271	0.11054	0.1081	0.10725	0.10644	0.1055	0.10456	0.1036	0.1027	0.10194	0.1012	0.10059	0.1	0.09953	0.0991	0.0987	0.09835	0.09804	0.09777	0.0975	0.0973	0.092991	0.00057	0.054693	0.03485	0.110788	1.059282	0.18
31.05.2017	0.10005	0.09994	0.09991	0.0999	0.09989	0.09989	0.0999	0.09989	0.0999	0.0999	0.09989	0.0999	0.09989	0.0999	0.09989	0.0999	0.09989	0.09989	0.09989	0.09989	0.0999	0.0999	0.099885	0.018903	0.019977	0.009491	0.000241	0.000431	15.57
30.06.2017	0.09824	0.1021	0.10535	0.107	0.10613	0.10473	0.1034	0.10232	0.1014	0.1007	0.10018	0.0997	0.09935	0.099	0.09877	0.0985	0.09835	0.09818	0.09802	0.09789	0.0978	0.0977	0.095586	1034533	1036409	0.038203	1.06E-13	0.542483	5.42
31.07.2017	0.1019	0.10817	0.11223	0.1123	0.10972	0.10732	0.1055	0.10416	0.1032	0.1024	0.10181	0.1013	0.10095	0.1006	0.10035	0.1001	0.09991	0.09973	0.09957	0.09944	0.0993	0.0992	0.097057	4015.047	4763.922	0.053397	1.47E-11	0.400771	0.23
31.08.2017	0.10153	0.1014	0.10137	0.1014	0.10135	0.10135	0.1013	0.10135	0.1013	0.1013	0.10134	0.1013	0.10134	0.1013	0.10134	0.1013	0.10134	0.10134	0.10134	0.10134	0.1013	0.1013	0.101341	0.106416	0.109121	0.08645	4.47E-05	7.17E-05	11.03
29.09.2017	0.10994	0.11284	0.11495	0.1146	0.11246	0.11025	0.1084	0.10701	0.1059	0.1051	0.1044	0.1039	0.10341	0.103	0.10273	0.1025	0.10222	0.10202	0.10184	0.10168	0.1015	0.1014	0.098951	0.00804	0.040964	0.044345	0.499959	0.000987	5.33
31.10.2017	0.12339	0.11805	0.1198	0.1219	0.12159	0.12029	0.1188	0.11731	0.116	0.115	0.11408	0.1133	0.11271	0.1122	0.11173	0.1113	0.111	0.11071	0.11045	0.11021	0.11	0.1098	0.106256	186.7928	182.5645	0.049382	3.25E-06	0.69703	0.42
30.11.2017	0.11906	0.12821	0.12845	0.1297	0.13124	0.13167	0.1311	0.12999	0.1285	0.1269	0.12525	0.1237	0.12215	0.1207	0.11946	0.1183	0.11723	0.11626	0.11539	0.11459	0.1139	0.1132	0.100294	5.6E-08	0.093331	0.068685	1.307987	0.110555	2.05
29.12.2017	0.12945	0.12291	0.1275	0.1313	0.12964	0.12633	0.1229	0.11987	0.1173	0.1153	0.11359	0.1122	0.11106	0.1101	0.10927	0.1086	0.10795	0.10741	0.10694	0.10652	0.1061	0.1058	0.099355	12907.45	9892.112	0.100697	8.74E-08	0.620185	7.84
31.01.2018	0.12478	0.11804	0.11526	0.1137	0.11316	0.11289	0.1127	0.11263	0.1126	0.1125	0.11245	0.1124	0.11239	0.1124	0.11235	0.1123	0.11231	0.1123	0.11229	0.11228	0.1123	0.1123	0.112103	1661.554	1437.15	0.011671	2.52E-07	0.068494	17.22
28.02.2018	0.13991	0.12245	0.1214	0.1231	0.12331	0.12245	0.1211	0.11968	0.1183	0.1171	0.11595	0.115	0.11418	0.1135	0.11285	0.1123	0.11184	0.11142	0.11106	0.11073	0.1104	0.1102	0.105138	5050.616	5215.902	0.054898	2.62E-07	0.867613	0.61
30.03.2018	0.13424	0.12218	0.12613	0.1331	0.13501	0.13407	0.1318	0.12914	0.1264	0.1239	0.12167	0.1197	0.11795	0.1164	0.11513	0.114	0.11298	0.11209	0.1113	0.11059	0.11	0.1094	0.098544	3538.964	3578.483	0.116788	3.59E-07	0.907151	5.61
30.04.2018	0.12417	0.13357	0.1279	0.1235	0.12391	0.12487	0.1255	0.12576	0.1256	0.1252	0.12452	0.1237	0.12281	0.1218	0.12086	0.1199	0.1189	0.11795	0.11704	0.11617	0.1153	0.1146	0.095788	5.55E-05	0.11321	0.088456	0.107569	2.084009	14.44
31.05.2018	0.15932	0.15712	0.15853	0.1621	0.16175	0.15886	0.1549	0.15089	0.1471	0.1437	0.14079	0.1383	0.1361	0.1342	0.13262	0.1312	0.13	0.12892	0.12797	0.12712	0.1264	0.1257	0.112656	0.050179	0.002345	0.144916	0.166931	0.838143	1.75
29.06.2018	0.14814	0.15747	0.16829	0.1765	0.17593	0.17235	0.1682	0.16431	0.161	0.1582	0.15586	0.1539	0.15235	0.151	0.14985	0.1489	0.148	0.14724	0.14658	0.14599	0.1455	0.145	0.135943	364.953	391.1142	0.136235	4.74E-07	0.661107	8.88
31.07.2018	0.36396	0.19362	0.1626	0.1626	0.17136	0.17898	0.1843	0.18755	0.189	0.1891	0.18812	0.1864	0.18411	0.1815	0.17858	0.1756	0.1725	0.16943	0.16641	0.16347	0.1606	0.1579	0.086523	599.5528	653.2357	0.324768	1.81E-05	2.280688	9.51
31.08.2018	0.19532	0.20411	0.21551	0.2328	0.24401	0.25047	0.2532	0.25311	0.2508	0.2469	0.24184	0.2359	0.2294	0.2225	0.21548	0.2084	0.20129	0.19432	0.18751	0.18091	0.1745	0.1684	5.21E-07	0.19055	0.503345	2.05E-06	2.656868	5.986696	4.23
28.09.2018	0.23363	0.23902	0.24071	0.2345	0.22612	0.21903	0.2134	0.20851	0.2039	0.1993	0.19456	0.1895	0.18433	0.179	0.1735	0.168	0.16255	0.15716	0.15187	0.14671	0.1417	0.1369	4.57E-08	0.228954	0.202865	0.481306	0.533273	2.66132	3.80
31.10.2018	0.20052	0.20912	0.21738	0.2228	0.22	0.2137	0.2063	0.19893	0.1921	0.1861	0.18081	0.1762	0.1723	0.1689	0.16593	0.1634	0.16109	0.1591	0.15733	0.15575	0.1543	0.1531	0.12881	0.066259	0.098368	0.098207	0.923105	0.923103	1.60
30.11.2018	0.22509	0.18962	0.18987	0.19	0.18449	0.17785	0.1719	0.16713	0.1633	0.1603	0.1579	0.1559	0.15433	0.153	0.15184	0.1509	0.15001	0.14927	0.14861	0.14803	0.1475	0.147	0.138126	2178.673	2309.579	0.152676	1.42E-06	0.542264	0.88

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2	(Zthe-Zreal)^2
31.12.2018	0.21125	0.20487	0.19766	0.1891	0.18359	0.17879	0.1743	0.17006	0.1662	0.1629	0.1599	0.1573	0.15509	0.1531	0.15146	0.15	0.14868	0.14754	0.14652	0.14561	0.1448	0.1441	0.13006	0.084769	0.033945	0.115911	0.243888	0.958638	0.17
																													1.455,9

area refers that since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yields which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period. Therefore, estimated values in the area should not be taken into consideration.

Appendix D. DNS Estimation Results of Matlab Opt. Methodology

Table D.1 DNS Estimation Results of Matlab Opt. Methodology

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
28.02.2005	0.14623	0.15333	0.15962	0.1627	0.15986	0.15512	0.1502	0.14574	0.1419	0.1387	0.13601	0.1338	0.1319	0.1303	0.12895	0.1278	0.12676	0.12587	0.12508	0.12438	0.1237	0.1232	0.112451	0.029087	0.118587151	1.375798	0.03
31.03.2005	0.14322	0.14793	0.15377	0.1617	0.16572	0.16677	0.1656	0.16292	0.1591	0.1545	0.14946	0.1441	0.1387	0.1333	0.12789	0.1227	0.11762	0.11278	0.10817	0.10378	0.0996	0.0957	3.24E-07	0.140594	0.292676949	0.428547	0.57
29.04.2005	0.13456	0.14181	0.15093	0.1639	0.17123	0.17444	0.1746	0.1726	0.169	0.1644	0.15915	0.1535	0.1476	0.1417	0.13585	0.1302	0.12466	0.11939	0.11437	0.10961	0.1051	0.1009	3.05E-06	0.130557	0.349292994	0.453933	0.28
31.05.2005	0.13558	0.14052	0.14652	0.1543	0.15781	0.15814	0.1562	0.15277	0.1483	0.1431	0.13763	0.132	0.12629	0.1207	0.1153	0.1101	0.10514	0.10045	0.09601	0.09183	0.0879	0.0842	3.7E-07	0.132807	0.279667149	0.471224	0.37
30.06.2005	0.13547	0.139	0.14338	0.1493	0.15224	0.15288	0.1518	0.14943	0.1462	0.1423	0.13794	0.1334	0.12867	0.1239	0.11926	0.1147	0.11022	0.10592	0.10179	0.09785	0.0941	0.0905	2.14E-06	0.133502	0.255143725	0.4011	0.46
29.07.2005	0.13325	0.13734	0.14249	0.1497	0.15366	0.15506	0.1546	0.15265	0.1497	0.146	0.14185	0.1374	0.13271	0.128	0.12327	0.1186	0.1141	0.10973	0.10551	0.10147	0.0976	0.094	5.69E-07	0.130984	0.271558867	0.399262	0.54
31.08.2005	0.13556	0.13927	0.14396	0.1506	0.15426	0.15562	0.1552	0.15349	0.1508	0.1473	0.14342	0.1392	0.13474	0.1302	0.12566	0.1212	0.11676	0.11247	0.10833	0.10434	0.1005	0.0969	6.98E-07	0.133507	0.266802369	0.380832	0.47
30.09.2005	0.13404	0.13625	0.13888	0.142	0.14287	0.14204	0.1399	0.13695	0.1333	0.1293	0.12496	0.1205	0.11603	0.1116	0.10722	0.103	0.09888	0.09495	0.09119	0.08762	0.0842	0.081	8.12E-07	0.132786	0.211720188	0.397981	0.30
31.10.2005	0.2144	0.14716	0.13034	0.1219	0.11914	0.11774	0.1169	0.11633	0.1159	0.1156	0.1154	0.1152	0.11506	0.1149	0.11483	0.1147	0.11465	0.11458	0.11452	0.11447	0.1144	0.1144	0.113533	546758.2	508659.8614	1.26E+08	31.69
30.11.2005	0.33717	0.18544	0.14751	0.1285	0.12222	0.11906	0.1172	0.1159	0.115	0.1143	0.11379	0.1134	0.11302	0.1127	0.11249	0.1123	0.1121	0.11194	0.1118	0.11168	0.1116	0.1115	0.109573	951685.9	927615.3401	99083702	7.95
30.12.2005	0.13572	0.13539	0.13474	0.133	0.13068	0.128	0.125	0.12185	0.1185	0.1151	0.11169	0.1082	0.10484	0.1015	0.09818	0.095	0.09185	0.08883	0.08591	0.0831	0.0804	0.0778	0.000264	0.135583	0.125749768	0.294026	0.05
31.01.2006	0.12165	0.12814	0.13162	0.1303	0.12714	0.12458	0.1228	0.1215	0.1206	0.1199	0.11931	0.1189	0.11851	0.1182	0.11796	0.1177	0.11755	0.11739	0.11724	0.11711	0.117	0.1169	0.114911	0.001358	0.054718036	2.833312	0.22
28.02.2006	0.12062	0.12731	0.12926	0.1259	0.12265	0.12056	0.1192	0.11833	0.1177	0.1172	0.11683	0.1165	0.11628	0.1161	0.1159	0.1158	0.11563	0.11551	0.11541	0.11533	0.1152	0.1152	0.113821	0.000155	0.051592531	3.822138	2.41
31.03.2006	0.13008	0.13089	0.12941	0.1277	0.12705	0.12672	0.1265	0.1264	0.1263	0.1262	0.12618	0.1261	0.1261	0.1261	0.12605	0.126	0.12601	0.12599	0.12598	0.12597	0.126	0.1259	0.125749	0.000808	0.016426026	8.833279	1.57
28.04.2006	0.12723	0.12737	0.12743	0.1274	0.1273	0.12725	0.1272	0.12719	0.1272	0.1272	0.12716	0.1271	0.12714	0.1271	0.12713	0.1271	0.12713	0.12712	0.12712	0.12712	0.1271	0.1271	0.127084	1.7E-05	0.001121832	3.472013	2.22
31.05.2006	0.13827	0.14136	0.14552	0.1523	0.15742	0.16118	0.1639	0.1657	0.1669	0.1675	0.16777	0.1677	0.1674	0.1669	0.16632	0.1656	0.16487	0.16408	0.16327	0.16245	0.1616	0.1608	0.136618	2.79E-06	0.104419628	0.387554	0.78
30.06.2006	0.17122	0.18488	0.19544	0.1991	0.19487	0.18967	0.1852	0.18166	0.1789	0.1768	0.17511	0.1738	0.17264	0.1717	0.17092	0.1702	0.16966	0.16915	0.1687	0.16829	0.1679	0.1676	0.161464	2.72E-07	0.1269939	2.065805	0.37
31.07.2006	0.16884	0.17613	0.18214	0.1843	0.18112	0.17673	0.1726	0.16907	0.1662	0.1639	0.162	0.1605	0.15919	0.1581	0.15721	0.1564	0.15575	0.15516	0.15464	0.15417	0.1538	0.1534	0.146271	0.017557	0.098789496	1.635886	0.16
31.08.2006	0.18053	0.18047	0.18023	0.1793	0.17784	0.17594	0.1737	0.17114	0.1683	0.1654	0.16225	0.159	0.15572	0.1524	0.149	0.1456	0.14226	0.13892	0.13562	0.13237	0.1292	0.126	0.000102	0.180436	0.181151127	0.220486	0.27
29.09.2006	0.15863	0.16739	0.17756	0.1899	0.19543	0.19691	0.1962	0.19426	0.1918	0.1893	0.18672	0.1843	0.18213	0.1801	0.17834	0.1767	0.17528	0.17399	0.17283	0.17179	0.1708	0.17	0.153537	4.97E-06	0.145332515	0.882006	1.27

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2006	0.15184	0.16152	0.17265	0.186	0.19167	0.19298	0.1919	0.18969	0.1869	0.1841	0.18129	0.1787	0.17631	0.1742	0.17226	0.1705	0.16902	0.16765	0.16643	0.16533	0.1643	0.1634	0.1462	4.58E-07	0.156772738	0.90814	0.81
30.11.2006	0.14979	0.16095	0.17318	0.1863	0.19027	0.18956	0.1866	0.18279	0.1788	0.175	0.17145	0.1683	0.16554	0.1631	0.16096	0.1591	0.15741	0.15594	0.15463	0.15346	0.1524	0.1515	0.133337	0.009779	0.175676682	1.023194	0.40
29.12.2006	0.15974	0.1676	0.17657	0.1869	0.19043	0.18999	0.1873	0.18353	0.1793	0.1749	0.17071	0.1668	0.16315	0.1599	0.15687	0.1542	0.15176	0.14958	0.14762	0.14584	0.1442	0.1428	0.114439	0.040703	0.186023567	0.797969	0.43
31.01.2007	0.15296	0.16019	0.16844	0.1781	0.18208	0.18282	0.1819	0.18007	0.178	0.1758	0.17375	0.1718	0.17011	0.1686	0.16718	0.166	0.16487	0.16389	0.16302	0.16224	0.1615	0.1609	0.148698	2.09E-05	0.114387854	0.936839	0.49
28.02.2007	0.17515	0.17855	0.18115	0.182	0.18089	0.17958	0.1785	0.17761	0.1769	0.1764	0.17602	0.1757	0.17542	0.1752	0.175	0.1748	0.17469	0.17457	0.17446	0.17436	0.1743	0.1742	0.172704	4.02E-07	0.031360458	2.10188	0.19
30.03.2007	0.16325	0.16874	0.17429	0.1792	0.17991	0.17881	0.1771	0.17534	0.1737	0.1723	0.17106	0.17	0.16914	0.1684	0.16774	0.1672	0.16669	0.16626	0.16589	0.16555	0.1652	0.165	0.159823	5.25E-07	0.067530923	1.309956	0.08
30.04.2007	0.16067	0.16618	0.17148	0.1756	0.17547	0.17384	0.1719	0.16995	0.1683	0.1669	0.16567	0.1647	0.16385	0.1631	0.16255	0.162	0.16158	0.16119	0.16084	0.16053	0.1603	0.16	0.155267	0.001867	0.065993311	1.432349	0.16
31.05.2007	0.15929	0.16206	0.16536	0.1694	0.17096	0.17071	0.1692	0.16697	0.1642	0.1611	0.15795	0.1548	0.1516	0.1486	0.14565	0.1429	0.14029	0.13785	0.13557	0.13345	0.1315	0.1296	0.08941	0.068309	0.144653571	0.51581	0.10
29.06.2007	0.1459	0.1533	0.16104	0.1684	0.16964	0.16807	0.1654	0.16236	0.1595	0.1568	0.15451	0.1525	0.15074	0.1492	0.14791	0.1468	0.14577	0.14489	0.14411	0.14341	0.1428	0.1422	0.131503	0.009865	0.112056903	1.137515	0.13
31.07.2007	0.15172	0.15516	0.15929	0.1643	0.16607	0.16534	0.1628	0.15909	0.1545	0.1493	0.14389	0.1383	0.13269	0.1272	0.12179	0.1166	0.11163	0.10689	0.10239	0.09814	0.0941	0.0903	4.3E-07	0.149761	0.262351983	0.433828	2.34
31.08.2007	0.16026	0.16185	0.16371	0.166	0.16703	0.16733	0.1672	0.16689	0.1665	0.166	0.16553	0.1651	0.16468	0.1643	0.16398	0.1637	0.16341	0.16317	0.16295	0.16275	0.1626	0.1624	0.159318	1.77E-05	0.026845089	0.865812	0.08
28.09.2007	0.15829	0.15831	0.15826	0.158	0.15742	0.15664	0.1557	0.15451	0.1532	0.1518	0.15021	0.1485	0.14681	0.145	0.14312	0.1412	0.13923	0.13724	0.13523	0.1332	0.1312	0.1291	3.14E-05	0.158241	0.162055812	0.152375	0.25
31.10.2007	0.14863	0.14985	0.15117	0.1524	0.15239	0.15157	0.1503	0.14873	0.1471	0.1455	0.14386	0.1423	0.14093	0.1396	0.13842	0.1373	0.13631	0.13539	0.13455	0.13379	0.1331	0.1325	0.119657	0.028255	0.056192341	0.654955	0.07
30.11.2007	0.13786	0.14224	0.1477	0.1552	0.15917	0.16039	0.1596	0.15726	0.1539	0.1498	0.14517	0.1403	0.13524	0.1302	0.12514	0.1202	0.11545	0.11086	0.10645	0.10225	0.0983	0.0945	3.73E-07	0.135438	0.280858948	0.414127	4.15
31.12.2007	0.15051	0.15142	0.15261	0.1544	0.15549	0.15601	0.1561	0.15575	0.1551	0.1542	0.15315	0.1519	0.15057	0.1491	0.14765	0.1461	0.14456	0.143	0.14144	0.1399	0.1384	0.1369	0.083844	0.066164	0.110662785	0.275595	0.04
31.01.2008	0.1508	0.15106	0.15128	0.1514	0.15128	0.15118	0.1511	0.15102	0.151	0.1509	0.15088	0.1509	0.15083	0.1508	0.15079	0.1508	0.15076	0.15075	0.15074	0.15074	0.1507	0.1507	0.150592	1.51E-05	0.002557074	1.985175	11.29
29.02.2008	0.13734	0.14181	0.14751	0.1558	0.16075	0.16306	0.1633	0.16209	0.1597	0.1564	0.15258	0.1483	0.14381	0.1392	0.13445	0.1298	0.12515	0.12065	0.11628	0.11207	0.108	0.1041	2.17E-08	0.134895	0.294659192	0.378917	3.62
31.03.2008	0.15993	0.16184	0.16442	0.1687	0.17196	0.17438	0.1761	0.17727	0.178	0.1783	0.17832	0.1781	0.1777	0.1771	0.17648	0.1757	0.17492	0.17407	0.17319	0.17229	0.1714	0.1705	0.138635	0.020285	0.098723762	0.316137	0.21
30.04.2008	0.16825	0.16993	0.17203	0.175	0.17675	0.17763	0.1779	0.17776	0.1773	0.1768	0.17607	0.1753	0.17456	0.1738	0.17308	0.1724	0.17171	0.17108	0.17049	0.16994	0.1694	0.169	0.158706	0.008616	0.04992904	0.55884	0.40
30.05.2008	0.15699	0.1623	0.16911	0.1792	0.18532	0.18841	0.1891	0.18802	0.1855	0.1821	0.17784	0.1731	0.16805	0.1628	0.15747	0.1521	0.14686	0.1417	0.13667	0.13181	0.1271	0.1226	8.03E-07	0.154085	0.346303507	0.372962	2.05
30.06.2008	0.15594	0.16542	0.17702	0.1928	0.20165	0.20585	0.2071	0.20651	0.2048	0.2025	0.19993	0.1972	0.19459	0.1921	0.18966	0.1874	0.18537	0.18347	0.18174	0.18015	0.1787	0.1774	0.150608	1.85E-06	0.18933599	0.70286	0.52
31.07.2008	0.17229	0.17397	0.17502	0.175	0.17425	0.17361	0.1731	0.17277	0.1725	0.1723	0.17217	0.172	0.17194	0.1719	0.17179	0.1717	0.17168	0.17163	0.17159	0.17155	0.1715	0.1715	0.170937	2.82E-05	0.014214888	2.573183	0.40
29.08.2008	0.1562	0.16106	0.16693	0.1744	0.17743	0.17724	0.1748	0.17071	0.1656	0.1598	0.15365	0.1474	0.14105	0.1349	0.12887	0.1231	0.11762	0.1124	0.10748	0.10284	0.0985	0.0944	4.2E-07	0.153459	0.301442092	0.462783	2.75
29.09.2008	0.17331	0.17472	0.1764	0.1785	0.17952	0.17987	0.1798	0.17957	0.1792	0.1788	0.17839	0.178	0.17762	0.1773	0.17697	0.1767	0.17643	0.1762	0.17599	0.17581	0.1756	0.1755	0.172489	3.36E-07	0.024793183	0.826515	0.44

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2008	0.18048	0.19025	0.20255	0.22	0.23	0.23438	0.2347	0.232	0.2273	0.2211	0.21401	0.2064	0.19852	0.1906	0.18274	0.1751	0.1677	0.16062	0.15388	0.14747	0.1414	0.1357	1.06E-06	0.17508	0.470212703	0.453594	1.88
28.11.2008	0.17302	0.17525	0.17818	0.1828	0.18601	0.18821	0.1896	0.19046	0.1908	0.1909	0.19075	0.1904	0.18997	0.1894	0.18888	0.1883	0.18769	0.18709	0.18651	0.18594	0.1854	0.1849	0.171815	2.7E-06	0.064019604	0.463374	0.30
31.12.2008	0.1457	0.147	0.14882	0.152	0.15455	0.15659	0.1582	0.15929	0.16	0.1604	0.16053	0.1603	0.15991	0.1593	0.15841	0.1574	0.15622	0.15491	0.15349	0.15197	0.1504	0.1487	0.000113	0.144905	0.252525176	0.154184	0.20
30.01.2009	0.08789	0.09832	0.11166	0.1313	0.14361	0.15048	0.1534	0.15342	0.1514	0.148	0.14374	0.1389	0.13367	0.1283	0.12303	0.1178	0.11276	0.10791	0.10328	0.09889	0.0947	0.0908	4.43E-08	0.082164	0.375184445	0.483631	3.17
27.02.2009	0.10679	0.1125	0.12034	0.1336	0.1442	0.15239	0.1586	0.16306	0.1661	0.1679	0.16876	0.1687	0.16801	0.1667	0.16493	0.1628	0.16032	0.15762	0.15475	0.15174	0.1486	0.1455	1.55E-05	0.103773	0.385488032	0.2604	0.83
31.03.2009	0.14735	0.14735	0.14735	0.1474	0.14735	0.14735	0.1474	0.14735	0.1474	0.1474	0.14735	0.1474	0.14735	0.1474	0.14735	0.1474	0.14735	0.14735	0.14735	0.14735	0.1474	0.1474	0.147353	6.25E-09	2.92772E-08	1.102431	12.62
30.04.2009	0.12505	0.12505	0.12505	0.1251	0.12505	0.12505	0.1251	0.12505	0.1251	0.1251	0.12505	0.1251	0.12505	0.1251	0.12505	0.1251	0.12505	0.12505	0.12505	0.12505	0.1251	0.1251	0.125051	6.86E-09	2.00367E-08	1.251922	23.37
29.05.2009	0.12849	0.12849	0.12849	0.1285	0.12849	0.12849	0.1285	0.12849	0.1285	0.1285	0.12849	0.1285	0.12849	0.1285	0.12849	0.1285	0.12849	0.12849	0.12849	0.12849	0.1285	0.1285	0.128489	7.79E-11	4.24986E-10	1.18981	7.93
30.06.2009	0.12475	0.12475	0.12475	0.1248	0.12475	0.12475	0.1248	0.12475	0.1248	0.1248	0.12475	0.1248	0.12475	0.1248	0.12475	0.1248	0.12475	0.12475	0.12475	0.12475	0.1248	0.1248	0.124751	5.79E-09	2.36734E-08	1.204416	14.19
31.07.2009	0.10262	0.10259	0.10259	0.1026	0.10258	0.10258	0.1026	0.10258	0.1026	0.1026	0.10258	0.1026	0.10258	0.1026	0.10258	0.1026	0.10258	0.10258	0.10258	0.10258	0.1026	0.1026	0.102578	6317.049	6821.200838	3.74E+09	8.36
31.08.2009	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.1035	0.103502	2.84E-08	2.80071E-08	216.7985	9.93
30.09.2009	0.08721	0.08721	0.08721	0.0872	0.08721	0.08721	0.0872	0.08721	0.0872	0.0872	0.08721	0.0872	0.08721	0.0872	0.08721	0.0872	0.08721	0.08721	0.08721	0.08721	0.0872	0.0872	0.08721	5.53E-06	5.53474E-06	524.8492	10.34
30.10.2009	0.09007	0.09007	0.09007	0.0901	0.09007	0.09007	0.0901	0.09007	0.0901	0.0901	0.09007	0.0901	0.09007	0.0901	0.09007	0.0901	0.09007	0.09007	0.09007	0.09007	0.0901	0.0901	0.090065	4.01E-05	4.01336E-05	721.57	30.29
26.11.2009	0.09345	0.09345	0.09345	0.0934	0.09344	0.09344	0.0934	0.09344	0.0934	0.0934	0.09344	0.0934	0.09344	0.0934	0.09344	0.0934	0.09344	0.09344	0.09344	0.09344	0.0934	0.0934	0.093445	4.17E-05	4.16914E-05	669.2624	7.53
31.12.2009	0.08982	0.08977	0.08976	0.0898	0.08975	0.08975	0.0897	0.08975	0.0897	0.0897	0.08975	0.0897	0.08975	0.0897	0.08975	0.0897	0.08975	0.08975	0.08975	0.08975	0.0897	0.0897	0.089746	0.002033	0.002033298	646.8521	13.91
29.01.2010	0.10005	0.10005	0.10005	0.1001	0.10005	0.10005	0.1001	0.10005	0.1001	0.1001	0.10005	0.1001	0.10005	0.1001	0.10005	0.1001	0.10005	0.10005	0.10005	0.10005	0.1001	0.1001	0.100053	3.76E-07	3.75524E-07	348.0544	42.73
26.02.2010	0.09986	0.09986	0.09986	0.0999	0.09986	0.09986	0.0999	0.09986	0.0999	0.0999	0.09986	0.0999	0.09986	0.0999	0.09986	0.0999	0.09986	0.09986	0.09986	0.09986	0.0999	0.0999	0.099856	4.63E-07	4.63453E-07	336.6951	23.54
31.03.2010	0.09548	0.09548	0.09548	0.0955	0.09548	0.09548	0.0955	0.09548	0.0955	0.0955	0.09548	0.0955	0.09548	0.0955	0.09548	0.0955	0.09548	0.09548	0.09548	0.09548	0.0955	0.0955	0.095479	345.413	344.5806769	1.99E+09	52.17
30.04.2010	0.09626	0.09626	0.09625	0.0963	0.09625	0.09625	0.0963	0.09625	0.0963	0.0963	0.09625	0.0963	0.09625	0.0963	0.09625	0.0963	0.09625	0.09625	0.09625	0.09625	0.0963	0.0963	0.096251	0.000198	0.00019839	354.5897	71.63
31.05.2010	0.09826	0.09826	0.09826	0.0983	0.09826	0.09826	0.0983	0.09826	0.0983	0.0983	0.09826	0.0983	0.09826	0.0983	0.09826	0.0983	0.09826	0.09826	0.09826	0.09826	0.0983	0.0983	0.098259	4.94E-07	4.94133E-07	329.5339	19.93
30.06.2010	0.0905	0.09049	0.09049	0.0905	0.09049	0.09049	0.0905	0.09049	0.0905	0.0905	0.09049	0.0905	0.09049	0.0905	0.09049	0.0905	0.09049	0.09049	0.09049	0.09049	0.0905	0.0905	0.090493	0.000144	0.000143691	861.8978	44.39
30.07.2010	0.08541	0.08541	0.08541	0.0854	0.08541	0.08541	0.0854	0.08541	0.0854	0.0854	0.08541	0.0854	0.08541	0.0854	0.08541	0.0854	0.08541	0.08541	0.08541	0.08541	0.0854	0.0854	0.085411	3.61E-06	3.61327E-06	962.949	3.12
31.08.2010	0.08536	0.08536	0.08536	0.0854	0.08536	0.08536	0.0854	0.08536	0.0854	0.0854	0.08536	0.0854	0.08536	0.0854	0.08536	0.0854	0.08536	0.08536	0.08536	0.08536	0.0854	0.0854	0.08536	3.26E-06	3.26756E-06	942.6402	3.82
30.09.2010	0.08294	0.08294	0.08294	0.0829	0.08294	0.08294	0.0829	0.08294	0.0829	0.0829	0.08294	0.0829	0.08294	0.0829	0.08294	0.0829	0.08294	0.08294	0.08294	0.08294	0.0829	0.0829	0.08294	3.18E-05	3.17865E-05	959.0094	53.86

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
28.10.2010	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.0775	0.077503	2.03E-05	2.03253E-05	1051.14	3.72
30.11.2010	0.08359	0.08359	0.08359	0.0836	0.08359	0.08359	0.0836	0.08359	0.0836	0.0836	0.08359	0.0836	0.08359	0.0836	0.08359	0.0836	0.08359	0.08359	0.08359	0.08359	0.0836	0.0836	0.08359	3.81E-07	3.80758E-07	941.505	14.90
31.12.2010	0.07888	0.07887	0.07886	0.0789	0.07886	0.07886	0.0789	0.07886	0.0789	0.0789	0.07886	0.0789	0.07886	0.0789	0.07886	0.0789	0.07886	0.07886	0.07886	0.07886	0.0789	0.0789	0.07886	0.000839	0.000838593	1001.137	21.98
31.01.2011	0.08782	0.08782	0.08782	0.0878	0.08782	0.08782	0.0878	0.08782	0.0878	0.0878	0.08782	0.0878	0.08782	0.0878	0.08782	0.0878	0.08782	0.08782	0.08782	0.08782	0.0878	0.0878	0.087824	1.71E-06	1.70866E-06	834.0714	10.84
28.02.2011	0.08955	0.08955	0.08955	0.0895	0.08955	0.08955	0.0895	0.08955	0.0895	0.0895	0.08955	0.0895	0.08955	0.0895	0.08955	0.0895	0.08955	0.08955	0.08955	0.08955	0.0895	0.0895	0.089548	3.26E-06	3.26026E-06	981.1459	4.20
31.03.2011	0.08825	0.08825	0.08825	0.0882	0.08825	0.08825	0.0882	0.08825	0.0882	0.0882	0.08825	0.0882	0.08825	0.0882	0.08825	0.0882	0.08825	0.08825	0.08825	0.08825	0.0882	0.0882	0.088246	1.86E-06	1.86177E-06	983.0712	44.66
29.04.2011	0.08798	0.08798	0.08798	0.088	0.08797	0.08797	0.088	0.08797	0.088	0.088	0.08797	0.088	0.08797	0.088	0.08797	0.088	0.08797	0.08797	0.08797	0.08797	0.088	0.088	0.087974	0.00036	0.000359601	986.8251	3.65
31.05.2011	0.09042	0.09042	0.09042	0.0904	0.09042	0.09042	0.0904	0.09042	0.0904	0.0904	0.09042	0.0904	0.09042	0.0904	0.09042	0.0904	0.09042	0.09042	0.09042	0.09042	0.0904	0.0904	0.09042	4.12E-06	4.1183E-06	914.1326	2.20
30.06.2011	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.0894	0.089397	3.23E-05	3.23454E-05	900.9828	47.90
29.07.2011	0.09111	0.09111	0.09111	0.0911	0.09111	0.09111	0.0911	0.09111	0.0911	0.0911	0.09111	0.0911	0.09111	0.0911	0.09111	0.0911	0.09111	0.09111	0.09111	0.09111	0.0911	0.0911	0.091111	3.03E-06	3.02846E-06	837.5819	3.78
29.08.2011	0.08308	0.08308	0.08308	0.0831	0.08308	0.08308	0.0831	0.08308	0.0831	0.0831	0.08308	0.0831	0.08308	0.0831	0.08308	0.0831	0.08308	0.08308	0.08308	0.08308	0.0831	0.0831	0.083077	0.000267	0.000267165	956.8492	8.28
30.09.2011	0.08602	0.08602	0.08602	0.086	0.08602	0.08601	0.086	0.08601	0.086	0.086	0.08601	0.086	0.08601	0.086	0.08601	0.086	0.08601	0.08601	0.08601	0.08601	0.086	0.086	0.086015	0.000201	0.00020055	872.4667	25.13
31.10.2011	0.16011	0.1127	0.10085	0.0949	0.09295	0.09196	0.0914	0.09097	0.0907	0.0905	0.09032	0.0902	0.09008	0.09	0.08991	0.0898	0.08979	0.08974	0.0897	0.08966	0.0896	0.0896	0.088999	1.487055	1.448996866	495.465	1.83
30.11.2011	0.13965	0.11072	0.10348	0.0999	0.09866	0.09806	0.0977	0.09746	0.0973	0.0972	0.09706	0.097	0.09691	0.0969	0.09681	0.0968	0.09673	0.0967	0.09668	0.09665	0.0966	0.0966	0.096252	0.501151	0.496414685	275.8709	1.06
30.12.2011	0.20404	0.1305	0.11211	0.1029	0.09985	0.09832	0.0974	0.09679	0.0964	0.096	0.09577	0.0956	0.0954	0.0953	0.09514	0.095	0.09495	0.09487	0.09481	0.09475	0.0947	0.0946	0.093725	1.638407	1.590894569	351.2861	8.95
31.01.2012	0.09242	0.09242	0.09241	0.0924	0.09241	0.09241	0.0924	0.09241	0.0924	0.0924	0.09241	0.0924	0.09241	0.0924	0.09241	0.0924	0.09241	0.09241	0.09241	0.09241	0.0924	0.0924	0.092413	0.000179	0.000178346	467.7983	0.35
29.02.2012	0.08888	0.08884	0.08883	0.0888	0.08883	0.08883	0.0888	0.08882	0.0888	0.0888	0.08882	0.0888	0.08882	0.0888	0.08882	0.0888	0.08882	0.08882	0.08882	0.08882	0.0888	0.0888	0.088823	0.000913	0.000913144	385.6276	13.66
30.03.2012	0.0915	0.09138	0.09134	0.0913	0.09132	0.09132	0.0913	0.09132	0.0913	0.0913	0.09132	0.0913	0.09132	0.0913	0.09132	0.0913	0.09132	0.09132	0.09132	0.09132	0.0913	0.0913	0.091313	0.004099	0.004099481	518.9712	0.96
30.04.2012	0.14288	0.10554	0.09621	0.0915	0.08999	0.08921	0.0887	0.08843	0.0882	0.088	0.08791	0.0878	0.08772	0.0877	0.08759	0.0875	0.0875	0.08746	0.08743	0.08739	0.0874	0.0873	0.086876	2.591466	2.562653245	1104.459	2.48
31.05.2012	0.10147	0.09188	0.08948	0.0883	0.08788	0.08768	0.0876	0.08748	0.0874	0.0874	0.08735	0.0873	0.0873	0.0873	0.08727	0.0873	0.08724	0.08723	0.08722	0.08721	0.0872	0.0872	0.087081	0.661248	0.660501691	1101.915	9.61
29.06.2012	0.08414	0.08408	0.08406	0.0841	0.08405	0.08405	0.0841	0.08405	0.084	0.084	0.08405	0.084	0.08405	0.084	0.08405	0.084	0.08405	0.08405	0.08405	0.08405	0.084	0.084	0.084047	0.004414	0.004413393	1158.736	0.56
31.07.2012	0.07695	0.07695	0.07695	0.0769	0.07695	0.07695	0.0769	0.07695	0.0769	0.0769	0.07695	0.0769	0.07695	0.0769	0.07695	0.0769	0.07695	0.07695	0.07695	0.07695	0.0769	0.0769	0.076949	0.000132	0.000132196	1296.923	11.79
31.08.2012	0.07821	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.078204	5.9E-05	5.89511E-05	1250.352	20.50
28.09.2012	0.07824	0.07824	0.07824	0.0782	0.07824	0.07824	0.0782	0.07824	0.0782	0.0782	0.07824	0.0782	0.07824	0.0782	0.07824	0.0782	0.07824	0.07824	0.07824	0.07824	0.0782	0.0782	0.078244	5.38E-06	5.38375E-06	1347.869	73.24

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2012	0.07658	0.07658	0.07658	0.0766	0.07658	0.07658	0.0766	0.07658	0.0766	0.0766	0.07658	0.0766	0.07658	0.0766	0.07658	0.0766	0.07658	0.07658	0.07658	0.07658	0.0766	0.0766	0.076581	2.4E-06	2.39497E-06	1447.136	13.68
30.11.2012	0.06657	0.06655	0.06655	0.0665	0.06654	0.06654	0.0665	0.06654	0.0665	0.0665	0.06654	0.0665	0.06654	0.0665	0.06654	0.0665	0.06654	0.06654	0.06654	0.06654	0.0665	0.0665	0.066542	0.001661	0.001660747	1708.592	13.79
31.12.2012	0.06324	0.06316	0.06313	0.0631	0.06312	0.06312	0.0631	0.06312	0.0631	0.0631	0.06312	0.0631	0.06312	0.0631	0.06312	0.0631	0.06312	0.06312	0.06312	0.06312	0.0631	0.0631	0.063115	0.009221	0.009220917	1809.003	3.73
31.01.2013	0.06355	0.06354	0.06354	0.0635	0.06354	0.06354	0.0635	0.06354	0.0635	0.0635	0.06354	0.0635	0.06354	0.0635	0.06354	0.0635	0.06354	0.06354	0.06354	0.06354	0.0635	0.0635	0.06354	0.001068	0.001068065	1819.456	52.69
28.02.2013	0.06301	0.06299	0.06299	0.063	0.06299	0.06299	0.063	0.06299	0.063	0.063	0.06299	0.063	0.06299	0.063	0.06299	0.063	0.06299	0.06299	0.06299	0.06299	0.063	0.063	0.062988	0.001295	0.00129478	1636.705	42.06
29.03.2013	0.06649	0.06648	0.06648	0.0665	0.06648	0.06648	0.0665	0.06648	0.0665	0.0665	0.06648	0.0665	0.06648	0.0665	0.06648	0.0665	0.06648	0.06648	0.06648	0.06648	0.0665	0.0665	0.066476	0.00054	0.00054036	1478.704	6.38
30.04.2013	0.05995	0.05993	0.05993	0.0599	0.05993	0.05993	0.0599	0.05993	0.0599	0.0599	0.05993	0.0599	0.05993	0.0599	0.05993	0.0599	0.05993	0.05993	0.05993	0.05993	0.0599	0.0599	0.059927	0.00156	0.001559602	1640.691	13.83
31.05.2013	0.06524	0.06521	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.0652	0.06519	0.06519	0.06519	0.0652	0.0652	0.065195	0.002728	0.002728244	1514.551	3.74
28.06.2013	0.07917	0.07911	0.0791	0.0791	0.07909	0.07909	0.0791	0.07909	0.0791	0.0791	0.07909	0.0791	0.07909	0.0791	0.07909	0.0791	0.07909	0.07909	0.07909	0.07909	0.0791	0.0791	0.079086	0.003907	0.003906593	1178.916	2.24
31.07.2013	0.08773	0.08773	0.08772	0.0877	0.08772	0.08772	0.0877	0.08772	0.0877	0.0877	0.08772	0.0877	0.08772	0.0877	0.08772	0.0877	0.08772	0.08772	0.08772	0.08772	0.0877	0.0877	0.087724	0.000254	0.000253939	1052.607	0.71
29.08.2013	0.09474	0.09471	0.09471	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.094702	0.000644	0.000643966	410.0148	12.98
30.09.2013	0.08733	0.08733	0.08733	0.0873	0.08733	0.08733	0.0873	0.08733	0.0873	0.0873	0.08733	0.0873	0.08733	0.0873	0.08733	0.0873	0.08733	0.08733	0.08733	0.08733	0.0873	0.0873	0.087333	4.54E-06	4.5373E-06	1133.828	2.99
31.10.2013	0.08263	0.08263	0.08263	0.0826	0.08263	0.08263	0.0826	0.08263	0.0826	0.0826	0.08263	0.0826	0.08263	0.0826	0.08263	0.0826	0.08263	0.08263	0.08263	0.08263	0.0826	0.0826	0.082631	6.91E-05	6.90747E-05	1265.713	7.85
29.11.2013	0.08915	0.08909	0.08907	0.0891	0.08906	0.08906	0.0891	0.08906	0.0891	0.0891	0.08906	0.0891	0.08906	0.0891	0.08906	0.0891	0.08906	0.08906	0.08906	0.08906	0.0891	0.0891	0.089057	38211	31986.54449	8.92E+09	2.18
31.12.2013	0.09793	0.09793	0.09793	0.0979	0.09793	0.09793	0.0979	0.09793	0.0979	0.0979	0.09793	0.0979	0.09793	0.0979	0.09793	0.0979	0.09793	0.09793	0.09793	0.09793	0.0979	0.0979	0.097934	1.03E-06	1.03443E-06	420.116	15.00
31.01.2014	0.10035	0.10119	0.10222	0.1036	0.10421	0.10436	0.1042	0.10381	0.1033	0.1027	0.10207	0.1014	0.1008	0.1002	0.09961	0.0991	0.09856	0.09808	0.09763	0.09722	0.0968	0.0965	0.088955	0.010918	0.032119053	0.560834	0.95
28.02.2014	0.09787	0.10043	0.10297	0.1051	0.10534	0.10477	0.104	0.10313	0.1024	0.1017	0.10119	0.1007	0.10034	0.1	0.09973	0.0995	0.09927	0.09908	0.09892	0.09877	0.0986	0.0985	0.096264	3.74E-06	0.030615246	1.358338	0.52
31.03.2014	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.0988	0.098805	2.1E-06	2.09573E-06	398.9788	15.62
30.04.2014	0.09035	0.09026	0.09024	0.0902	0.09022	0.09022	0.0902	0.09022	0.0902	0.0902	0.09022	0.0902	0.09022	0.0902	0.09022	0.0902	0.09022	0.09022	0.09022	0.09022	0.0902	0.0902	0.090217	0.002817	0.002817127	519.02	1.52
30.05.2014	0.08502	0.08502	0.08502	0.085	0.08502	0.08502	0.085	0.08502	0.085	0.085	0.08502	0.085	0.08502	0.085	0.08502	0.085	0.08502	0.08502	0.08502	0.08502	0.085	0.085	0.085022	7.81E-07	7.80718E-07	1142.138	21.28
30.06.2014	0.08317	0.08312	0.08311	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.0831	0.083098	0.003567	0.00356617	1213.401	4.74
31.07.2014	0.08331	0.08325	0.08324	0.0832	0.08322	0.08322	0.0832	0.08322	0.0832	0.0832	0.08322	0.0832	0.08322	0.0832	0.08322	0.0832	0.08322	0.08322	0.08322	0.08322	0.0832	0.0832	0.083219	0.004376	0.004375857	1114.804	2.00
29.08.2014	0.08703	0.08693	0.08691	0.0869	0.08689	0.08689	0.0869	0.08689	0.0869	0.0869	0.08689	0.0869	0.08689	0.0869	0.08689	0.0869	0.08689	0.08689	0.08689	0.08689	0.0869	0.0869	0.086885	0.006465	0.006464206	1087.194	0.69
30.09.2014	0.09429	0.09428	0.09428	0.0943	0.09428	0.09428	0.0943	0.09428	0.0943	0.0943	0.09428	0.0943	0.09428	0.0943	0.09428	0.0943	0.09428	0.09428	0.09428	0.09428	0.0943	0.0943	0.094284	40.8946	43.04017796	6.43E+08	1.15

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2014	0.08219	0.08209	0.08207	0.0821	0.08205	0.08205	0.082	0.08205	0.082	0.082	0.08205	0.082	0.08205	0.082	0.08204	0.082	0.08204	0.08204	0.08204	0.08204	0.082	0.082	0.082043	0.00732	0.007319711	1210.854	1.39
28.11.2014	0.07446	0.07444	0.07443	0.0744	0.07443	0.07443	0.0744	0.07443	0.0744	0.0744	0.07443	0.0744	0.07443	0.0744	0.07443	0.0744	0.07443	0.07443	0.07443	0.07443	0.0744	0.0744	0.07443	0.001505	0.001505338	1421.238	0.99
31.12.2014	0.10589	0.08645	0.08159	0.0792	0.07835	0.07795	0.0777	0.07754	0.0774	0.0773	0.07727	0.0772	0.07717	0.0771	0.07711	0.0771	0.07706	0.07704	0.07702	0.077	0.077	0.077	0.076733	1.630294	1.622707695	1339.021	0.42
30.01.2015	0.06839	0.06836	0.06835	0.0684	0.06835	0.06835	0.0683	0.06835	0.0683	0.0683	0.06835	0.0683	0.06835	0.0683	0.06835	0.0683	0.06835	0.06835	0.06835	0.06835	0.0683	0.0683	0.068347	0.003058	0.003056979	1561.793	1.20
27.02.2015	0.08932	0.0834	0.08192	0.0812	0.08094	0.08081	0.0807	0.08069	0.0807	0.0806	0.08061	0.0806	0.08058	0.0806	0.08056	0.0805	0.08054	0.08054	0.08053	0.08053	0.0805	0.0805	0.080444	0.45141	0.450725617	1220.209	2.36
31.03.2015	0.1064	0.08867	0.08424	0.082	0.08128	0.08091	0.0807	0.08054	0.0804	0.0804	0.0803	0.0802	0.08021	0.0802	0.08015	0.0801	0.0801	0.08008	0.08007	0.08005	0.08	0.08	0.079804	1672702	208236.0639	8.49E+08	5.39
30.04.2015	0.12863	0.10194	0.09527	0.0919	0.09083	0.09027	0.0899	0.08972	0.0896	0.0894	0.08934	0.0893	0.08921	0.0892	0.08912	0.0891	0.08905	0.08902	0.089	0.08897	0.089	0.0889	0.088603	0.806203	0.79832489	481.0768	10.73
29.05.2015	0.14951	0.10834	0.09805	0.0929	0.09118	0.09033	0.0898	0.08947	0.0892	0.089	0.0889	0.0888	0.08869	0.0886	0.08854	0.0885	0.08844	0.0884	0.08836	0.08832	0.0883	0.0883	0.087752	2.565638	2.531902826	990.4849	0.87
30.06.2015	0.08921	0.08911	0.08909	0.0891	0.08907	0.08907	0.0891	0.08907	0.0891	0.0891	0.08907	0.0891	0.08907	0.0891	0.08907	0.0891	0.08907	0.08907	0.08906	0.08906	0.0891	0.0891	0.089064	0.005995	0.005994412	964.0883	15.47
31.07.2015	0.13634	0.10673	0.09933	0.0956	0.09439	0.09378	0.0934	0.09316	0.093	0.0929	0.09275	0.0927	0.0926	0.0925	0.09249	0.0925	0.09242	0.09239	0.09236	0.09234	0.0923	0.0923	0.091925	0.862091	0.854328578	463.7687	0.29
31.08.2015	0.15033	0.11512	0.10631	0.1019	0.10045	0.09971	0.0993	0.09898	0.0988	0.0986	0.09849	0.0984	0.09831	0.0982	0.09819	0.0981	0.0981	0.09806	0.09803	0.098	0.098	0.098	0.097511	0.742341	0.545273699	292.5611	1.59
30.09.2015	0.10542	0.10541	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.1054	0.105399	0.000259	0.00025848	309.1151	13.51
30.10.2015	0.14379	0.11068	0.1024	0.0983	0.09689	0.0962	0.0958	0.09551	0.0953	0.0952	0.09505	0.095	0.09488	0.0948	0.09476	0.0947	0.09468	0.09464	0.09461	0.09459	0.0946	0.0945	0.094126	0.947687	0.937708439	455.5077	0.51
30.11.2015	0.15386	0.11623	0.10682	0.1021	0.10054	0.09976	0.0993	0.09898	0.0988	0.0986	0.09845	0.0983	0.09826	0.0982	0.09813	0.0981	0.09804	0.098	0.09796	0.09793	0.0979	0.0979	0.097408	0.977118	0.966297088	413.0814	1.13
31.12.2015	0.1211	0.1088	0.10572	0.1042	0.10367	0.10342	0.1033	0.10316	0.1031	0.103	0.10299	0.103	0.10293	0.1029	0.10288	0.1029	0.10285	0.10284	0.10283	0.10282	0.1028	0.1028	0.102648	0.264306	0.263229394	343.1677	0.66
29.01.2016	0.10573	0.10379	0.10331	0.1031	0.10299	0.10295	0.1029	0.10291	0.1029	0.1029	0.10288	0.1029	0.10287	0.1029	0.10286	0.1029	0.10286	0.10286	0.10286	0.10285	0.1029	0.1029	0.102828	2056366	2078629.241	1.71E+10	0.20
29.02.2016	0.10041	0.10035	0.10034	0.1003	0.10033	0.10032	0.1003	0.10032	0.1003	0.1003	0.10032	0.1003	0.10032	0.1003	0.10032	0.1003	0.10032	0.10032	0.10032	0.10032	0.1003	0.1003	0.100321	0.001461	0.001460477	402.5584	7.77
31.03.2016	0.09438	0.09438	0.09438	0.0944	0.09438	0.09438	0.0944	0.09438	0.0944	0.0944	0.09438	0.0944	0.09438	0.0944	0.09438	0.0944	0.09438	0.09438	0.09438	0.09438	0.0944	0.0944	0.094378	0.000143	0.000143194	489.928	18.18
29.04.2016	0.0876	0.08759	0.08759	0.0876	0.08759	0.08759	0.0876	0.08759	0.0876	0.0876	0.08759	0.0876	0.08759	0.0876	0.08759	0.0876	0.08759	0.08759	0.08759	0.08759	0.0876	0.0876	0.087591	0.000516	0.000516154	1134.171	17.41
31.05.2016	0.09466	0.09463	0.09463	0.0946	0.09463	0.09462	0.0946	0.09462	0.0946	0.0946	0.09462	0.0946	0.09462	0.0946	0.09462	0.0946	0.09462	0.09462	0.09462	0.09462	0.0946	0.0946	0.094623	0.000694	0.000694183	487.262	13.79
30.06.2016	0.08791	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.0879	0.000624	0.000624273	1126.551	2.18
29.07.2016	0.0925	0.09249	0.09249	0.0925	0.09249	0.09249	0.0925	0.09249	0.0925	0.0925	0.09249	0.0925	0.09249	0.0925	0.09249	0.0925	0.09249	0.09249	0.09249	0.09249	0.0925	0.0925	0.092493	4.51E-05	4.50795E-05	516.3197	2.22
31.08.2016	0.09248	0.09248	0.09248	0.0925	0.09248	0.09248	0.0925	0.09248	0.0925	0.0925	0.09248	0.0925	0.09248	0.0925	0.09248	0.0925	0.09248	0.09248	0.09248	0.09248	0.0925	0.0925	0.092482	1.84E-06	1.83584E-06	536.1689	4.54
30.09.2016	0.09001	0.09001	0.09001	0.09	0.09001	0.09001	0.09	0.09001	0.09	0.09	0.09001	0.09	0.09001	0.09	0.09001	0.09	0.09001	0.09001	0.09001	0.09001	0.09	0.09	0.090005	1.49E-06	1.49402E-06	567.0572	10.88

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2016	0.09447	0.09447	0.09447	0.0945	0.09447	0.09447	0.0945	0.09447	0.0945	0.0945	0.09447	0.0945	0.09447	0.0945	0.09447	0.0945	0.09447	0.09447	0.09447	0.09447	0.0945	0.0945	0.094466	0.000179	0.000179028	505.0151	4.21
30.11.2016	0.10264	0.10264	0.10264	0.1026	0.10264	0.10264	0.1026	0.10264	0.1026	0.1026	0.10264	0.1026	0.10264	0.1026	0.10264	0.1026	0.10264	0.10264	0.10264	0.10264	0.1026	0.1026	0.102636	6.54E-07	6.54084E-07	400.0387	32.23
30.12.2016	0.10662	0.10662	0.10661	0.1066	0.10661	0.10661	0.1066	0.10661	0.1066	0.1066	0.10661	0.1066	0.10661	0.1066	0.10661	0.1066	0.10661	0.10661	0.10661	0.10661	0.1066	0.1066	0.106612	2393.642	2725.467915	6.99E+09	6.59
31.01.2017	0.12086	0.10928	0.10639	0.1049	0.10446	0.10422	0.1041	0.10398	0.1039	0.1039	0.10382	0.1038	0.10376	0.1037	0.10372	0.1037	0.10369	0.10368	0.10367	0.10366	0.1036	0.1036	0.103497	0.271993	0.271279905	375.5361	2.46
28.02.2017	0.10304	0.10303	0.10303	0.103	0.10303	0.10303	0.103	0.10302	0.103	0.103	0.10302	0.103	0.10302	0.103	0.10302	0.103	0.10302	0.10302	0.10302	0.10302	0.103	0.103	0.103025	0.000194	0.000193775	384.3203	12.02
31.03.2017	0.16538	0.12365	0.11322	0.108	0.10627	0.1054	0.1049	0.10453	0.1043	0.1041	0.10395	0.1038	0.10374	0.1037	0.10359	0.1035	0.10349	0.10344	0.10341	0.10337	0.1033	0.1033	0.102792	1.006103	0.997181631	384.0813	6.33
28.04.2017	0.19206	0.12996	0.11443	0.1067	0.10408	0.10279	0.102	0.10149	0.1011	0.1008	0.10063	0.1005	0.10032	0.1002	0.1001	0.1	0.09994	0.09988	0.09982	0.09977	0.0997	0.0997	0.098907	1.703575	1.667327193	434.2162	3.79
31.05.2017	0.09989	0.09989	0.09988	0.0999	0.09988	0.09988	0.0999	0.09988	0.0999	0.0999	0.09988	0.0999	0.09988	0.0999	0.09988	0.0999	0.09988	0.09988	0.09988	0.09988	0.0999	0.0999	0.099883	0.000132	0.000131542	427.0322	15.57
30.06.2017	0.18761	0.12791	0.11298	0.1055	0.10303	0.10179	0.101	0.10055	0.1002	0.0999	0.09972	0.0996	0.09942	0.0993	0.09921	0.0991	0.09905	0.09899	0.09894	0.09889	0.0988	0.0988	0.09806	1.674548	1.627846324	442.5425	6.92
31.07.2017	0.10196	0.1082	0.11224	0.1123	0.10972	0.10732	0.1055	0.10416	0.1032	0.1024	0.10181	0.1013	0.10095	0.1006	0.10035	0.1001	0.09991	0.09973	0.09957	0.09943	0.0993	0.0992	0.097057	8.33E-05	0.053268738	2.492801	0.23
31.08.2017	0.10135	0.10135	0.10135	0.1013	0.10135	0.10135	0.1013	0.10135	0.1013	0.1013	0.10135	0.1013	0.10135	0.1013	0.10135	0.1013	0.10135	0.10135	0.10135	0.10135	0.1013	0.1013	0.101345	0.000153	0.000153356	431.9374	11.03
29.09.2017	0.21317	0.13904	0.12051	0.1112	0.10816	0.10661	0.1057	0.10507	0.1046	0.1043	0.10404	0.1038	0.10366	0.1035	0.1034	0.1033	0.10321	0.10314	0.10307	0.10301	0.103	0.1029	0.101979	1.945145	1.897039898	414.6404	7.36
31.10.2017	0.11637	0.11861	0.12069	0.122	0.1214	0.1201	0.1186	0.11726	0.116	0.115	0.11412	0.1134	0.11275	0.1122	0.11175	0.1114	0.11101	0.1107	0.11043	0.11019	0.11	0.1098	0.106119	0.008809	0.038162008	1.280658	0.41
30.11.2017	0.11918	0.12226	0.12585	0.1302	0.13196	0.13212	0.1313	0.13002	0.1284	0.1268	0.12512	0.1235	0.12205	0.1207	0.11943	0.1183	0.11724	0.1163	0.11544	0.11466	0.114	0.1133	0.100636	0.016764	0.077255801	0.738521	2.18
29.12.2017	0.11631	0.12276	0.12843	0.1314	0.12952	0.1262	0.1228	0.11986	0.1174	0.1153	0.11363	0.1122	0.11108	0.1101	0.10928	0.1086	0.10795	0.10741	0.10693	0.10651	0.1061	0.1058	0.099277	0.012736	0.086738901	1.528948	7.84
31.01.2018	0.12907	0.11815	0.11514	0.1136	0.11312	0.11287	0.1127	0.11262	0.1125	0.1125	0.11245	0.1124	0.11239	0.1124	0.11235	0.1123	0.11232	0.11231	0.11229	0.11228	0.1123	0.1123	0.112117	0.003253	0.076461378	52.81174	17.22
28.02.2018	0.12112	0.12233	0.12348	0.1241	0.12351	0.12232	0.1209	0.11952	0.1182	0.117	0.11595	0.115	0.1142	0.1135	0.11287	0.1123	0.11184	0.11141	0.11104	0.1107	0.1104	0.1101	0.104872	0.015479	0.03580567	0.977372	0.61
30.03.2018	0.11463	0.12068	0.12717	0.1336	0.13503	0.13388	0.1316	0.12898	0.1263	0.1239	0.12167	0.1197	0.11799	0.1165	0.11517	0.114	0.113	0.1121	0.11131	0.1106	0.11	0.1094	0.098391	0.01257	0.102208601	1.044082	5.65
30.04.2018	0.11552	0.11742	0.11981	0.1232	0.12518	0.12617	0.1265	0.12626	0.1257	0.125	0.12414	0.1232	0.12227	0.1213	0.1204	0.1195	0.11868	0.11788	0.11713	0.11643	0.1158	0.1152	0.101812	0.01266	0.061134549	0.538857	15.19
31.05.2018	0.14744	0.15307	0.15863	0.1628	0.16187	0.15869	0.1547	0.15075	0.147	0.1437	0.14084	0.1383	0.13617	0.1343	0.13268	0.1313	0.13003	0.12894	0.12797	0.12711	0.1263	0.1256	0.112377	0.03153	0.114445068	1.100316	1.77
29.06.2018	0.14403	0.15642	0.16808	0.1766	0.17604	0.17242	0.1682	0.1643	0.161	0.1582	0.15585	0.1539	0.15234	0.151	0.14984	0.1489	0.148	0.14725	0.14659	0.146	0.1455	0.145	0.135986	2.11E-06	0.137550285	1.526384	8.88
31.07.2018	0.13501	0.14227	0.15174	0.1664	0.17636	0.18284	0.1867	0.18855	0.189	0.1883	0.18688	0.1849	0.18267	0.1802	0.17757	0.1749	0.17229	0.16971	0.1672	0.16478	0.1625	0.1603	0.105855	0.025216	0.237503959	0.457189	12.22
31.08.2018	0.19532	0.20411	0.21551	0.2328	0.24401	0.25047	0.2532	0.25311	0.2508	0.2469	0.24184	0.2359	0.2294	0.2225	0.21548	0.2084	0.20129	0.19432	0.18751	0.18091	0.1745	0.1684	5.21E-07	0.19055	0.503345523	0.376382	4.23
28.09.2018	0.23742	0.23635	0.23459	0.2306	0.22606	0.22114	0.2159	0.21052	0.205	0.1994	0.19378	0.1882	0.18267	0.1772	0.1719	0.1667	0.16163	0.15671	0.15194	0.14733	0.1429	0.1386	1.89E-07	0.237923	0.192849211	0.261438	4.50

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1	(Zthe-Zreal)^2
31.10.2018	0.20052	0.20912	0.21738	0.2228	0.22	0.2137	0.2063	0.19893	0.1921	0.1861	0.18081	0.1762	0.1723	0.1689	0.16593	0.1634	0.16109	0.1591	0.15733	0.15575	0.1543	0.1531	0.12881	0.066259	0.196576385	1.083306	1.60
30.11.2018	0.17544	0.18404	0.19029	0.1903	0.18442	0.17775	0.1719	0.16713	0.1634	0.1603	0.15794	0.156	0.15436	0.153	0.15187	0.1509	0.15003	0.14929	0.14863	0.14804	0.1475	0.147	0.138092	0.03117	0.125863657	1.753628	0.92
31.12.2018	0.20209	0.19999	0.1968	0.1905	0.18449	0.17903	0.1741	0.16982	0.166	0.1627	0.15985	0.1573	0.15515	0.1532	0.15154	0.1501	0.14874	0.14757	0.14652	0.14558	0.1447	0.144	0.129285	0.073832	0.042996279	0.794224	0.22
																											1.447,8

area refers that since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yields which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period. Therefore, estimated values in the area should not be taken into consideration.

Appendix E. DNS Estimation Results of OLS Methodology

Table E.1 DNS Estimation Results of OLS Methodology

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
28.02.2005	0,16879	0,17177	0,17455	0,1758	0,17373	0,17	0,1656	0,1612	0,157	0,1531	0,1496	0,1465	0,14375	0,1413	0,13919	0,1373	0,13563	0,13414	0,13282	0,13163	0,1306	0,1296	0,111056	0,055841	0,1105676	**0,897**
31.03.2005	0,15051	0,15836	0,16717	0,177	0,1803	0,17991	0,1776	0,17442	0,1709	0,1675	0,16423	0,1612	0,15854	0,1561	0,15396	0,152	0,15033	0,1488	0,14744	0,14621	0,1451	0,1441	0,124869	0,02101	0,1517167	**0,897**
29.04.2005	0,13627	0,14853	0,16269	0,1798	0,18729	0,1892	0,1881	0,18537	0,182	0,1784	0,17492	0,1717	0,16865	0,1659	0,1635	0,1613	0,15938	0,15764	0,15607	0,15467	0,1534	0,1523	0,130159	-0,00102	0,1994273	**0,897**
31.05.2005	0,13896	0,14767	0,15738	0,168	0,17128	0,17042	0,1675	0,16354	0,1593	0,1552	0,15134	0,1478	0,1446	0,1417	0,13919	0,1369	0,13491	0,13311	0,1315	0,13006	0,1288	0,1276	0,104931	0,028877	0,1744796	**0,897**
30.06.2005	0,14596	0,15094	0,15646	0,1624	0,16398	0,16322	0,1613	0,15879	0,1562	0,1536	0,15124	0,1491	0,14711	0,1454	0,14382	0,1424	0,14121	0,14011	0,13913	0,13825	0,1375	0,1367	0,122958	0,020046	0,1037077	**0,897**
29.07.2005	0,13826	0,1453	0,1533	0,1626	0,16614	0,16646	0,165	0,1628	0,1602	0,1576	0,15512	0,1528	0,15071	0,1488	0,14714	0,1456	0,1443	0,1431	0,14203	0,14106	0,1402	0,1394	0,124282	0,009861	0,1259826	**0,897**
31.08.2005	0,13909	0,14624	0,15437	0,1638	0,16745	0,16778	0,1664	0,16407	0,1615	0,1588	0,15628	0,1539	0,15181	0,1499	0,14819	0,1467	0,1453	0,14409	0,143	0,14202	0,1411	0,1403	0,124986	0,009911	0,1279643	**0,897**
30.09.2005	0,14148	0,1455	0,14975	0,1536	0,15371	0,1518	0,149	0,14578	0,1426	0,1396	0,13687	0,1344	0,13219	0,1302	0,12849	0,127	0,12559	0,12438	0,12329	0,12232	0,1214	0,1206	0,105421	0,033616	0,1030706	**0,897**
31.10.2005	0,14583	0,14667	0,14713	0,1461	0,1435	0,14033	0,137	0,13387	0,131	0,1283	0,12601	0,124	0,12217	0,1206	0,11921	0,118	0,11691	0,11595	0,1151	0,11433	0,1136	0,113	0,101125	0,044077	0,06273148	**0,897**
30.11.2005	0,13843	0,14041	0,14206	0,1421	0,1395	0,13577	0,1316	0,12757	0,1237	0,1203	0,11715	0,1144	0,11197	0,1098	0,10795	0,1063	0,10482	0,10352	0,10235	0,10131	0,1004	0,0995	0,083273	0,053844	0,09205643	**0,897**
30.12.2005	0,14455	0,14488	0,14472	0,1428	0,13981	0,13642	0,133	0,12985	0,127	0,1244	0,12211	0,1201	0,11838	0,1169	0,11552	0,1143	0,1133	0,11238	0,11156	0,11083	0,1102	0,1096	0,098142	0,046074	0,05651219	**0,897**
31.01.2006	0,13911	0,1395	0,13966	0,1389	0,13744	0,13564	0,1338	0,13204	0,1304	0,129	0,12769	0,1266	0,12557	0,1247	0,12394	0,1233	0,12268	0,12215	0,12168	0,12127	0,1209	0,1205	0,114012	0,024801	0,03385387	**0,897**
28.02.2006	0,13759	0,13722	0,13652	0,1348	0,13292	0,1311	0,1294	0,12792	0,1266	0,1254	0,12443	0,1236	0,1228	0,1221	0,12156	0,1211	0,12062	0,12022	0,11987	0,11956	0,1193	0,119	0,11416	0,023578	0,02006247	**0,897**
31.03.2006	0,13814	0,13818	0,13813	0,1378	0,13729	0,13673	0,1362	0,13565	0,1352	0,1348	0,13439	0,1341	0,13378	0,1335	0,13332	0,1331	0,13296	0,13281	0,13268	0,13256	0,1324	0,1324	0,130499	0,0076	0,00903128	**0,897**
28.04.2006	0,13164	0,13314	0,13485	0,1368	0,13755	0,1376	0,1373	0,13677	0,1362	0,1356	0,13507	0,1346	0,1341	0,1337	0,13332	0,133	0,1327	0,13244	0,1322	0,13199	0,1318	0,1316	0,12832	0,002441	0,02728023	**0,897**
31.05.2006	0,13836	0,14504	0,15325	0,1647	0,17172	0,17589	0,1783	0,17967	0,1804	0,1807	0,18075	0,1807	0,18056	0,1804	0,18023	0,1801	0,17989	0,17973	0,17959	0,17945	0,1793	0,1792	0,177011	-0,04241	0,06228649	**0,897**
30.06.2006	0,1862	0,19576	0,20622	0,2171	0,21947	0,21729	0,2128	0,20741	0,2018	0,1964	0,19133	0,1867	0,18264	0,179	0,17573	0,1728	0,17028	0,16799	0,16594	0,1641	0,1624	0,1609	0,132186	0,048304	0,2099379	**0,897**
31.07.2006	0,18595	0,1914	0,19707	0,202	0,2016	0,19849	0,1941	0,18937	0,1847	0,1802	0,17617	0,1725	0,1693	0,1664	0,16389	0,1616	0,15964	0,15787	0,15628	0,15485	0,1536	0,1524	0,130168	0,05246	0,1472588	**0,897**
31.08.2006	0,17881	0,18527	0,19222	0,199	0,19988	0,19761	0,1938	0,18945	0,185	0,1808	0,17687	0,1733	0,17019	0,1674	0,1649	0,1627	0,16073	0,15898	0,15742	0,15601	0,1548	0,1536	0,131689	0,04324	0,1535747	**0,897**
29.09.2006	0,18231	0,18983	0,19856	0,2093	0,21415	0,21564	0,2153	0,21388	0,2121	0,2101	0,20816	0,2063	0,20464	0,2031	0,20173	0,2005	0,19939	0,1984	0,19751	0,19672	0,196	0,1953	0,182786	-0,00484	0,1176298	**0,897**

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
31.10.2006	0,17217	0,18122	0,19169	0,2044	0,21003	0,21157	0,2109	0,20898	0,2066	0,204	0,20154	0,1992	0,19704	0,1951	0,19334	0,1918	0,19038	0,18912	0,188	0,18699	0,1861	0,1852	0,169341	-0,00242	0,1452832	**0,897**
30.11.2006	0,17321	0,18226	0,19246	0,204	0,20799	0,20778	0,2054	0,2019	0,1981	0,1943	0,19068	0,1874	0,18437	0,1817	0,17929	0,1772	0,17525	0,17355	0,17203	0,17067	0,1694	0,1683	0,146915	0,020969	0,1712891	**0,897**
29.12.2006	0,18968	0,194	0,19878	0,2039	0,20528	0,20461	0,2029	0,20074	0,1985	0,1962	0,19415	0,1923	0,19055	0,189	0,18768	0,1865	0,1854	0,18445	0,18359	0,18282	0,1821	0,1815	0,169497	0,017613	0,09023453	**0,897**
31.01.2007	0,17413	0,17965	0,18607	0,194	0,19753	0,19864	0,1984	0,19736	0,196	0,1946	0,19317	0,1918	0,1906	0,1895	0,18847	0,1876	0,18676	0,18603	0,18538	0,1848	0,1843	0,1838	0,1746	-0,00367	0,08625384	**0,897**
28.02.2007	0,19015	0,19313	0,19635	0,1996	0,20017	0,19931	0,1977	0,19588	0,194	0,1922	0,19048	0,189	0,18759	0,1864	0,18529	0,1843	0,18348	0,18272	0,18204	0,18143	0,1809	0,1804	0,170856	0,017514	0,06806198	**0,897**
30.03.2007	0,17321	0,1797	0,18704	0,1955	0,1985	0,19855	0,197	0,19471	0,1921	0,1896	0,1871	0,1848	0,18279	0,1809	0,1793	0,1778	0,17653	0,17536	0,17432	0,17338	0,1725	0,1718	0,15705	0,012352	0,1198282	**0,897**
30.04.2007	0,17644	0,18088	0,18578	0,191	0,19244	0,19174	0,19	0,18774	0,1854	0,1831	0,18096	0,179	0,17725	0,1757	0,17429	0,1731	0,17195	0,17097	0,17009	0,1693	0,1686	0,1679	0,155579	0,018224	0,09278513	**0,897**
31.05.2007	0,16995	0,17478	0,18011	0,1858	0,18718	0,1863	0,1843	0,18172	0,1791	0,1765	0,17407	0,1719	0,16991	0,1682	0,16659	0,1652	0,16397	0,16287	0,16188	0,161	0,1602	0,1595	0,14564	0,021429	0,1028689	**0,897**
29.06.2007	0,16074	0,16729	0,17457	0,1825	0,18478	0,18399	0,1816	0,17855	0,1753	0,1721	0,16905	0,1663	0,16383	0,1616	0,15965	0,1579	0,15634	0,15495	0,1537	0,15259	0,1516	0,1507	0,133176	0,023682	0,1334033	**0,897**
31.07.2007	0,1761	0,17724	0,17835	0,179	0,17846	0,17729	0,1759	0,17439	0,173	0,1717	0,1705	0,1694	0,16852	0,1677	0,16697	0,1663	0,16576	0,16525	0,1648	0,1644	0,164	0,1637	0,1574	0,017981	0,03863808	**0,897**
31.08.2007	0,17151	0,1741	0,1771	0,1807	0,18233	0,18276	0,1825	0,18198	0,1813	0,1805	0,17981	0,1791	0,1785	0,1779	0,17743	0,177	0,17657	0,1762	0,17588	0,17558	0,1753	0,1751	0,170464	-0,00046	0,04191487	**0,897**
28.09.2007	0,16641	0,16842	0,17051	0,1723	0,17219	0,17104	0,1694	0,16767	0,1659	0,1643	0,16279	0,1614	0,16025	0,1592	0,15825	0,1574	0,15668	0,15603	0,15544	0,15492	0,1544	0,154	0,145796	0,019384	0,05439559	**0,897**
31.10.2007	0,15727	0,1598	0,16251	0,1651	0,16541	0,16446	0,1629	0,16115	0,1594	0,1577	0,1561	0,1547	0,15342	0,1523	0,1513	0,1504	0,14963	0,14893	0,14831	0,14774	0,1472	0,1468	0,138013	0,017736	0,06100657	**0,897**
30.11.2007	0,15858	0,16174	0,16532	0,1694	0,17092	0,17095	0,1702	0,16909	0,1678	0,1666	0,16539	0,1643	0,16329	0,1624	0,16159	0,1609	0,16025	0,15968	0,15917	0,15871	0,1583	0,1579	0,150764	0,005952	0,05838598	**0,897**
31.12.2007	0,16223	0,1638	0,16559	0,1677	0,16851	0,16861	0,1683	0,16786	0,1673	0,1668	0,16621	0,1657	0,16527	0,1649	0,1645	0,1642	0,16388	0,16362	0,16339	0,16318	0,163	0,1628	0,159555	0,001761	0,0276084	**0,897**
31.01.2008	0,16419	0,16384	0,16358	0,1637	0,16433	0,16517	0,1661	0,16696	0,1678	0,1685	0,16918	0,1698	0,17028	0,1707	0,17113	0,1715	0,17179	0,17207	0,17231	0,17253	0,1727	0,1729	0,176339	-0,01191	-0,0188701	**0,897**
29.02.2008	0,16536	0,16607	0,16707	0,1689	0,17045	0,17177	0,1729	0,17382	0,1746	0,1753	0,17583	0,1763	0,17672	0,1771	0,17738	0,1776	0,17788	0,17808	0,17827	0,17843	0,1786	0,1787	0,181235	-0,01624	-0,006438	**0,897**
31.03.2008	0,17422	0,17671	0,17987	0,1846	0,18782	0,19004	0,1916	0,1927	0,1935	0,1941	0,19455	0,1949	0,19517	0,1954	0,19557	0,1957	0,19585	0,19596	0,19606	0,19614	0,1962	0,1963	0,197561	-0,02471	0,01328727	**0,897**
30.04.2008	0,18331	0,1856	0,1883	0,1917	0,19348	0,1942	0,1943	0,19415	0,1938	0,1934	0,19298	0,1926	0,19217	0,1918	0,1915	0,1912	0,19094	0,19071	0,1905	0,19031	0,1901	0,19	0,186978	-0,00499	0,03195156	**0,897**
30.05.2008	0,18237	0,18585	0,19023	0,1966	0,20073	0,20345	0,2052	0,20642	0,2072	0,2078	0,20814	0,2084	0,20859	0,2087	0,20884	0,2089	0,20899	0,20904	0,20909	0,20913	0,2092	0,2092	0,209712	-0,02929	0,02461095	**0,897**
30.06.2008	0,18153	0,18977	0,19969	0,213	0,22037	0,22422	0,226	0,22646	0,2263	0,2257	0,22498	0,2242	0,22342	0,2227	0,22198	0,2213	0,22077	0,22025	0,21978	0,21935	0,219	0,2186	0,211826	-0,03499	0,09602547	**0,897**
31.07.2008	0,18641	0,18781	0,18934	0,1909	0,19125	0,19091	0,1902	0,18944	0,1886	0,1878	0,18705	0,1864	0,18576	0,1852	0,18474	0,1843	0,18393	0,18359	0,18329	0,18302	0,1828	0,1826	0,178298	0,00728	0,03092863	**0,897**
29.08.2008	0,18739	0,1884	0,18947	0,1904	0,19047	0,18999	0,1893	0,18848	0,1877	0,1869	0,18624	0,1856	0,18507	0,1846	0,18414	0,1838	0,18341	0,18311	0,18283	0,18259	0,1824	0,1822	0,178345	0,008428	0,02591089	**0,897**

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
29.09.2008	0,18768	0,18972	0,19211	0,1951	0,19654	0,19707	0,1971	0,19682	0,1964	0,196	0,19553	0,1951	0,1947	0,1943	0,194	0,1937	0,19344	0,1932	0,19299	0,1928	0,1926	0,1925	0,189441	-0,00294	0,03013574	**0,897**
31.10.2008	0,20878	0,21891	0,23102	0,2469	0,25542	0,25952	0,261	0,26106	0,2603	0,2592	0,25787	0,2565	0,25528	0,2541	0,25301	0,252	0,25113	0,25033	0,2496	0,24895	0,2484	0,2478	0,237456	-0,03447	0,127601	**0,897**
28.11.2008	0,18153	0,18637	0,19225	0,2003	0,20489	0,20745	0,2088	0,20933	0,2095	0,2094	0,20911	0,2088	0,2085	0,2082	0,2079	0,2076	0,20737	0,20714	0,20693	0,20674	0,2066	0,2064	0,203365	-0,02458	0,05197057	**0,897**
31.12.2008	0,1706	0,16884	0,16703	0,1655	0,16571	0,1668	0,1683	0,1699	0,1715	0,173	0,17435	0,1756	0,17665	0,1776	0,17846	0,1792	0,17989	0,18048	0,18101	0,18149	0,1819	0,1823	0,189754	-0,01808	-0,0487773	**0,897**
30.01.2009	0,12083	0,1256	0,13187	0,1418	0,14904	0,15448	0,1586	0,16179	0,1643	0,1663	0,16786	0,1692	0,17026	0,1712	0,17196	0,1726	0,17321	0,17372	0,17417	0,17457	0,1749	0,1753	0,181381	-0,06315	0,0082035	**0,897**
27.02.2009	0,12036	0,12566	0,13281	0,1447	0,15401	0,16137	0,1672	0,17197	0,1758	0,179	0,18158	0,1838	0,18562	0,1872	0,18855	0,1897	0,19075	0,19165	0,19245	0,19316	0,1938	0,1944	0,205351	-0,08782	-0,0106191	**0,897**
31.03.2009	0,11391	0,1183	0,12421	0,134	0,14168	0,14772	0,1525	0,1564	0,1595	0,1621	0,16423	0,166	0,16752	0,1688	0,1699	0,1709	0,17169	0,17242	0,17307	0,17365	0,1742	0,1746	0,183544	-0,07198	-0,0079413	**0,897**
30.04.2009	0,10056	0,10307	0,10682	0,114	0,12053	0,12628	0,1313	0,13554	0,1392	0,1423	0,14497	0,1473	0,14922	0,1509	0,15239	0,1537	0,1548	0,1558	0,15669	0,15749	0,1582	0,1588	0,17113	-0,07182	-0,0384538	**0,897**
29.05.2009	0,10497	0,10798	0,1121	0,1191	0,12477	0,12933	0,133	0,13607	0,1386	0,1406	0,14236	0,1438	0,14504	0,1461	0,14701	0,1478	0,14849	0,1491	0,14964	0,15012	0,1506	0,1509	0,158378	-0,055	-0,0116848	**0,897**
30.06.2009	0,09221	0,09591	0,10102	0,1098	0,11698	0,12283	0,1276	0,13155	0,1348	0,1375	0,13978	0,1417	0,14333	0,1447	0,14593	0,147	0,14789	0,1487	0,14942	0,15006	0,1506	0,1511	0,161018	-0,07076	-0,017794	**0,897**
31.07.2009	0,08521	0,08792	0,09167	0,0981	0,1034	0,10771	0,1112	0,11416	0,1166	0,1186	0,12026	0,1217	0,12289	0,1239	0,12481	0,1256	0,12627	0,12687	0,12741	0,12788	0,1283	0,1287	0,136018	-0,05224	-0,013509	**0,897**
31.08.2009	0,07914	0,08144	0,08479	0,091	0,09647	0,10119	0,1052	0,10866	0,1116	0,114	0,11613	0,1179	0,11945	0,1208	0,12193	0,1229	0,12381	0,12459	0,12528	0,1259	0,1265	0,127	0,136506	-0,05854	-0,027181	**0,897**
30.09.2009	0,07395	0,07465	0,07618	0,0803	0,08503	0,08975	0,0942	0,09817	0,1017	0,1048	0,10752	0,1099	0,11192	0,1137	0,11526	0,1166	0,11783	0,11889	0,11985	0,1207	0,1215	0,1221	0,135346	-0,06162	-0,0568272	**0,897**
30.10.2009	0,07013	0,07271	0,07621	0,0821	0,08681	0,09056	0,0936	0,09605	0,0981	0,0997	0,1011	0,1023	0,10325	0,1041	0,10481	0,1054	0,10599	0,10647	0,1069	0,10728	0,1076	0,1079	0,113823	-0,04506	-0,0077751	**0,897**
26.11.2009	0,06958	0,07243	0,07624	0,0825	0,08742	0,09125	0,0943	0,09671	0,0987	0,1003	0,10161	0,1027	0,10366	0,1045	0,10514	0,1057	0,10625	0,1067	0,1071	0,10746	0,1078	0,1081	0,113588	-0,04552	-0,0039661	**0,897**
31.12.2009	0,07003	0,07244	0,07595	0,0824	0,08816	0,09311	0,0973	0,10092	0,104	0,1065	0,10874	0,1106	0,11222	0,1136	0,11482	0,1159	0,11679	0,1176	0,11833	0,11898	0,1196	0,1201	0,130081	-0,06127	-0,028489	**0,897**
29.01.2010	0,0702	0,07212	0,07494	0,0802	0,08498	0,0891	0,0926	0,09566	0,0982	0,1004	0,10228	0,1039	0,10525	0,1064	0,10745	0,1083	0,10913	0,10983	0,11045	0,111	0,1115	0,1119	0,120476	-0,05125	-0,0253438	**0,897**
26.02.2010	0,0668	0,07002	0,07435	0,0815	0,08708	0,09146	0,0949	0,09772	0,1	0,1018	0,10336	0,1046	0,10571	0,1066	0,10742	0,1081	0,1087	0,10922	0,10969	0,1101	0,1105	0,1108	0,117178	-0,05209	-0,0050713	**0,897**
31.03.2010	0,06558	0,06908	0,07371	0,0811	0,08671	0,09095	0,0942	0,09677	0,0988	0,1004	0,10176	0,1029	0,10377	0,1045	0,10521	0,1058	0,10628	0,10671	0,1071	0,10744	0,1077	0,108	0,113288	-0,04961	0,00239241	**0,897**
30.04.2010	0,07079	0,07383	0,07783	0,0842	0,08891	0,09246	0,0952	0,09728	0,0989	0,1003	0,10134	0,1022	0,10297	0,1036	0,10412	0,1046	0,10497	0,10532	0,10563	0,1059	0,1061	0,1064	0,110552	-0,04141	0,00385633	**0,897**
31.05.2010	0,0778	0,07946	0,08181	0,086	0,08953	0,0925	0,095	0,09706	0,0988	0,1003	0,10151	0,1026	0,10346	0,1042	0,1049	0,1055	0,10599	0,10644	0,10684	0,1072	0,1075	0,1078	0,11333	-0,03639	-0,0131479	**0,897**
30.06.2010	0,07538	0,07757	0,08041	0,0849	0,08807	0,09043	0,0922	0,09354	0,0946	0,0954	0,09604	0,0966	0,09701	0,0974	0,09769	0,098	0,09818	0,09838	0,09856	0,09872	0,0989	0,099	0,101388	-0,0272	0,00564626	**0,897**
30.07.2010	0,07451	0,07576	0,07744	0,0802	0,08231	0,08397	0,0853	0,08631	0,0871	0,0878	0,08839	0,0889	0,08925	0,0896	0,08988	0,0901	0,09034	0,09053	0,0907	0,09085	0,091	0,0911	0,093427	-0,01959	-0,0011908	**0,897**

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
31.08.2010	0,07311	0,07443	0,0762	0,0791	0,08143	0,08324	0,0847	0,08582	0,0868	0,0875	0,08816	0,0887	0,08914	0,0895	0,08985	0,0901	0,09038	0,0906	0,09079	0,09096	0,0911	0,0913	0,09391	-0,0215	-0,0022892	**0,897**
30.09.2010	0,0733	0,07421	0,07553	0,0779	0,08001	0,08179	0,0833	0,08458	0,0857	0,0866	0,08734	0,088	0,08857	0,0891	0,08948	0,0898	0,09017	0,09046	0,09071	0,09094	0,0911	0,0913	0,094823	-0,02199	-0,0094247	**0,897**
28.10.2010	0,07494	0,07454	0,07425	0,0744	0,07518	0,07618	0,0772	0,07829	0,0793	0,0801	0,08091	0,0816	0,08221	0,0827	0,08321	0,0836	0,08399	0,08431	0,0846	0,08486	0,0851	0,0853	0,089339	-0,01413	-0,0220999	**0,897**
30.11.2010	0,07076	0,07134	0,0723	0,0744	0,07644	0,07838	0,0801	0,08166	0,083	0,0842	0,08516	0,086	0,08678	0,0874	0,08799	0,0885	0,08892	0,08931	0,08965	0,08996	0,0902	0,0905	0,095244	-0,02475	-0,0179776	**0,897**
31.12.2010	0,06524	0,06514	0,06535	0,0667	0,0686	0,07073	0,0728	0,07477	0,0765	0,0781	0,07948	0,0807	0,08174	0,0827	0,08347	0,0842	0,08481	0,08537	0,08586	0,08631	0,0867	0,0871	0,093971	-0,02859	-0,0333782	**0,897**
31.01.2011	0,06609	0,06847	0,07167	0,0769	0,08106	0,08429	0,0868	0,0889	0,0906	0,0919	0,09305	0,094	0,09479	0,0955	0,09604	0,0965	0,09698	0,09737	0,09771	0,09802	0,0983	0,0985	0,103222	-0,03841	-0,003643	**0,897**
28.02.2011	0,07126	0,07413	0,07774	0,0831	0,08661	0,08898	0,0906	0,09169	0,0925	0,093	0,09341	0,0937	0,09392	0,0941	0,09424	0,0944	0,09445	0,09453	0,09459	0,09465	0,0947	0,0948	0,095626	-0,02596	0,01815145	**0,897**
31.03.2011	0,07892	0,08095	0,08349	0,0872	0,08962	0,09122	0,0923	0,09298	0,0935	0,0938	0,09402	0,0942	0,0943	0,0944	0,09446	0,0945	0,09456	0,09459	0,09462	0,09465	0,0947	0,0947	0,095052	-0,01726	0,01402971	**0,897**
29.04.2011	0,07639	0,0779	0,07988	0,083	0,08539	0,08716	0,0885	0,08956	0,0904	0,0911	0,0916	0,092	0,09241	0,0927	0,09298	0,0932	0,09341	0,09359	0,09374	0,09388	0,094	0,0941	0,096209	-0,02064	0,00181336	**0,897**
31.05.2011	0,0775	0,07976	0,0826	0,0868	0,0895	0,09132	0,0925	0,09336	0,0939	0,0943	0,0946	0,0948	0,09496	0,0951	0,09517	0,0952	0,0953	0,09535	0,0954	0,09543	0,0955	0,0955	0,096027	-0,01978	0,01502192	**0,897**
30.06.2011	0,07897	0,08133	0,08427	0,0885	0,09113	0,0928	0,0939	0,09452	0,0949	0,0952	0,09534	0,0954	0,09548	0,0955	0,09552	0,0955	0,09553	0,09552	0,09552	0,09551	0,0955	0,0955	0,095353	-0,01771	0,01903298	**0,897**
29.07.2011	0,07945	0,08119	0,08343	0,0869	0,08935	0,09113	0,0924	0,09342	0,0942	0,0947	0,0952	0,0956	0,09587	0,0961	0,09633	0,0965	0,09667	0,0968	0,09692	0,09703	0,0971	0,0972	0,09882	-0,02032	0,0058759	**0,897**
29.08.2011	0,07439	0,0752	0,07635	0,0784	0,08003	0,08142	0,0826	0,08354	0,0843	0,085	0,08559	0,0861	0,08648	0,0868	0,08714	0,0874	0,08763	0,08784	0,08802	0,08818	0,0883	0,0885	0,090967	-0,017	-0,0055	**0,897**
30.09.2011	0,07231	0,07418	0,07662	0,0805	0,08326	0,08535	0,0869	0,08812	0,0891	0,0898	0,09041	0,0909	0,0913	0,0916	0,09193	0,0922	0,09239	0,09258	0,09275	0,0929	0,093	0,0931	0,095407	-0,02411	0,00383735	**0,897**
31.10.2011	0,09802	0,0986	0,09923	0,0999	0,10006	0,09995	0,0997	0,09939	0,0991	0,0988	0,09847	0,0982	0,09797	0,0978	0,09757	0,0974	0,09725	0,09712	0,097	0,09689	0,0968	0,0967	0,095041	0,002639	0,01233301	**0,897**
30.11.2011	0,1003	0,10191	0,10372	0,1058	0,10648	0,10644	0,106	0,10541	0,1047	0,1041	0,10344	0,1029	0,10233	0,1019	0,10143	0,1011	0,10072	0,10042	0,10015	0,09991	0,0997	0,0995	0,095718	0,003641	0,03027628	**0,897**
30.12.2011	0,10654	0,10809	0,10971	0,1111	0,11109	0,11026	0,1091	0,10777	0,1065	0,1053	0,10414	0,1031	0,10225	0,1015	0,10076	0,1001	0,09958	0,09909	0,09865	0,09826	0,0979	0,0976	0,091438	0,014161	0,04102853	**0,897**
31.01.2012	0,09794	0,09734	0,09666	0,0958	0,09552	0,09546	0,0956	0,09572	0,0959	0,0961	0,09631	0,0965	0,09666	0,0968	0,09694	0,0971	0,09716	0,09725	0,09734	0,09742	0,0975	0,0975	0,098741	-0,00045	-0,0102755	**0,897**
29.02.2012	0,08716	0,08804	0,08915	0,0908	0,09181	0,0925	0,0929	0,09324	0,0934	0,0936	0,09367	0,0937	0,09378	0,0938	0,09384	0,0939	0,09387	0,09389	0,0939	0,09391	0,0939	0,0939	0,094038	-0,00738	0,00632057	**0,897**
30.03.2012	0,09798	0,09724	0,09637	0,0953	0,09471	0,09449	0,0945	0,09454	0,0947	0,0948	0,09495	0,0951	0,09523	0,0953	0,09546	0,0956	0,09565	0,09573	0,0958	0,09586	0,0959	0,096	0,096998	0,001415	-0,0105946	**0,897**
30.04.2012	0,09627	0,09599	0,09562	0,095	0,09458	0,09424	0,094	0,09377	0,0936	0,0935	0,09337	0,0933	0,0932	0,0931	0,09309	0,093	0,093	0,09297	0,09293	0,09291	0,0929	0,0929	0,092433	0,003991	-0,0001663	**0,897**
31.05.2012	0,1044	0,10283	0,10085	0,0979	0,09601	0,09473	0,0939	0,09327	0,0929	0,0926	0,09236	0,0922	0,09209	0,092	0,09193	0,0919	0,09182	0,09178	0,09175	0,09172	0,0917	0,0917	0,091231	0,014044	-0,0101506	**0,897**
29.06.2012	0,09139	0,0906	0,08965	0,0884	0,08766	0,08729	0,0871	0,08706	0,0871	0,0871	0,08719	0,0873	0,08733	0,0874	0,08746	0,0875	0,08757	0,08762	0,08767	0,08771	0,0877	0,0878	0,088402	0,003432	-0,0090796	**0,897**

Date/Maturity (year)	**0,08**	**0,25**	**0,5**	**1**	**1,5**	**2**	**2,5**	**3**	**3,5**	**4**	**4,5**	**5**	**5,5**	**6**	**6,5**	**7**	**7,5**	**8**	**8,5**	**9**	**9,5**	**10**	**Beta 1 (Level)**	**Beta 2 (Slope)**	**Beta 3 (Curvature)**	**Lambda 1**
31.07.2012	0,07692	0,07689	0,07694	0,0773	0,07771	0,0782	0,0787	0,07915	0,0796	0,0799	0,08025	0,0805	0,08077	0,081	0,08118	0,0813	0,08149	0,08162	0,08174	0,08184	0,0819	0,082	0,083629	-0,00668	-0,007787	**0,897**
31.08.2012	0,06593	0,06776	0,07009	0,0736	0,07604	0,07774	0,079	0,07983	0,0805	0,081	0,08133	0,0816	0,08185	0,082	0,0822	0,0823	0,08245	0,08255	0,08264	0,08271	0,0828	0,0828	0,083997	-0,01907	0,00873992	**0,897**
28.09.2012	0,06378	0,06551	0,06777	0,0713	0,07383	0,07569	0,0771	0,07815	0,079	0,0796	0,08012	0,0805	0,08088	0,0812	0,08141	0,0816	0,0818	0,08196	0,0821	0,08222	0,0823	0,0824	0,084318	-0,02148	0,00455754	**0,897**
31.10.2012	0,059	0,06055	0,06264	0,0661	0,06883	0,07098	0,0727	0,07406	0,0752	0,0761	0,07686	0,0775	0,07804	0,0785	0,07889	0,0792	0,07953	0,07979	0,08002	0,08023	0,0804	0,0806	0,08377	-0,02559	-0,0030127	**0,897**
30.11.2012	0,05741	0,05711	0,05698	0,0574	0,05846	0,0597	0,061	0,06219	0,0633	0,0643	0,0652	0,066	0,06667	0,0673	0,0678	0,0683	0,06867	0,06904	0,06936	0,06966	0,0699	0,0702	0,074694	-0,01707	-0,0236712	**0,897**
31.12.2012	0,06064	0,06073	0,06093	0,0615	0,06205	0,06264	0,0632	0,0637	0,0641	0,0645	0,06486	0,0652	0,06541	0,0656	0,06583	0,066	0,06615	0,06628	0,0664	0,0665	0,0666	0,0667	0,068329	-0,00772	-0,0070314	**0,897**
31.01.2013	0,05518	0,05529	0,05561	0,0566	0,05781	0,05905	0,0602	0,06132	0,0623	0,0631	0,06388	0,0645	0,06509	0,0656	0,06601	0,0664	0,06673	0,06702	0,06728	0,06752	0,0677	0,0679	0,071579	-0,01642	-0,0164101	**0,897**
28.02.2013	0,05391	0,05369	0,05366	0,0543	0,05549	0,05687	0,0583	0,05957	0,0608	0,0619	0,0628	0,0636	0,06437	0,065	0,06557	0,0661	0,0665	0,06689	0,06724	0,06755	0,0678	0,0681	0,07289	-0,0188	-0,0244179	**0,897**
29.03.2013	0,06255	0,0623	0,06214	0,0623	0,06296	0,06374	0,0646	0,06536	0,0661	0,0668	0,06735	0,0679	0,06833	0,0687	0,06909	0,0694	0,06967	0,06992	0,07013	0,07033	0,0705	0,0707	0,073698	-0,01097	-0,0162794	**0,897**
30.04.2013	0,04828	0,04854	0,04907	0,0504	0,0519	0,05337	0,0547	0,05597	0,0571	0,058	0,05884	0,0596	0,06018	0,0607	0,0612	0,0616	0,06198	0,06231	0,0626	0,06286	0,0631	0,0633	0,067322	-0,01913	-0,0169671	**0,897**
31.05.2013	0,0538	0,05539	0,05741	0,0604	0,06249	0,0639	0,0649	0,06558	0,0661	0,0665	0,06674	0,067	0,06712	0,0673	0,06737	0,0675	0,06754	0,06761	0,06767	0,06772	0,0678	0,0678	0,068587	-0,01567	0,00869521	**0,897**
28.06.2013	0,06351	0,06645	0,07009	0,0753	0,07848	0,08048	0,0817	0,08245	0,0829	0,0831	0,08328	0,0833	0,08336	0,0834	0,08334	0,0833	0,08329	0,08327	0,08324	0,08322	0,0832	0,0832	0,082711	-0,02085	0,02497776	**0,897**
31.07.2013	0,07492	0,07845	0,08269	0,0883	0,09134	0,09286	0,0935	0,09357	0,0934	0,093	0,09265	0,0922	0,09185	0,0915	0,09113	0,0908	0,09053	0,09027	0,09004	0,08983	0,0896	0,0895	0,086144	-0,01324	0,04311438	**0,897**
29.08.2013	0,08371	0,08638	0,08965	0,0942	0,09703	0,09871	0,0997	0,10023	0,1005	0,1006	0,10068	0,1007	0,10061	0,1006	0,10048	0,1004	0,10035	0,10029	0,10024	0,10019	0,1001	0,1001	0,099239	-0,01703	0,02473877	**0,897**
30.09.2013	0,07015	0,07314	0,07685	0,0822	0,08555	0,08769	0,089	0,0899	0,0904	0,0908	0,09098	0,0911	0,09119	0,0912	0,09126	0,0913	0,09127	0,09127	0,09127	0,09127	0,0913	0,0913	0,091148	-0,02267	0,02370293	**0,897**
31.10.2013	0,06597	0,06774	0,07008	0,0738	0,07662	0,07874	0,0804	0,08166	0,0827	0,0835	0,08415	0,0847	0,08516	0,0855	0,08587	0,0862	0,0864	0,08662	0,08681	0,08698	0,0871	0,0873	0,089895	-0,02488	0,00137764	**0,897**
29.11.2013	0,07789	0,0803	0,08328	0,0874	0,08996	0,09146	0,0923	0,09282	0,0931	0,0932	0,0932	0,0932	0,09312	0,0931	0,093	0,0929	0,09287	0,09281	0,09276	0,09271	0,0927	0,0926	0,091801	-0,01528	0,02265382	**0,897**
31.12.2013	0,08367	0,08722	0,09154	0,0974	0,10082	0,10271	0,1037	0,10408	0,1042	0,1041	0,10392	0,1037	0,10347	0,1032	0,10303	0,1028	0,10264	0,10247	0,10232	0,10218	0,102	0,1019	0,099693	-0,01804	0,03819268	**0,897**
31.01.2014	0,10438	0,10597	0,10777	0,1098	0,11049	0,11043	0,11	0,10936	0,1087	0,108	0,10734	0,1067	0,1062	0,1057	0,10529	0,1049	0,10457	0,10426	0,10399	0,10374	0,1035	0,1033	0,099484	0,003949	0,03053337	**0,897**
28.02.2014	0,11634	0,11502	0,11335	0,1109	0,10929	0,10822	0,1075	0,10701	0,1067	0,1064	0,10627	0,1061	0,10605	0,106	0,10592	0,1059	0,10584	0,10581	0,10578	0,10576	0,1057	0,1057	0,105386	0,011692	-0,0087139	**0,897**
31.03.2014	0,11528	0,11398	0,11234	0,1099	0,10816	0,10698	0,1062	0,10556	0,1051	0,1048	0,10456	0,1044	0,10421	0,1041	0,10399	0,1039	0,10383	0,10377	0,10371	0,10366	0,1036	0,1036	0,102855	0,013139	-0,0066234	**0,897**
30.04.2014	0,09634	0,09547	0,09447	0,0932	0,09268	0,09252	0,0926	0,09275	0,093	0,0932	0,09343	0,0936	0,09385	0,094	0,09419	0,0943	0,09447	0,09459	0,09469	0,09479	0,0949	0,0949	0,096432	0,000412	-0,0137383	**0,897**
30.05.2014	0,08936	0,08822	0,08695	0,0856	0,08519	0,08534	0,0858	0,0863	0,0869	0,0875	0,08798	0,0885	0,0889	0,0893	0,08964	0,0899	0,09022	0,09047	0,09069	0,09089	0,0911	0,0912	0,094307	-0,00427	-0,023419	**0,897**

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
30.06.2014	0,08454	0,08385	0,08313	0,0825	0,08257	0,08297	0,0835	0,08414	0,0847	0,0853	0,08582	0,0863	0,0867	0,0871	0,08739	0,0877	0,08793	0,08816	0,08836	0,08854	0,0887	0,0888	0,091684	-0,00673	-0,0187175	**0,897**
31.07.2014	0,06902	0,07216	0,07601	0,0813	0,08451	0,08635	0,0874	0,0879	0,0881	0,0882	0,08814	0,088	0,08792	0,0878	0,08767	0,0875	0,08743	0,08733	0,08723	0,08714	0,0871	0,087	0,085563	-0,01832	0,03116242	**0,897**
29.08.2014	0,08523	0,08604	0,08704	0,0885	0,08935	0,08989	0,0902	0,09043	0,0906	0,0906	0,09065	0,0907	0,09067	0,0907	0,09067	0,0907	0,09065	0,09064	0,09063	0,09063	0,0906	0,0906	0,090476	-0,0057	0,00692555	**0,897**
30.09.2014	0,09015	0,09187	0,09394	0,0967	0,09823	0,09902	0,0994	0,09947	0,0994	0,0993	0,09913	0,099	0,09879	0,0986	0,09848	0,0983	0,09822	0,09811	0,09801	0,09791	0,0978	0,0978	0,096297	-0,00713	0,02023597	**0,897**
31.10.2014	0,08611	0,08562	0,08506	0,0844	0,08414	0,0841	0,0842	0,08432	0,0845	0,0847	0,08482	0,085	0,0851	0,0852	0,08534	0,0854	0,08552	0,0856	0,08567	0,08574	0,0858	0,0858	0,086837	-0,00044	-0,0084744	**0,897**
28.11.2014	0,07407	0,07427	0,07454	0,075	0,07543	0,07577	0,0761	0,07629	0,0765	0,0767	0,0768	0,0769	0,07702	0,0771	0,07718	0,0772	0,07731	0,07736	0,0774	0,07744	0,0775	0,0775	0,078136	-0,00416	-0,0014298	**0,897**
31.12.2014	0,09001	0,08851	0,08666	0,084	0,08242	0,08143	0,0808	0,08047	0,0803	0,0802	0,0801	0,0801	0,08008	0,0801	0,08011	0,0801	0,08015	0,08017	0,08019	0,08021	0,0802	0,0802	0,080553	0,010296	-0,0131005	**0,897**
30.01.2015	0,07867	0,07683	0,07464	0,0718	0,0702	0,06945	0,0692	0,06916	0,0693	0,0695	0,06973	0,07	0,07019	0,0704	0,0706	0,0708	0,07093	0,07108	0,07121	0,07133	0,0714	0,0715	0,073388	0,006334	-0,0230527	**0,897**
27.02.2015	0,09147	0,09066	0,0896	0,0879	0,0867	0,08578	0,0851	0,08456	0,0841	0,0838	0,08355	0,0833	0,08315	0,083	0,08287	0,0828	0,08267	0,08258	0,08251	0,08244	0,0824	0,0823	0,081322	0,010593	-0,001541	**0,897**
31.03.2015	0,09392	0,09256	0,09087	0,0884	0,0869	0,08593	0,0853	0,08492	0,0847	0,0845	0,08443	0,0844	0,08434	0,0843	0,0843	0,0843	0,0843	0,0843	0,0843	0,0843	0,0843	0,0843	0,084358	0,010323	-0,0108189	**0,897**
30.04.2015	0,1057	0,10481	0,1036	0,1016	0,10007	0,09887	0,0979	0,09714	0,0965	0,096	0,0956	0,0952	0,09495	0,0947	0,09449	0,0943	0,09414	0,094	0,09387	0,09376	0,0937	0,0936	0,091825	0,014356	0,00123888	**0,897**
29.05.2015	0,09652	0,09704	0,09755	0,0979	0,09766	0,09717	0,0966	0,09592	0,0953	0,0947	0,09422	0,0938	0,09336	0,093	0,09269	0,0924	0,09216	0,09194	0,09174	0,09156	0,0914	0,0913	0,088505	0,00769	0,0170479	**0,897**
30.06.2015	0,10214	0,10181	0,1013	0,1003	0,09935	0,0985	0,0978	0,09711	0,0966	0,0961	0,09567	0,0953	0,09501	0,0948	0,09453	0,0943	0,09415	0,094	0,09386	0,09374	0,0936	0,0935	0,091618	0,010679	0,00642954	**0,897**
31.07.2015	0,09928	0,09991	0,10057	0,1011	0,1011	0,10074	0,1002	0,09969	0,0991	0,0986	0,09815	0,0977	0,09736	0,097	0,09673	0,0965	0,09624	0,09603	0,09585	0,09568	0,0955	0,0954	0,092817	0,006073	0,01710181	**0,897**
31.08.2015	0,09915	0,10195	0,10514	0,1088	0,11027	0,11041	0,1099	0,10897	0,108	0,1069	0,10594	0,105	0,1042	0,1034	0,10278	0,1022	0,10166	0,10118	0,10076	0,10038	0,1	0,0997	0,093732	0,003776	0,05001235	**0,897**
30.09.2015	0,11424	0,11458	0,11491	0,1151	0,115	0,11469	0,1143	0,11392	0,1135	0,1132	0,11285	0,1126	0,11231	0,1121	0,11189	0,1117	0,11155	0,11142	0,11129	0,11118	0,1111	0,111	0,109258	0,004772	0,01078798	**0,897**
30.10.2015	0,10663	0,106	0,10517	0,1038	0,10284	0,10208	0,1015	0,10104	0,1007	0,1004	0,10015	0,1	0,09979	0,0996	0,09953	0,0994	0,09934	0,09926	0,09919	0,09913	0,0991	0,099	0,098089	0,008875	-0,0004505	**0,897**
30.11.2015	0,11022	0,10964	0,10887	0,1076	0,10667	0,10594	0,1054	0,10493	0,1046	0,1043	0,10404	0,1038	0,10368	0,1035	0,10342	0,1033	0,10323	0,10315	0,10308	0,10301	0,103	0,1029	0,101949	0,008584	0,0000146	**0,897**
31.12.2015	0,10646	0,10714	0,10793	0,1089	0,1094	0,10957	0,1096	0,10948	0,1093	0,1092	0,10903	0,1089	0,10875	0,1086	0,10852	0,1084	0,10832	0,10824	0,10817	0,10811	0,108	0,108	0,106964	-0,0009	0,01014487	**0,897**
29.01.2016	0,1029	0,10421	0,10577	0,1078	0,10883	0,1093	0,1094	0,10938	0,1092	0,109	0,10882	0,1086	0,10842	0,1082	0,10807	0,1079	0,10779	0,10767	0,10756	0,10746	0,1074	0,1073	0,105739	-0,0036	0,01752854	**0,897**
29.02.2016	0,09829	0,1005	0,10311	0,1065	0,10829	0,1091	0,1093	0,10928	0,1091	0,1087	0,10841	0,1081	0,10777	0,1075	0,10721	0,107	0,10676	0,10656	0,10639	0,10623	0,1061	0,106	0,103452	-0,00642	0,02891098	**0,897**
31.03.2016	0,10311	0,10226	0,10124	0,0999	0,09916	0,0988	0,0987	0,09863	0,0987	0,0988	0,09886	0,099	0,09906	0,0991	0,09923	0,0993	0,09938	0,09944	0,0995	0,09955	0,0996	0,0996	0,100447	0,003152	-0,0104373	**0,897**
29.04.2016	0,09283	0,09255	0,09222	0,0918	0,09167	0,09164	0,0917	0,09176	0,0919	0,092	0,09205	0,0921	0,09221	0,0923	0,09234	0,0924	0,09245	0,0925	0,09254	0,09257	0,0926	0,0926	0,093207	-0,00021	-0,0049241	**0,897**

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
31.05.2016	0,09454	0,09407	0,09363	0,0935	0,09381	0,09443	0,0952	0,09588	0,0966	0,0972	0,09778	0,0983	0,09874	0,0991	0,09948	0,0998	0,10007	0,10031	0,10053	0,10072	0,1009	0,1011	0,10408	-0,00924	-0,0179407	**0,897**
30.06.2016	0,09098	0,08991	0,08874	0,0875	0,08722	0,08743	0,0879	0,08848	0,0891	0,0897	0,09021	0,0907	0,09115	0,0915	0,0919	0,0922	0,09249	0,09274	0,09296	0,09316	0,0933	0,0935	0,096615	-0,005	-0,0229876	**0,897**
29.07.2016	0,0806	0,08277	0,08548	0,0894	0,09199	0,09366	0,0948	0,09549	0,096	0,0963	0,09654	0,0967	0,09681	0,0969	0,09696	0,097	0,09704	0,09707	0,0971	0,09712	0,0971	0,0972	0,097451	-0,01806	0,01542752	**0,897**
31.08.2016	0,0849	0,08535	0,08607	0,0876	0,08904	0,0904	0,0916	0,09267	0,0936	0,0944	0,09507	0,0957	0,09617	0,0966	0,097	0,0973	0,09763	0,0979	0,09813	0,09834	0,0985	0,0987	0,101927	-0,01723	-0,0117892	**0,897**
30.09.2016	0,08128	0,08144	0,08189	0,0832	0,08484	0,08648	0,088	0,08947	0,0907	0,0919	0,09283	0,0937	0,09441	0,0951	0,09562	0,0961	0,09655	0,09694	0,09728	0,09759	0,0979	0,0981	0,102898	-0,02166	-0,0212782	**0,897**
31.10.2016	0,08582	0,08656	0,08764	0,0896	0,09139	0,09291	0,0942	0,09531	0,0962	0,097	0,09772	0,0983	0,09879	0,0992	0,09958	0,0999	0,10019	0,10044	0,10066	0,10086	0,101	0,1012	0,104268	-0,01883	-0,0087291	**0,897**
30.11.2016	0,08983	0,09205	0,09487	0,0991	0,10207	0,10411	0,1056	0,1066	0,1074	0,1079	0,10838	0,1087	0,109	0,1092	0,10941	0,1096	0,1097	0,10981	0,10991	0,11	0,1101	0,1101	0,111485	-0,02288	0,01091062	**0,897**
30.12.2016	0,08164	0,0854	0,09017	0,0973	0,10207	0,10535	0,1076	0,10923	0,1104	0,1112	0,11184	0,1123	0,1127	0,113	0,11324	0,1134	0,11362	0,11376	0,11389	0,114	0,1141	0,1142	0,115869	-0,03631	0,02130959	**0,897**
31.01.2017	0,10625	0,10725	0,10845	0,11	0,1108	0,11116	0,1113	0,11123	0,1111	0,111	0,11082	0,1107	0,11051	0,1104	0,11025	0,1101	0,11004	0,10995	0,10987	0,10979	0,1097	0,1097	0,108498	-0,00283	0,01332062	**0,897**
28.02.2017	0,11021	0,11003	0,1098	0,1095	0,10934	0,10925	0,1092	0,1092	0,1092	0,1092	0,10923	0,1092	0,10926	0,1093	0,10929	0,1093	0,10932	0,10933	0,10934	0,10935	0,1094	0,1094	0,109513	0,000801	-0,0021249	**0,897**
31.03.2017	0,11243	0,1125	0,11256	0,1126	0,11252	0,11243	0,1123	0,1122	0,1121	0,112	0,11191	0,1118	0,11177	0,1117	0,11165	0,1116	0,11156	0,11153	0,11149	0,11146	0,1114	0,1114	0,110951	0,001436	0,00270687	**0,897**
28.04.2017	0,11201	0,11284	0,11365	0,1142	0,11377	0,11294	0,1119	0,11088	0,1099	0,1089	0,1081	0,1074	0,10669	0,1061	0,10558	0,1051	0,10472	0,10436	0,10404	0,10375	0,1035	0,1033	0,098749	0,012738	0,02770494	**0,897**
31.05.2017	0,11849	0,11701	0,11513	0,1123	0,11042	0,10911	0,1082	0,10754	0,1071	0,1067	0,10647	0,1063	0,10611	0,106	0,10588	0,1058	0,10572	0,10566	0,1056	0,10555	0,1055	0,1055	0,104747	0,014566	-0,0080782	**0,897**
30.06.2017	0,10344	0,10522	0,10725	0,1096	0,11055	0,11067	0,1103	0,1098	0,1092	0,1085	0,10792	0,1074	0,10684	0,1064	0,10596	0,1056	0,10526	0,10497	0,1047	0,10446	0,1043	0,1041	0,100327	0,002068	0,03142529	**0,897**
31.07.2017	0,11223	0,11361	0,11503	0,1162	0,11605	0,11519	0,114	0,11275	0,1115	0,1103	0,10926	0,1083	0,10744	0,1067	0,10602	0,1054	0,1049	0,10444	0,10402	0,10365	0,1033	0,103	0,097159	0,014235	0,0382502	**0,897**
31.08.2017	0,11024	0,11168	0,11322	0,1147	0,11493	0,11442	0,1136	0,11261	0,1116	0,1107	0,10981	0,109	0,10833	0,1077	0,10715	0,1067	0,10622	0,10583	0,10549	0,10517	0,1049	0,1046	0,099766	0,00961	0,03414824	**0,897**
29.09.2017	0,11992	0,12001	0,11993	0,1193	0,11824	0,11711	0,116	0,11492	0,114	0,1131	0,11236	0,1117	0,11113	0,1106	0,11019	0,1098	0,10945	0,10915	0,10888	0,10864	0,1084	0,1082	0,104452	0,01537	0,01847716	**0,897**
31.10.2017	0,12699	0,12781	0,12859	0,129	0,12848	0,12752	0,1264	0,12522	0,1241	0,1231	0,12218	0,1214	0,12064	0,12	0,11944	0,1189	0,1185	0,11811	0,11776	0,11745	0,1172	0,1169	0,112024	0,01445	0,02941252	**0,897**
30.11.2017	0,13216	0,13478	0,13764	0,1406	0,14124	0,14062	0,1394	0,13789	0,1363	0,1348	0,13345	0,1322	0,13106	0,13	0,12915	0,1284	0,12765	0,12702	0,12646	0,12595	0,1255	0,1251	0,117159	0,013443	0,05769418	**0,897**
29.12.2017	0,13242	0,1343	0,13614	0,1374	0,13658	0,13481	0,1326	0,13036	0,1282	0,1261	0,12431	0,1227	0,12122	0,1199	0,11881	0,1178	0,11692	0,11614	0,11543	0,1148	0,1142	0,1137	0,103872	0,027375	0,06103534	**0,897**
31.01.2018	0,13042	0,13112	0,13172	0,1318	0,131	0,12979	0,1285	0,12712	0,1259	0,1247	0,12369	0,1228	0,12198	0,1213	0,12066	0,1201	0,11963	0,11919	0,11881	0,11847	0,1182	0,1179	0,112507	0,017459	0,03073688	**0,897**
28.02.2018	0,13027	0,13108	0,1318	0,132	0,13134	0,13017	0,1288	0,12751	0,1262	0,1251	0,12404	0,1231	0,1223	0,1216	0,12095	0,1204	0,11989	0,11945	0,11906	0,11871	0,1184	0,1181	0,112611	0,017143	0,03215469	**0,897**
30.03.2018	0,13464	0,13697	0,13944	0,1418	0,14196	0,14099	0,1395	0,13778	0,1361	0,1344	0,13293	0,1316	0,13037	0,1293	0,12835	0,1275	0,12675	0,12609	0,12549	0,12496	0,1245	0,124	0,115686	0,017552	0,05746254	**0,897**

Date/Maturity (year)	0,08	0,25	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6	6,5	7	7,5	8	8,5	9	9,5	10	Beta 1 (Level)	Beta 2 (Slope)	Beta 3 (Curvature)	Lambda 1
30.04.2018	0,13896	0,1408	0,14267	0,1441	0,14368	0,1423	0,1405	0,1386	0,1367	0,135	0,13344	0,132	0,13078	0,1297	0,12869	0,1278	0,12705	0,12637	0,12576	0,12521	0,1247	0,1243	0,115729	0,022091	0,0546304	**0,897**
31.05.2018	0,17222	0,17386	0,17521	0,1752	0,17299	0,16985	0,1664	0,16296	0,1597	0,1568	0,15421	0,1519	0,14986	0,1481	0,14649	0,1451	0,14386	0,14277	0,14179	0,14092	0,1401	0,1394	0,125789	0,045346	0,07702313	**0,897**
29.06.2018	0,19068	0,19092	0,1908	0,1894	0,18725	0,18479	0,1823	0,18005	0,178	0,1761	0,17447	0,173	0,17177	0,1707	0,16971	0,1689	0,16811	0,16745	0,16686	0,16633	0,1658	0,1654	0,157173	0,033275	0,04073668	**0,897**
31.07.2018	0,18307	0,18964	0,19718	0,2061	0,2098	0,21048	0,2095	0,20776	0,2057	0,2035	0,2014	0,1995	0,19768	0,1961	0,19464	0,1934	0,19221	0,19119	0,19027	0,18945	0,1887	0,188	0,175082	0,004153	0,1121378	**0,897**
31.08.2018	0,20879	0,22687	0,24773	0,2729	0,28382	0,28653	0,2847	0,28067	0,2756	0,2702	0,26503	0,2601	0,25566	0,2516	0,24798	0,2447	0,24183	0,23923	0,2369	0,23481	0,2329	0,2312	0,198276	-4,3E-06	0,2957481	**0,897**
28.09.2018	0,27481	0,27467	0,27313	0,2669	0,2586	0,24976	0,2412	0,23326	0,2261	0,2198	0,21431	0,2095	0,20527	0,2016	0,19837	0,1955	0,19304	0,19083	0,18885	0,18709	0,1855	0,1841	0,156613	0,117924	0,1284892	**0,897**
31.10.2018	0,26232	0,26067	0,25753	0,2499	0,24156	0,23347	0,226	0,21929	0,2134	0,2082	0,20377	0,1999	0,19653	0,1936	0,19104	0,1888	0,18682	0,18507	0,18351	0,18212	0,1809	0,1797	0,158115	0,104851	0,08922442	**0,897**
30.11.2018	0,21481	0,21334	0,21086	0,2054	0,19994	0,19478	0,1901	0,186	0,1824	0,1793	0,1766	0,1743	0,17227	0,1705	0,169	0,1677	0,16649	0,16545	0,16452	0,16369	0,163	0,1623	0,149458	0,066016	0,04907632	**0,897**
31.12.2018	0,23026	0,22612	0,2204	0,2105	0,2024	0,19576	0,1903	0,18581	0,1821	0,179	0,17638	0,1742	0,17231	0,1707	0,16932	0,1681	0,16706	0,16613	0,16531	0,16457	0,1639	0,1633	0,151951	0,080481	0,02147049	**0,897**

area refers that since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yields which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period. Therefore, estimated values in the area should not be taken into consideration.

Table E.2 Adjusted R Values and Significance of Betas in OLS Methodology

* Among the variables; Constant refers to $\boldsymbol{\beta_1}$, x2 refers to $\boldsymbol{\beta_2}$ and x3 refers to $\boldsymbol{\beta_3}$.

VARIABLES	02.2005 return_comp	03.2005 return_comp	04.2005 return_comp	05.2005 return_comp	06.2005 return_comp	07.2005 return_comp	08.2005 return_comp	09.2005 return_comp	10.2005 return_comp	11.2005 return_comp
x2	5.584***	2.101**	-0.102	2.888***	2.005***	0.986**	0.991	3.362***	4.408***	5.384***
	(0.265)	(0.493)	(0.367)	(0.307)	(0.357)	(0.324)	(0.642)	(0.331)	(0.287)	(0.154)
x3	11.06***	15.17***	19.94***	17.45***	10.37***	12.60***	12.80***	10.31***	6.273***	9.206***
	(1.147)	(2.870)	(1.776)	(1.933)	(1.610)	(1.809)	(2.479)	(1.461)	(1.229)	(0.659)
Constant	11.11***	12.49***	13.02***	10.49***	12.30***	12.43***	12.50***	10.54***	10.11***	8.327***
	(0.327)	(0.719)	(0.484)	(0.444)	(0.444)	(0.450)	(0.740)	(0.349)	(0.357)	(0.194)
Observations	7	7	7	7	7	7	7	7	7	7
R-squared	0.986	0.851	0.978	0.935	0.876	0.915	0.888	0.870	0.951	0.988

VARIABLES	12.2005 return_comp	01.2006 return_comp	02.2006 return_comp	03.2006 return_comp	04.2006 return_comp	05.2006 return_comp	06.2006 return_comp	07.2006 return_comp	08.2006 return_comp	09.2006 return_comp
x2	4.607***	2.480***	2.358**	0.760	0.244	-4.241***	4.830**	5.246***	4.324**	-0.484
	(0.106)	(0.348)	(0.791)	(0.713)	(0.870)	(0.794)	(1.548)	(0.905)	(1.077)	(2.119)
x3	5.651***	3.385**	2.006	0.903	2.728	6.229	20.99**	14.73*	15.36*	11.76
	(0.811)	(0.758)	(1.411)	(2.129)	(1.949)	(3.392)	(5.102)	(6.222)	(5.829)	(6.146)
Constant	9.814***	11.40***	11.42***	13.05***	12.83***	17.70***	13.22***	13.02***	13.17***	18.28***
	(0.203)	(0.379)	(0.826)	(0.806)	(0.982)	(0.945)	(1.701)	(1.623)	(1.652)	(2.164)
Observations	7	7	7	7	7	7	7	7	7	7
R-squared	0.985	0.961	0.843	0.252	0.275	0.922	0.797	0.693	0.676	0.555

VARIABLES	10.2006 return_comp	11.2006 return_comp	12.2006 return_comp	01.2007 return_comp	02.2007 return_comp	03.2007 return_comp	04.2007 return_comp	05.2007 return_comp	06.2007 return_comp	07.2007 return_comp
x2	-0.242	2.097	1.761	-0.367	1.751*	1.235	1.822***	2.143***	2.368**	1.798**
	(1.836)	(1.299)	(2.052)	(1.595)	(0.734)	(0.669)	(0.372)	(0.380)	(0.691)	(0.432)
x3	14.53**	17.13***	9.023	8.625	6.806**	11.98**	9.279***	10.29***	13.34***	3.864
	(4.537)	(3.127)	(6.034)	(7.058)	(1.576)	(2.944)	(1.407)	(1.485)	(2.280)	(2.005)
Constant	16.93***	14.69***	16.95***	17.46***	17.09***	15.70***	15.56***	14.56***	13.32***	15.74***
	(1.685)	(1.134)	(2.138)	(2.102)	(0.797)	(0.787)	(0.444)	(0.446)	(0.763)	(0.596)
Observations	7	7	7	7	7	7	7	7	7	7
R-squared	0.761	0.761	0.239	0.391	0.821	0.766	0.893	0.914	0.888	0.744

VARIABLES	08.2007 return_comp	09.2007 return_comp	10.2007 return_comp	11.2007 return_comp	12.2007 return_comp	01.2008 return_comp	02.2008 return_comp	03.2008 return_comp	04.2008 return_comp	05.2008 return_comp
x2	-0.0462	1.938*	1.774***	0.595	0.176	-1.191**	-1.624***	-2.471***	-0.499	-2.929***
	(0.398)	(0.714)	(0.187)	(0.326)	(0.288)	(0.273)	(0.245)	(0.253)	(0.507)	(0.268)
x3	4.191**	5.440	6.101***	5.839***	2.761*	-1.887	-0.644	1.329	3.195	2.461*
	(1.307)	(2.652)	(0.680)	(1.145)	(1.022)	(1.269)	(1.306)	(1.263)	(2.142)	(0.958)
Constant	17.05***	14.58***	13.80***	15.08***	15.96***	17.63***	18.12***	19.76***	18.70***	20.97***
	(0.456)	(0.854)	(0.184)	(0.331)	(0.328)	(0.359)	(0.373)	(0.371)	(0.666)	(0.332)
Observations	7	7	7	7	7	7	7	7	7	7
R-squared	0.852	0.592	0.959	0.795	0.674	0.764	0.928	0.967	0.690	0.991

VARIABLES	06.2008 return_comp	07.2008 return_comp	08.2008 return_comp	09.2008 return_comp	10.2008 return_comp	11.2008 return_comp	12.2008 return_comp	01.2009 return_comp	02.2009 return_comp	03.2009 return_comp
x2	-3.499**	0.728	0.843**	-0.294	-3.447**	-2.458***	-1.808***	-6.315***	-8.782***	-7.198***
	(0.856)	(0.706)	(0.300)	(0.332)	(0.891)	(0.470)	(0.391)	(0.456)	(0.691)	(0.410)
x3	9.603*	3.093	2.591	3.014	12.76**	5.197**	-4.878***	0.820	-1.062	-0.794
	(3.519)	(1.923)	(1.222)	(1.660)	(2.836)	(1.488)	(0.965)	(1.388)	(2.550)	(1.495)
Constant	21.18***	17.83***	17.83***	18.94***	23.75***	20.34***	18.98***	18.14***	20.54***	18.35***
	(1.056)	(0.760)	(0.377)	(0.506)	(1.116)	(0.494)	(0.422)	(0.522)	(0.884)	(0.490)
Observations	7	7	7	7	7	7	7	7	7	7
R-squared	0.930	0.461	0.536	0.675	0.975	0.965	0.863	0.988	0.987	0.995

VARIABLES	04.2009 return_comp	05.2009 return_comp	06.2009 return_comp	07.2009 return_comp	08.2009 return_comp	09.2009 return_comp	10.2009 return_comp	11.2009 return_comp	12.2009 return_comp	01.2010 return_comp
x2	-7.182***	-5.500***	-7.076***	-5.224***	-5.854***	-6.162***	-4.506***	-4.552***	-6.127***	-5.125***
	(0.631)	(0.719)	(0.366)	(0.0415)	(0.362)	(0.551)	(0.428)	(0.381)	(0.533)	(0.109)
x3	-3.845*	-1.168	-1.779	-1.351***	-2.718*	-5.683**	-0.778	-0.397	-2.849	-2.534**
	(1.724)	(2.871)	(1.169)	(0.121)	(1.145)	(1.354)	(1.988)	(1.250)	(1.441)	(0.648)
Constant	17.11***	15.84***	16.10***	13.60***	13.65***	13.53***	11.38***	11.36***	13.01***	12.05***
	(0.719)	(1.029)	(0.462)	(0.0443)	(0.398)	(0.619)	(0.585)	(0.471)	(0.571)	(0.129)
Observations	7	7	7	7	7	7	8	8	8	8
R-squared	0.983	0.974	0.996	1.000	0.989	0.987	0.953	0.985	0.972	0.993

VARIABLES	02.2010 return_comp	03.2010 return_comp	04.2010 return_comp	05.2010 return_comp	06.2010 return_comp	07.2010 return_comp	08.2010 return_comp	09.2010 return_comp	10.2010 return_comp	11.2010 return_comp
x2	-5.209***	-4.961***	-4.141***	-3.639***	-2.720***	-1.959***	-2.150***	-2.199***	-1.413***	-2.475***
	(0.314)	(0.455)	(0.148)	(0.0671)	(0.0812)	(0.120)	(0.0745)	(0.134)	(0.155)	(0.147)
x3	-0.507	0.239	0.386	-1.315***	0.565	-0.119	-0.229	-0.942*	-2.210***	-1.798**
	(0.953)	(1.419)	(0.539)	(0.302)	(0.472)	(0.435)	(0.337)	(0.453)	(0.413)	(0.497)
Constant	11.72***	11.33***	11.06***	11.33***	10.14***	9.343***	9.391***	9.482***	8.934***	9.524***
	(0.294)	(0.478)	(0.155)	(0.0434)	(0.112)	(0.140)	(0.0872)	(0.134)	(0.121)	(0.167)
Observations	8	8	8	8	8	8	8	8	8	8
R-squared	0.986	0.968	0.992	0.997	0.995	0.985	0.993	0.986	0.912	0.983

VARIABLES	12.2010 return_comp	01.2011 return_comp	02.2011 return_comp	03.2011 return_comp	04.2011 return_comp	05.2011 return_comp	06.2011 return_comp	07.2011 return_comp	08.2011 return_comp	09.2011 return_comp
x2	-2.859***	-3.841***	-2.596***	-1.726***	-2.064***	-1.978***	-1.771***	-2.032***	-1.700***	-2.411***
	(0.123)	(0.203)	(0.175)	(0.0966)	(0.138)	(0.0986)	(0.152)	(0.157)	(0.299)	(0.368)
x3	-3.338**	-0.364	1.815**	1.403***	0.181	1.502**	1.903***	0.588	-0.550	0.384
	(0.885)	(0.591)	(0.605)	(0.335)	(0.883)	(0.479)	(0.464)	(0.635)	(0.976)	(1.126)
Constant	9.397***	10.32***	9.563***	9.505***	9.621***	9.603***	9.535***	9.882***	9.097***	9.541***
	(0.157)	(0.201)	(0.170)	(0.100)	(0.185)	(0.120)	(0.144)	(0.125)	(0.271)	(0.396)
Observations	8	9	9	9	9	9	9	9	9	9
R-squared	0.949	0.978	0.985	0.981	0.946	0.982	0.977	0.952	0.874	0.925

VARIABLES	10.2011 return_comp	11.2011 return_comp	12.2011 return_comp	01.2012 return_comp	02.2012 return_comp	03.2012 return_comp	04.2012 return_comp	05.2012 return_comp	06.2012 return_comp	07.2012 return_comp
x2	0.264	0.364	1.416***	-0.0453	-0.738***	0.142	0.399**	1.404***	0.343	-0.668***
	(0.307)	(0.175)	(0.111)	(0.0986)	(0.166)	(0.166)	(0.124)	(0.142)	(0.184)	(0.0874)
x3	1.233	3.028**	4.103***	-1.028*	0.632	-1.059*	-0.0166	-1.015*	-0.908	-0.779
	(0.969)	(0.713)	(0.354)	(0.467)	(0.510)	(0.533)	(0.457)	(0.517)	(0.689)	(0.494)
Constant	9.504***	9.572***	9.144***	9.874***	9.404***	9.700***	9.243***	9.123***	8.840***	8.363***
	(0.194)	(0.163)	(0.0980)	(0.1000)	(0.107)	(0.109)	(0.0736)	(0.0911)	(0.144)	(0.0830)
Observations	7	7	8	9	8	9	9	9	9	9
R-squared	0.227	0.794	0.971	0.415	0.816	0.462	0.702	0.958	0.576	0.858

VARIABLES	08.2012 return_comp	09.2012 return_comp	10.2012 return_comp	11.2012 return_comp	12.2012 return_comp	01.2013 return_comp	02.2013 return_comp	03.2013 return_comp	04.2013 return_comp	05.2013 return_comp
x2	-1.907***	-2.148***	-2.559***	-1.707***	-0.772***	-1.642***	-1.880***	-1.097***	-1.913***	-1.567***
	(0.262)	(0.215)	(0.156)	(0.185)	(0.123)	(0.0490)	(0.110)	(0.126)	(0.0990)	(0.249)
x3	0.874	0.456	-0.301	-2.367**	-0.703	-1.641***	-2.442***	-1.628***	-1.697***	0.870
	(0.850)	(0.736)	(0.630)	(0.649)	(0.417)	(0.228)	(0.321)	(0.395)	(0.296)	(0.645)
Constant	8.400***	8.432***	8.377***	7.469***	6.833***	7.158***	7.289***	7.370***	6.732***	6.859***
	(0.159)	(0.125)	(0.143)	(0.0921)	(0.0562)	(0.0457)	(0.110)	(0.0981)	(0.0890)	(0.145)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.927	0.949	0.969	0.953	0.902	0.994	0.981	0.933	0.984	0.914

VARIABLES	06.2013 return_comp	07.2013 return_comp	08.2013 return_comp	09.2013 return_comp	10.2013 return_comp	11.2013 return_comp	12.2013 return_comp	01.2014 return_comp	02.2014 return_comp	03.2014 return_comp
x2	-2.085***	-1.324**	-1.703***	-2.267***	-2.488***	-1.528***	-1.804***	0.395**	1.169**	1.314***
	(0.487)	(0.460)	(0.153)	(0.329)	(0.134)	(0.284)	(0.363)	(0.146)	(0.418)	(0.192)
x3	2.498	4.311*	2.474**	2.370	0.138	2.265*	3.819**	3.053***	-0.871	-0.662
	(1.544)	(1.802)	(0.697)	(1.366)	(0.505)	(0.997)	(1.064)	(0.509)	(1.354)	(0.673)
Constant	8.271***	8.614***	9.924***	9.115***	8.989***	9.180***	9.969***	9.948***	10.54***	10.29***
	(0.270)	(0.444)	(0.175)	(0.259)	(0.113)	(0.191)	(0.226)	(0.140)	(0.279)	(0.111)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.845	0.822	0.950	0.920	0.981	0.871	0.887	0.809	0.677	0.898

VARIABLES	04.2014 return_comp	05.2014 return_comp	06.2014 return_comp	07.2014 return_comp	08.2014 return_comp	09.2014 return_comp	10.2014 return_comp	11.2014 return_comp	12.2014 return_comp	01.2015 return_comp
x2	0.0412	-0.427*	-0.673***	-1.832**	-0.570**	-0.713**	-0.0440	-0.416**	1.030***	0.633***
	(0.0986)	(0.188)	(0.0796)	(0.565)	(0.176)	(0.225)	(0.0870)	(0.143)	(0.252)	(0.0679)
x3	-1.374**	-2.342**	-1.872***	3.116	0.693	2.024**	-0.847*	-0.143	-1.310	-2.305***
	(0.509)	(0.694)	(0.254)	(1.779)	(0.672)	(0.793)	(0.413)	(0.448)	(0.900)	(0.220)
Constant	9.643***	9.431***	9.168***	8.556***	9.048***	9.630***	8.684***	7.814***	8.055***	7.339***
	(0.0922)	(0.135)	(0.0547)	(0.373)	(0.126)	(0.157)	(0.106)	(0.105)	(0.154)	(0.0599)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.590	0.734	0.937	0.775	0.721	0.773	0.415	0.648	0.818	0.976

VARIABLES	02.2015 return_comp	03.2015 return_comp	04.2015 return_comp	05.2015 return_comp	06.2015 return_comp	07.2015 return_comp	08.2015 return_comp	09.2015 return_comp	10.2015 return_comp	11.2015 return_comp
x2	1.059***	1.032***	1.436***	0.769***	1.068***	0.607*	0.378	0.477	0.888***	0.858***
	(0.263)	(0.145)	(0.127)	(0.167)	(0.0845)	(0.250)	(0.354)	(0.286)	(0.0596)	(0.127)
x3	-0.154	-1.082	0.124	1.705*	0.643	1.710*	5.001***	1.079	-0.0450	0.00146
	(1.025)	(0.712)	(0.498)	(0.709)	(0.334)	(0.754)	(0.863)	(0.713)	(0.116)	(0.426)
Constant	8.132***	8.436***	9.182***	8.851***	9.162***	9.282***	9.373***	10.93***	9.809***	10.19***
	(0.234)	(0.140)	(0.108)	(0.157)	(0.0830)	(0.159)	(0.332)	(0.157)	(0.0381)	(0.155)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.715	0.887	0.947	0.734	0.956	0.604	0.763	0.376	0.946	0.912

VARIABLES	12.2015 return_comp	01.2016 return_comp	02.2016 return_comp	03.2016 return_comp	04.2016 return_comp	05.2016 return_comp	06.2016 return_comp	07.2016 return_comp	08.2016 return_comp	09.2016 return_comp
x2	-0.0902	-0.360**	-0.642**	0.315***	-0.0206	-0.924***	-0.500**	-1.806***	-1.723***	-2.166***
	(0.0933)	(0.137)	(0.228)	(0.0583)	(0.0905)	(0.0790)	(0.176)	(0.411)	(0.0572)	(0.110)
x3	1.014**	1.753**	2.891***	-1.044***	-0.492*	-1.794***	-2.299***	1.543	-1.179**	-2.128***
	(0.327)	(0.487)	(0.755)	(0.204)	(0.244)	(0.299)	(0.447)	(1.435)	(0.406)	(0.413)
Constant	10.70***	10.57***	10.35***	10.04***	9.321***	10.41***	9.662***	9.745***	10.19***	10.29***
	(0.110)	(0.136)	(0.151)	(0.0427)	(0.0510)	(0.0706)	(0.0744)	(0.216)	(0.0623)	(0.0905)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.746	0.829	0.838	0.880	0.342	0.962	0.801	0.845	0.986	0.981

VARIABLES	10.2016 return_comp	11.2016 return_comp	12.2016 return_comp	01.2017 return_comp	02.2017 return_comp	03.2017 return_comp	04.2017 return_comp	05.2017 return_comp	06.2017 return_comp	07.2017 return_comp
x2	-1.883***	-2.288***	-3.631***	-0.283**	0.0801	0.144	1.274**	1.457*	0.207	1.423**
	(0.119)	(0.193)	(0.151)	(0.106)	(0.238)	(0.268)	(0.379)	(0.623)	(0.480)	(0.408)
x3	-0.873**	1.091	2.131**	1.332***	-0.212	0.271	2.770**	-0.808	3.143*	3.825**
	(0.273)	(0.712)	(0.835)	(0.316)	(0.773)	(0.844)	(1.124)	(1.448)	(1.605)	(1.381)
Constant	10.43***	11.15***	11.59***	10.85***	10.95***	11.10***	9.875***	10.47***	10.03***	9.716***
	(0.0783)	(0.138)	(0.136)	(0.0592)	(0.146)	(0.304)	(0.165)	(0.222)	(0.419)	(0.327)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.983	0.963	0.983	0.856	0.050	0.064	0.643	0.619	0.420	0.780

VARIABLES	08.2017 return_comp	09.2017 return_comp	10.2017 return_comp	11.2017 return_comp	12.2017 return_comp	01.2018 return_comp	02.2018 return_comp	03.2018 return_comp	04.2018 return_comp	05.2018 return_comp
x2	0.961***	1.537***	1.445***	1.344***	2.738***	1.746***	1.714***	1.755***	2.209***	4.535***
	(0.206)	(0.265)	(0.146)	(0.291)	(0.370)	(0.164)	(0.257)	(0.236)	(0.218)	(0.453)
x3	3.415**	1.848*	2.941***	5.769***	6.104***	3.074***	3.215***	5.746***	5.463***	7.702***
	(0.924)	(0.811)	(0.385)	(1.254)	(1.208)	(0.413)	(0.644)	(0.716)	(0.811)	(1.121)
Constant	9.977***	10.45***	11.20***	11.72***	10.39***	11.25***	11.26***	11.57***	11.57***	12.58***
	(0.183)	(0.197)	(0.152)	(0.310)	(0.336)	(0.106)	(0.169)	(0.239)	(0.254)	(0.332)
Observations	9	9	9	9	9	9	9	9	9	9
R-squared	0.893	0.898	0.963	0.811	0.939	0.955	0.918	0.929	0.955	0.953

VARIABLES	06.2018 return_comp	07.2018 return_comp	08.2018 return_comp	09.2018 return_comp	10.2018 return_comp	11.2018 return_comp	12.2018 return_comp
x2	3.328**	0.415	-0.000431	11.79***	10.49***	6.602***	8.048***
	(1.011)	(1.001)	(1.418)	(0.709)	(0.711)	(0.399)	(0.340)
x3	4.074	11.21***	29.57***	12.85***	8.922**	4.908**	2.147*
	(2.728)	(2.667)	(5.872)	(2.893)	(3.216)	(1.346)	(1.050)
Constant	15.72***	17.51***	19.83***	15.66***	15.81***	14.95***	15.20***
	(0.492)	(0.473)	(1.666)	(0.783)	(0.667)	(0.404)	(0.191)
Observations	9	9	9	9	9	9	9
R-squared	0.694	0.677	0.820	0.968	0.967	0.981	0.993

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix F. A New Attempt: ENS Estimation Results of OLS Methodology

Table F.1 ENS Estimation Results of OLS Methodology

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
28.02.2005	0.13594	0.11611	0.11329	0.138	0.16286	0.17937	0.1893	0.19526	0.1988	0.201	0.20238	0.2033	0.20393	0.2044	0.20474	0.205	0.20524	0.20542	0.20558	0.20572	0.2058	0.206	0.208025	-0.05263	0.142136	-0.28133	**0.897**	**0.359**
31.03.2005	0.16385	0.18858	0.18624	0.1925	0.17364	0.15632	0.1421	0.1306	0.1213	0.1137	0.10739	0.1022	0.09775	0.094	0.0908	0.088	0.08561	0.08349	0.08162	0.07994	0.0784	0.0771	0.051468	0.091999	0.115711	0.195462	**0.897**	**0.359**
29.04.2005	0.13619	0.15215	0.1892	0.1796	0.1809	0.17769	0.1729	0.16768	0.1628	0.1583	0.15438	0.151	0.14801	0.1454	0.14322	0.1413	0.13959	0.13809	0.13676	0.13558	0.1345	0.1336	0.115351	0.010357	0.180485	0.030707	**0.897**	**0.359**
31.05.2005	0.13895	0.15158	0.17059	0.1675	0.16422	0.15819	0.1516	0.1453	0.1396	0.1347	0.1304	0.1267	0.12357	0.1208	0.1185	0.1165	0.11467	0.1131	0.1117	0.11046	0.1093	0.1083	0.089242	0.040905	0.156963	0.037982	**0.897**	**0.359**
30.06.2005	0.16489	0.19338	0.16353	0.1864	0.15889	0.13586	0.1181	0.10447	0.0938	0.0853	0.07845	0.0728	0.06809	0.0641	0.06073	0.0578	0.05527	0.05304	0.05107	0.04932	0.0477	0.0463	0.019477	0.120629	0.069879	0.272589	**0.897**	**0.359**
29.07.2005	0.13148	0.13614	0.13111	0.1546	0.15982	0.16121	0.1605	0.15894	0.157	0.1551	0.15332	0.1517	0.15029	0.149	0.14795	0.147	0.14614	0.1454	0.14473	0.14414	0.1436	0.1431	0.134021	-0.00441	0.120499	-0.03611	**0.897**	**0.359**
31.08.2005	0.10404	0.0802	0.08468	0.1197	0.15894	0.1862	0.2039	0.21556	0.2234	0.2289	0.23284	0.2359	0.23822	0.2401	0.24169	0.243	0.24415	0.24513	0.24599	0.24676	0.2474	0.2481	0.259667	-0.13107	0.150175	-0.37158	**0.897**	**0.359**
30.09.2005	0.1331	0.13342	0.11258	0.1433	0.14663	0.14714	0.1461	0.14434	0.1424	0.1405	0.13883	0.1373	0.13596	0.1348	0.13377	0.1329	0.13209	0.13139	0.13078	0.13023	0.1297	0.1293	0.120822	0.01324	0.100291	-0.04768	**0.897**	**0.359**
31.10.2005	0.2004	0.25838	0.18872	0.2126	0.14023	0.08395	0.043	0.01301	-0.01	-0.0269	-0.0406	-0.052	-0.0608	-0.068	-0.0749	-0.08	-0.0853	-0.0895	-0.0932	-0.0966	-0.0995	-0.1022	-0.15288	0.299431	-0.00531	0.678052	**0.897**	**0.359**
30.11.2005	0.16129	0.19033	0.15183	0.1703	0.13418	0.10482	0.0825	0.06562	0.0525	0.0422	0.03381	0.027	0.0213	0.0165	0.01245	0.0089	0.00589	0.00322	0.00086	-0.0012	-0.0031	-0.0048	-0.03698	0.171776	0.060192	0.317139	**0.897**	**0.359**
30.12.2005	0.14435	0.14929	0.09663	0.1426	0.13315	0.12492	0.1182	0.11275	0.1083	0.1047	0.10174	0.0993	0.09717	0.0954	0.09389	0.0926	0.09143	0.09043	0.08954	0.08875	0.088	0.0874	0.075295	0.06436	0.048819	0.054806	**0.897**	**0.359**
31.01.2006	0.10938	0.08474	0.03076	0.1019	0.12951	0.14993	0.1639	0.17359	0.1805	0.1855	0.18939	0.1924	0.19487	0.1969	0.19858	0.2	0.20127	0.20235	0.20331	0.20416	0.2049	0.2056	0.218584	-0.08635	0.059372	-0.29441	**0.897**	**0.359**
28.02.2006	0.08785	0.04141	-0.016	0.0715	0.12338	0.16269	0.1904	0.20998	0.2243	0.2351	0.24341	0.2501	0.25551	0.26	0.26382	0.2671	0.26989	0.27235	0.27452	0.27645	0.2782	0.2797	0.309217	-0.17865	0.064949	-0.53789	**0.897**	**0.359**
31.03.2006	0.09148	0.04889	-0.0156	0.079	0.12862	0.16635	0.1931	0.21223	0.2263	0.2369	0.24519	0.2518	0.25723	0.2617	0.26555	0.2688	0.27163	0.2741	0.27627	0.27821	0.2799	0.2815	0.31108	-0.18023	0.049645	-0.49837	**0.897**	**0.359**
28.04.2006	0.0673	0.01141	-0.0271	0.0596	0.12944	0.18189	0.2187	0.24477	0.2637	0.278	0.28906	0.2979	0.30502	0.311	0.31599	0.3203	0.32399	0.32723	0.33009	0.33263	0.3349	0.3369	0.37578	-0.2559	0.09723	-0.68599	**0.897**	**0.359**
31.05.2006	0.12787	0.12842	0.09086	0.1532	0.16724	0.17649	0.1824	0.18618	0.1887	0.1904	0.19167	0.1926	0.19329	0.1939	0.19432	0.1947	0.19503	0.19532	0.19556	0.19578	0.196	0.1962	0.199488	-0.06956	0.064582	-0.08041	**0.897**	**0.359**
30.06.2006	0.08004	-0.0111	0.05116	0.0804	0.19942	0.28633	0.3457	0.38644	0.4153	0.4366	0.45272	0.4654	0.47555	0.4839	0.49096	0.4969	0.5021	0.50661	0.51057	0.5141	0.5172	0.5201	0.573813	-0.40638	0.280569	-1.18372	**0.897**	**0.359**
31.07.2006	0.0869	0.00467	0.03902	0.081	0.18478	0.26096	0.3131	0.34913	0.3747	0.3936	0.40794	0.4192	0.42832	0.4358	0.44211	0.4475	0.4521	0.45613	0.45969	0.46285	0.4657	0.4682	0.5164	-0.35134	0.231834	-1.04489	**0.897**	**0.359**
31.08.2006	0.08061	-0.0032	0.02677	0.076	0.18304	0.26189	0.3161	0.35373	0.3806	0.4004	0.41561	0.4276	0.43722	0.4452	0.45189	0.4576	0.46252	0.46682	0.47061	0.47398	0.477	0.4797	0.531077	-0.37068	0.224284	-1.06658	**0.897**	**0.359**
29.09.2006	0.22549	0.28329	0.25912	0.2644	0.20795	0.16229	0.1282	0.10271	0.0832	0.068	0.0558	0.0459	0.03764	0.0307	0.02486	0.0198	0.01541	0.01156	0.00817	0.00514	0.0024	3E-06	-0.04629	0.220829	0.061808	0.584039	**0.897**	**0.359**

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
31.10.2006	0.19587	0.23599	0.23667	0.2358	0.20318	0.17506	0.1531	0.13597	0.1225	0.1117	0.10295	0.0957	0.08967	0.0846	0.08019	0.0764	0.07314	0.07027	0.06772	0.06546	0.0634	0.0616	0.026927	0.134997	0.110573	0.353182	**0.897**	**0.359**
30.11.2006	0.2068	0.25666	0.26834	0.2471	0.2007	0.16161	0.1314	0.10807	0.0898	0.0753	0.06352	0.0538	0.04574	0.0389	0.03309	0.0281	0.02371	0.01988	0.01649	0.01348	0.0108	0.0084	-0.03781	0.201514	0.126076	0.468307	**0.897**	**0.359**
29.12.2006	0.31427	0.45415	0.40553	0.3648	0.20403	0.07871	-0.0124	-0.0789	-0.129	-0.1672	-0.1976	-0.222	-0.2422	-0.259	-0.2734	-0.286	-0.2963	-0.3056	-0.3138	-0.3211	-0.3277	-0.3336	-0.44546	0.631783	-0.01433	1.57588	**0.897**	**0.359**
31.01.2007	0.24852	0.33603	0.29283	0.2894	0.19413	0.11919	0.0644	0.02413	-0.006	-0.0296	-0.0482	-0.063	-0.0756	-0.086	-0.0948	-0.102	-0.1089	-0.1146	-0.1197	-0.1242	-0.1282	-0.1319	-0.20082	0.37024	0.017606	0.953388	**0.897**	**0.359**
28.02.2007	0.13345	0.08654	0.048	0.1281	0.18712	0.23122	0.262	0.28371	0.2994	0.3112	0.32028	0.3275	0.33337	0.3382	0.34233	0.3458	0.34885	0.3515	0.35383	0.3559	0.3578	0.3594	0.391076	-0.21334	0.09297	-0.58159	**0.897**	**0.359**
30.03.2007	0.12074	0.08436	0.09862	0.1335	0.18761	0.22603	0.2516	0.26868	0.2805	0.2889	0.29524	0.3001	0.30394	0.3071	0.30968	0.3119	0.3138	0.31545	0.31691	0.3182	0.3194	0.3204	0.340045	-0.18305	0.172768	-0.52233	**0.897**	**0.359**
30.04.2007	0.14165	0.11923	0.10503	0.1494	0.18221	0.20521	0.2203	0.23015	0.2368	0.2415	0.24497	0.2476	0.24963	0.2513	0.25266	0.2538	0.2548	0.25566	0.25642	0.25709	0.2577	0.2582	0.268395	-0.10438	0.120809	-0.32467	**0.897**	**0.359**
31.05.2007	0.17167	0.18432	0.15805	0.188	0.1788	0.16976	0.162	0.15551	0.1501	0.1457	0.14196	0.1388	0.13621	0.134	0.13202	0.1304	0.12889	0.12761	0.12648	0.12547	0.1246	0.1237	0.108242	0.053229	0.083857	0.089626	**0.897**	**0.359**
29.06.2007	0.13555	0.12343	0.12841	0.152	0.17547	0.1906	0.1996	0.20474	0.2077	0.2095	0.21057	0.2112	0.21164	0.2119	0.21212	0.2123	0.21237	0.21245	0.21252	0.21258	0.2126	0.2127	0.213532	-0.06447	0.146632	-0.22904	**0.897**	**0.359**
31.07.2007	0.14875	0.13117	0.0808	0.1475	0.16933	0.18515	0.1958	0.20303	0.2081	0.2117	0.21448	0.2166	0.21833	0.2197	0.2209	0.2219	0.22274	0.22349	0.22415	0.22473	0.2252	0.2257	0.23459	-0.0691	0.060429	-0.22575	**0.897**	**0.359**
31.08.2007	0.1511	0.14053	0.0895	0.1571	0.17417	0.1863	0.1944	0.19983	0.2036	0.2063	0.20832	0.2099	0.21112	0.2121	0.21297	0.2137	0.2143	0.21484	0.21531	0.21573	0.2161	0.2164	0.222791	-0.06094	0.053646	-0.159	**0.897**	**0.359**
28.09.2007	0.13133	0.10455	0.06207	0.1292	0.16281	0.18742	0.2042	0.21582	0.224	0.2301	0.23465	0.2382	0.24115	0.2435	0.24553	0.2472	0.24871	0.24999	0.25112	0.25213	0.253	0.2538	0.269141	-0.11236	0.077704	-0.34027	**0.897**	**0.359**
31.10.2007	0.14099	0.13486	0.09645	0.1474	0.15812	0.16487	0.1687	0.17087	0.172	0.1726	0.17294	0.1731	0.17314	0.1732	0.17314	0.1731	0.1731	0.17307	0.17304	0.17302	0.173	0.173	0.172556	-0.02491	0.073752	-0.11042	**0.897**	**0.359**
30.11.2007	0.15071	0.15207	0.1066	0.1609	0.16405	0.16523	0.1653	0.16482	0.1641	0.1634	0.16264	0.162	0.16138	0.1609	0.16039	0.16	0.15963	0.15931	0.15903	0.15878	0.1586	0.1583	0.154474	-0.00392	0.057272	-0.02535	**0.897**	**0.359**
31.12.2007	0.16475	0.17424	0.10425	0.1714	0.16218	0.15466	0.149	0.14474	0.1415	0.1389	0.13682	0.1351	0.13372	0.1325	0.13154	0.1307	0.12993	0.12927	0.12869	0.12817	0.1277	0.1273	0.119373	0.037046	0.013495	0.094463	**0.897**	**0.359**
31.01.2008	0.16301	0.1678	0.07399	0.164	0.15875	0.15508	0.1528	0.15129	0.1503	0.1497	0.14925	0.1489	0.14867	0.1485	0.14831	0.1482	0.14807	0.14797	0.14788	0.14781	0.1477	0.1477	0.146537	0.01196	-0.02366	0.061105	**0.897**	**0.359**
29.02.2008	0.17161	0.1844	0.09504	0.178	0.16505	0.1553	0.1485	0.14377	0.1403	0.1378	0.13584	0.1343	0.13302	0.132	0.1311	0.1303	0.1297	0.12913	0.12863	0.12819	0.1278	0.1274	0.120658	0.039359	-0.02111	0.143389	**0.897**	**0.359**
31.03.2008	0.17222	0.17964	0.10685	0.1841	0.18135	0.17892	0.1771	0.17571	0.1747	0.1739	0.1732	0.1727	0.17223	0.1719	0.17154	0.1713	0.17103	0.17082	0.17064	0.17047	0.1703	0.1702	0.167694	-0.00137	0.007084	0.055473	**0.897**	**0.359**
30.04.2008	0.17815	0.18297	0.1201	0.187	0.18536	0.18343	0.1817	0.18014	0.1789	0.1778	0.17685	0.1761	0.17541	0.1748	0.17436	0.1739	0.17357	0.17324	0.17296	0.1727	0.1725	0.1723	0.168339	0.006147	0.026478	0.027917	**0.897**	**0.359**
30.05.2008	0.16765	0.16426	0.10268	0.1805	0.19278	0.20154	0.2075	0.21172	0.2147	0.2169	0.2186	0.2199	0.221	0.2219	0.22263	0.2233	0.22381	0.22429	0.22471	0.22508	0.2254	0.2257	0.231401	-0.05924	0.029845	-0.08515	**0.897**	**0.359**
30.06.2008	0.25238	0.33996	0.30129	0.3046	0.21657	0.14705	0.0962	0.05884	0.0307	0.009	-0.0082	-0.022	-0.0336	-0.043	-0.0513	-0.058	-0.0644	-0.0697	-0.0744	-0.0786	-0.0823	-0.0857	-0.14961	0.323896	0.020449	0.921091	**0.897**	**0.359**
31.07.2008	0.15243	0.12681	0.0666	0.1488	0.18075	0.20466	0.2214	0.23322	0.2418	0.2482	0.25323	0.2572	0.26041	0.2631	0.26534	0.2673	0.26893	0.27039	0.27167	0.27281	0.2738	0.2748	0.292184	-0.11564	0.047207	-0.31495	**0.897**	**0.359**
29.08.2008	0.18044	0.18272	0.11574	0.1835	0.18175	0.17988	0.1782	0.17674	0.1755	0.1745	0.17359	0.1728	0.17222	0.1717	0.17122	0.1708	0.17047	0.17016	0.16989	0.16965	0.1694	0.1692	0.165513	0.013137	0.022809	0.013925	**0.897**	**0.359**
29.09.2008	0.17597	0.17496	0.11401	0.1828	0.18776	0.19088	0.1927	0.19373	0.1943	0.1947	0.19485	0.195	0.19503	0.1951	0.19509	0.1951	0.19512	0.19513	0.19513	0.19514	0.1951	0.1951	0.195191	-0.01752	0.032745	-0.03939	**0.897**	**0.359**

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
31.10.2008	0.25253	0.31214	0.27866	0.2987	0.24504	0.20184	0.1699	0.14614	0.1281	0.1141	0.103	0.0939	0.08645	0.0802	0.07483	0.0702	0.06626	0.06277	0.05969	0.05695	0.0545	0.0523	0.010328	0.190144	0.041841	0.590051	**0.897**	**0.359**
28.11.2008	0.16627	0.16372	0.11935	0.1834	0.19657	0.20541	0.2111	0.21474	0.2172	0.2189	0.22008	0.221	0.22169	0.2222	0.22271	0.2231	0.22342	0.2237	0.22395	0.22417	0.2244	0.2245	0.227892	-0.05742	0.057469	-0.09337	**0.897**	**0.359**
31.12.2008	0.18316	0.20144	0.08796	0.1842	0.16131	0.1447	0.1335	0.12591	0.1206	0.1167	0.11383	0.1116	0.10976	0.1083	0.10704	0.106	0.10508	0.10429	0.1036	0.10298	0.1024	0.1019	0.092525	0.073195	-0.06246	0.235451	**0.897**	**0.359**
30.01.2009	0.15002	0.18623	0.10391	0.1794	0.14919	0.12579	0.1092	0.09744	0.0888	0.0823	0.07727	0.0732	0.06994	0.0672	0.06489	0.0629	0.06119	0.05969	0.05837	0.05719	0.0561	0.0552	0.037219	0.081126	-0.02723	0.36648	**0.897**	**0.359**
27.02.2009	0.14273	0.17371	0.08768	0.1755	0.15493	0.1391	0.1281	0.12056	0.1152	0.1112	0.10814	0.1057	0.1038	0.1022	0.10085	0.0997	0.09871	0.09784	0.09708	0.0964	0.0958	0.0952	0.084869	0.031447	-0.03332	0.293912	**0.897**	**0.359**
31.03.2009	0.0984	0.0903	0.0146	0.117	0.14029	0.15802	0.171	0.1805	0.1877	0.1933	0.19773	0.2013	0.20427	0.2067	0.20884	0.2106	0.2122	0.21357	0.21478	0.21585	0.2168	0.2177	0.234113	-0.12629	0.004476	-0.15366	**0.897**	**0.359**
30.04.2009	0.13921	0.18245	0.0734	0.1646	0.12322	0.09218	0.0707	0.05577	0.0451	0.0371	0.03107	0.0263	0.02239	0.0192	0.01648	0.0142	0.01219	0.01045	0.00892	0.00756	0.0063	0.0053	-0.01552	0.11586	-0.0742	0.474967	**0.897**	**0.359**
29.05.2009	0.14287	0.18343	0.08402	0.1657	0.12586	0.09567	0.0745	0.05965	0.0489	0.0408	0.03456	0.0296	0.02557	0.0222	0.0194	0.017	0.01491	0.01309	0.01148	0.01006	0.0088	0.0076	-0.01417	0.120532	-0.05545	0.44516	**0.897**	**0.359**
30.06.2009	0.06567	0.04603	-0.0307	0.0801	0.11667	0.14465	0.165	0.17992	0.1911	0.1998	0.20666	0.2122	0.21677	0.2206	0.22382	0.2266	0.229	0.23111	0.23297	0.23462	0.2361	0.2374	0.262748	-0.17708	0.008581	-0.28452	**0.897**	**0.359**
31.07.2009	0.08759	0.09457	0.00943	0.1031	0.10407	0.10487	0.1057	0.1066	0.1074	0.1081	0.10871	0.1092	0.10969	0.1101	0.1104	0.1107	0.11095	0.11117	0.11136	0.11154	0.1117	0.1118	0.114534	-0.03216	-0.0158	0.044747	**0.897**	**0.359**
31.08.2009	0.06918	0.06331	-0.0268	0.0808	0.09712	0.10996	0.1196	0.12697	0.1327	0.1371	0.14074	0.1437	0.14613	0.1482	0.14995	0.1515	0.15277	0.15392	0.15493	0.15583	0.1566	0.1574	0.171195	-0.09543	-0.01828	-0.10123	**0.897**	**0.359**
30.09.2009	0.11282	0.15481	0.03948	0.1322	0.08885	0.05651	0.0342	0.01867	0.0076	-0.0006	-0.0069	-0.012	-0.0159	-0.019	-0.022	-0.024	-0.0264	-0.0282	-0.0298	-0.0312	-0.0325	-0.0336	-0.05502	0.129572	-0.08201	0.478604	**0.897**	**0.359**
30.10.2009	0.10496	0.13986	0.0368	0.1234	0.08872	0.06261	0.0445	0.03178	0.0227	0.0159	0.01066	0.0065	0.00318	0.0004	-0.0019	-0.004	-0.0056	-0.0071	-0.0085	-0.0096	-0.0107	-0.0116	-0.02963	0.103031	-0.05791	0.38865	**0.897**	**0.359**
26.11.2009	0.09733	0.1272	0.03319	0.1169	0.08934	0.06846	0.0539	0.04369	0.0363	0.0308	0.02658	0.0232	0.02049	0.0182	0.01632	0.0147	0.01328	0.01205	0.01097	0.01	0.0091	0.0084	-0.00635	0.077047	-0.04092	0.32001	**0.897**	**0.359**
31.12.2009	0.1131	0.15934	0.05091	0.1379	0.09206	0.05751	0.0335	0.01665	0.0045	-0.0045	-0.0115	-0.017	-0.0214	-0.025	-0.0282	-0.031	-0.0332	-0.0352	-0.037	-0.0386	-0.04	-0.0412	-0.06525	0.136585	-0.07394	0.513256	**0.897**	**0.359**
29.01.2010	0.06916	0.07146	-0.0202	0.0809	0.08616	0.09049	0.094	0.09693	0.0993	0.1012	0.10284	0.1042	0.10531	0.1063	0.10709	0.1078	0.10841	0.10896	0.10944	0.10986	0.1102	0.1106	0.117129	-0.04914	-0.02377	-0.00014	**0.897**	**0.359**
26.02.2010	0.07303	0.08182	-0.0104	0.0889	0.08796	0.08753	0.0877	0.08817	0.0888	0.0894	0.08992	0.0904	0.09086	0.0912	0.09158	0.0919	0.09214	0.09236	0.09257	0.09275	0.0929	0.0931	0.095842	-0.02975	-0.02885	0.068815	**0.897**	**0.359**
31.03.2010	0.07854	0.09146	-0.0092	0.0938	0.08712	0.08257	0.08	0.07855	0.0778	0.0775	0.0773	0.0772	0.07723	0.0772	0.07728	0.0773	0.07735	0.07738	0.07741	0.07744	0.0775	0.0775	0.077941	-0.01038	-0.04471	0.125022	**0.897**	**0.359**
30.04.2010	0.06617	0.06694	-0.0005	0.0813	0.08973	0.09568	0.0998	0.10276	0.1049	0.1065	0.10777	0.1088	0.10958	0.1102	0.11081	0.1113	0.11171	0.11207	0.1124	0.11268	0.1129	0.1132	0.117519	-0.05061	0.017189	-0.03784	**0.897**	**0.359**
31.05.2010	0.0757	0.07728	-0.0069	0.0853	0.08976	0.09322	0.0959	0.09805	0.0997	0.1011	0.1022	0.1031	0.10388	0.1045	0.10508	0.1056	0.10597	0.10633	0.10665	0.10693	0.1072	0.1074	0.111791	-0.03671	-0.00958	-0.00617	**0.897**	**0.359**
30.06.2010	0.07724	0.08135	0.00056	0.0869	0.08761	0.08813	0.0886	0.08905	0.0894	0.0898	0.09006	0.0903	0.0905	0.0907	0.09083	0.091	0.09108	0.09118	0.09127	0.09134	0.0914	0.0915	0.092695	-0.01847	-0.00465	0.023926	**0.897**	**0.359**
30.07.2010	0.07687	0.08059	-0.0062	0.0826	0.08156	0.08092	0.0807	0.08063	0.0807	0.0808	0.08097	0.0811	0.08122	0.0813	0.08142	0.0815	0.08158	0.08165	0.08171	0.08176	0.0818	0.0819	0.082671	-0.00885	-0.0132	0.032326	**0.897**	**0.359**
31.08.2010	0.07427	0.07742	-0.0074	0.0808	0.08093	0.08116	0.0815	0.08186	0.0822	0.0825	0.08284	0.0831	0.08331	0.0835	0.08366	0.0838	0.08393	0.08404	0.08414	0.08422	0.0843	0.0844	0.085705	-0.01386	-0.00996	0.022355	**0.897**	**0.359**
30.09.2010	0.07477	0.07793	-0.0119	0.08	0.07954	0.07946	0.0797	0.08005	0.0805	0.0808	0.08121	0.0815	0.08181	0.0821	0.08227	0.0825	0.08262	0.08276	0.08289	0.08301	0.0831	0.0832	0.084962	-0.01276	-0.01803	0.027897	**0.897**	**0.359**

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
28.10.2010	0.07079	0.06857	-0.0201	0.0711	0.07469	0.07772	0.0801	0.08198	0.0835	0.0847	0.08565	0.0865	0.08714	0.0877	0.0882	0.0886	0.08899	0.08932	0.0896	0.08986	0.0901	0.0903	0.094182	-0.0213	-0.01198	-0.02534	**0.897**	**0.359**
30.11.2010	0.06635	0.06466	-0.0195	0.071	0.07661	0.081	0.0843	0.08684	0.0888	0.0903	0.09157	0.0926	0.09343	0.0941	0.09474	0.0953	0.09571	0.0961	0.09645	0.09676	0.097	0.0973	0.102051	-0.03369	-0.00631	-0.03272	**0.897**	**0.359**
31.12.2010	0.06552	0.06651	-0.0352	0.0677	0.06886	0.0704	0.0721	0.07367	0.0751	0.0764	0.07749	0.0784	0.07923	0.0799	0.08052	0.081	0.0815	0.0819	0.08226	0.08257	0.0829	0.0831	0.087976	-0.02331	-0.03657	0.014057	**0.897**	**0.359**
31.01.2011	0.06685	0.07074	-0.0113	0.079	0.08177	0.0839	0.0856	0.087	0.0881	0.0891	0.08981	0.0904	0.09098	0.0914	0.09182	0.0921	0.09244	0.09269	0.09292	0.09312	0.0933	0.0935	0.096526	-0.03226	-0.00785	0.014748	**0.897**	**0.359**
28.02.2011	0.06684	0.0674	0.00602	0.0798	0.08676	0.09139	0.0944	0.09636	0.0977	0.0986	0.09933	0.0999	0.10026	0.1006	0.10086	0.1011	0.10128	0.10145	0.1016	0.10173	0.1019	0.102	0.103959	-0.03634	0.028744	-0.03685	**0.897**	**0.359**
31.03.2011	0.07539	0.0763	0.00923	0.0847	0.08898	0.09176	0.0935	0.09465	0.0954	0.0959	0.09627	0.0965	0.09675	0.0969	0.09705	0.0972	0.09726	0.09734	0.09741	0.09747	0.0975	0.0976	0.098546	-0.02307	0.020384	-0.02015	**0.897**	**0.359**
29.04.2011	0.07684	0.07977	-0.0012	0.084	0.08481	0.08535	0.0858	0.08624	0.0866	0.0869	0.08715	0.0874	0.08754	0.0877	0.08782	0.0879	0.08804	0.08812	0.0882	0.08827	0.0883	0.0884	0.089438	-0.01471	-0.00347	0.016098	**0.897**	**0.359**
31.05.2011	0.07398	0.07482	0.0088	0.0841	0.08904	0.09226	0.0943	0.09566	0.0966	0.0972	0.09764	0.098	0.09824	0.0984	0.09862	0.0988	0.09889	0.099	0.09909	0.09917	0.0992	0.0993	0.10057	-0.02636	0.021849	-0.02379	**0.897**	**0.359**
30.06.2011	0.0739	0.0735	0.01196	0.0841	0.09056	0.09481	0.0975	0.09923	0.1004	0.1011	0.1017	0.1021	0.10241	0.1027	0.10286	0.103	0.10318	0.1033	0.10341	0.1035	0.1036	0.1037	0.105118	-0.02977	0.030028	-0.0411	**0.897**	**0.359**
29.07.2011	0.07632	0.07711	0.00437	0.0847	0.08876	0.09159	0.0935	0.09487	0.0958	0.0965	0.0971	0.0975	0.09788	0.0982	0.0984	0.0986	0.09879	0.09894	0.09908	0.0992	0.0993	0.0994	0.101245	-0.02485	0.011023	-0.0168	**0.897**	**0.359**
29.08.2011	0.06496	0.05982	-0.0112	0.0698	0.07961	0.08681	0.0918	0.09535	0.0979	0.0998	0.10129	0.1025	0.10341	0.1042	0.10487	0.1054	0.10592	0.10635	0.10673	0.10706	0.1074	0.1076	0.112751	-0.04242	0.017682	-0.08088	**0.897**	**0.359**
30.09.2011	0.06056	0.05402	-0.0074	0.0693	0.08314	0.09313	0.1	0.1047	0.1081	0.1106	0.11246	0.114	0.11516	0.1162	0.11699	0.1177	0.11831	0.11884	0.11932	0.11973	0.1201	0.1204	0.12682	-0.05913	0.033107	-0.11274	**0.897**	**0.359**
31.10.2011	0.09031	0.08591	0.01915	0.0912	0.0972	0.1013	0.1039	0.10558	0.1067	0.1074	0.10791	0.1083	0.10858	0.1088	0.109	0.1092	0.10929	0.1094	0.1095	0.10959	0.1097	0.1097	0.111089	-0.01643	0.026457	-0.06263	**0.897**	**0.359**
30.11.2011	0.09571	0.09558	0.03628	0.1011	0.10385	0.10518	0.1057	0.10566	0.1054	0.1051	0.10483	0.1045	0.10425	0.104	0.10377	0.1036	0.10339	0.10324	0.1031	0.10297	0.1029	0.1028	0.100838	-0.00438	0.035925	-0.02524	**0.897**	**0.359**
30.12.2011	0.10116	0.10048	0.04768	0.1054	0.10777	0.10862	0.1085	0.10804	0.1074	0.1066	0.10597	0.1054	0.10481	0.1043	0.10391	0.1035	0.10322	0.10293	0.10268	0.10245	0.1022	0.1021	0.098548	0.00381	0.047888	-0.03129	**0.897**	**0.359**
31.01.2012	0.09972	0.10175	0.00562	0.0969	0.0929	0.09035	0.0888	0.08797	0.0875	0.0872	0.087	0.0869	0.08682	0.0868	0.08675	0.0867	0.08671	0.0867	0.08668	0.08668	0.0867	0.0867	0.086538	0.010917	-0.02501	0.038658	**0.897**	**0.359**
29.02.2012	0.08041	0.07747	0.00925	0.0842	0.0901	0.09421	0.0969	0.09868	0.0999	0.1007	0.10135	0.1018	0.10219	0.1025	0.10274	0.1029	0.10313	0.10328	0.10342	0.10354	0.1036	0.1037	0.10559	-0.02196	0.022178	-0.05193	**0.897**	**0.359**
30.03.2012	0.09155	0.08863	0.00866	0.0899	0.09281	0.095	0.0965	0.09759	0.0984	0.0989	0.0994	0.0998	0.10004	0.1003	0.10048	0.1007	0.1008	0.10093	0.10105	0.10115	0.1012	0.1013	0.102883	-0.00869	0.00419	-0.03223	**0.897**	**0.359**
30.04.2012	0.09258	0.09146	0.01241	0.0916	0.09233	0.09283	0.0931	0.09329	0.0934	0.0934	0.09346	0.0935	0.09347	0.0935	0.09348	0.0935	0.09348	0.09348	0.09347	0.09347	0.0935	0.0935	0.093454	0.000117	0.00488	-0.01197	**0.897**	**0.359**
31.05.2012	0.09995	0.09698	0.01099	0.0932	0.09296	0.09298	0.093	0.09308	0.0931	0.0932	0.09318	0.0932	0.09324	0.0933	0.09328	0.0933	0.09331	0.09332	0.09334	0.09335	0.0934	0.0934	0.093529	0.008596	-0.00397	-0.01616	**0.897**	**0.359**
29.06.2012	0.08713	0.08457	0.00135	0.0841	0.08572	0.08702	0.088	0.08868	0.0892	0.0896	0.08993	0.0902	0.0904	0.0906	0.09073	0.0909	0.09097	0.09107	0.09116	0.09124	0.0913	0.0914	0.092557	-0.00329	-0.00097	-0.0225	**0.897**	**0.359**
31.07.2012	0.07848	0.08029	-0.0111	0.0784	0.07631	0.07505	0.0744	0.07409	0.074	0.074	0.07398	0.074	0.07409	0.0741	0.0742	0.0742	0.07429	0.07433	0.07436	0.07439	0.0744	0.0744	0.074942	0.001758	-0.01787	0.026506	**0.897**	**0.359**
31.08.2012	0.05832	0.05583	-0.0051	0.0677	0.07648	0.08249	0.0864	0.08907	0.0909	0.0921	0.09307	0.0938	0.09436	0.0948	0.0952	0.0955	0.0958	0.09604	0.09625	0.09644	0.0966	0.0968	0.099598	-0.03793	0.032164	-0.06485	**0.897**	**0.359**
28.09.2012	0.05579	0.0523	-0.0088	0.0646	0.07437	0.08116	0.0857	0.0887	0.0908	0.0923	0.09343	0.0943	0.09499	0.0955	0.09601	0.0964	0.09675	0.09705	0.09731	0.09754	0.0977	0.0979	0.10144	-0.0414	0.032436	-0.07553	**0.897**	**0.359**

Date/Maturity (year)	**0.08**	**0.25**	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**	**6.5**	**7**	**7.5**	**8**	**8.5**	**9**	**9.5**	**10**	**Beta 0**	**Beta 1**	**Beta 2**	**Beta 3**	**Lambda 1**	**Lambda 2**
31.10.2012	0.0519	0.0481	-0.0196	0.0597	0.06956	0.07664	0.0815	0.08493	0.0874	0.0892	0.09059	0.0917	0.09258	0.0933	0.09394	0.0945	0.09492	0.09532	0.09567	0.09598	0.0963	0.0965	0.101259	-0.04496	0.021555	-0.07397	**0.897**	**0.359**
30.11.2012	0.05142	0.04766	-0.0366	0.0527	0.05884	0.06369	0.0673	0.07	0.0721	0.0737	0.07497	0.076	0.07689	0.0776	0.07824	0.0788	0.07924	0.07964	0.08	0.08032	0.0806	0.0809	0.085741	-0.03065	-0.00426	-0.04883	**0.897**	**0.359**
31.12.2012	0.05871	0.05808	-0.0247	0.0599	0.06164	0.06302	0.0641	0.06488	0.0655	0.066	0.06641	0.0667	0.06702	0.0672	0.06745	0.0676	0.06777	0.0679	0.06801	0.06811	0.0682	0.0683	0.069849	-0.01044	-0.00279	-0.0105	**0.897**	**0.359**
31.01.2013	0.05378	0.05338	-0.0353	0.0557	0.05793	0.05987	0.0615	0.06283	0.0639	0.0648	0.06557	0.0662	0.06673	0.0672	0.06756	0.0679	0.06818	0.06844	0.06866	0.06886	0.069	0.0692	0.072282	-0.01799	-0.01337	-0.00741	**0.897**	**0.359**
28.02.2013	0.04983	0.04681	-0.0416	0.0509	0.05605	0.0603	0.0636	0.06609	0.0681	0.0696	0.07092	0.072	0.07284	0.0736	0.07421	0.0748	0.07522	0.07564	0.076	0.07633	0.0766	0.0769	0.081873	-0.02913	-0.01156	-0.03739	**0.897**	**0.359**
29.03.2013	0.05725	0.05392	-0.0278	0.0579	0.06294	0.06684	0.0697	0.07177	0.0733	0.0746	0.07552	0.0763	0.07694	0.0775	0.07793	0.0783	0.07866	0.07896	0.07922	0.07945	0.0797	0.0799	0.083415	-0.02294	0.000327	-0.04283	**0.897**	**0.359**
30.04.2013	0.04558	0.04423	-0.0417	0.0484	0.05242	0.05564	0.0581	0.06005	0.0616	0.0628	0.06376	0.0646	0.06524	0.0658	0.06629	0.0667	0.06707	0.06739	0.06767	0.06792	0.0681	0.0683	0.072184	-0.0251	-0.00862	-0.02273	**0.897**	**0.359**
31.05.2013	0.04847	0.04671	-0.0185	0.0562	0.06296	0.06763	0.0707	0.07272	0.0741	0.0751	0.07582	0.0764	0.07682	0.0772	0.07747	0.0777	0.07793	0.07811	0.07828	0.07842	0.0786	0.0787	0.080862	-0.02992	0.025181	-0.04937	**0.897**	**0.359**
28.06.2013	0.05555	0.05372	0.00384	0.069	0.07906	0.08567	0.0898	0.09244	0.0941	0.0953	0.09605	0.0966	0.09706	0.0974	0.09768	0.0979	0.0981	0.09826	0.09841	0.09854	0.0987	0.0988	0.100696	-0.04198	0.049272	-0.07232	**0.897**	**0.359**
31.07.2013	0.06315	0.05882	0.02562	0.078	0.09155	0.10031	0.1056	0.10878	0.1107	0.1119	0.11269	0.1132	0.11357	0.1138	0.11405	0.1142	0.11435	0.11446	0.11456	0.11464	0.1147	0.1148	0.116047	-0.04715	0.078454	-0.11341	**0.897**	**0.359**
29.08.2013	0.07923	0.08023	0.02168	0.0909	0.09624	0.09953	0.1015	0.1026	0.1033	0.1037	0.10392	0.1041	0.10418	0.1043	0.1043	0.1043	0.10437	0.10439	0.10441	0.10443	0.1044	0.1045	0.104699	-0.02522	0.034075	-0.02892	**0.897**	**0.359**
30.09.2013	0.05964	0.05646	0.01191	0.0742	0.08649	0.09469	0.0999	0.10315	0.1053	0.1067	0.10774	0.1085	0.10905	0.1095	0.10985	0.1102	0.11041	0.11063	0.11082	0.11099	0.1111	0.1113	0.113858	-0.04965	0.058517	-0.09395	**0.897**	**0.359**
31.10.2013	0.06162	0.06099	-0.0098	0.0707	0.07709	0.08164	0.0848	0.08698	0.0886	0.0898	0.09067	0.0914	0.09198	0.0925	0.09287	0.0932	0.09351	0.09378	0.09401	0.09421	0.0944	0.0946	0.09768	-0.03458	0.014521	-0.03691	**0.897**	**0.359**
29.11.2013	0.06823	0.06566	0.0155	0.0799	0.0897	0.09616	0.1002	0.1027	0.1043	0.1054	0.1061	0.1066	0.10702	0.1073	0.10757	0.1078	0.10794	0.10809	0.10821	0.10833	0.1084	0.1085	0.110212	-0.0383	0.049852	-0.07616	**0.897**	**0.359**
31.12.2013	0.0727	0.07026	0.0333	0.0887	0.10064	0.10827	0.1129	0.11558	0.1172	0.1182	0.1189	0.1193	0.11963	0.1198	0.12001	0.1201	0.12024	0.12033	0.1204	0.12047	0.1205	0.1206	0.121549	-0.0448	0.070752	-0.09186	**0.897**	**0.359**
31.01.2014	0.10298	0.10552	0.04053	0.1082	0.10743	0.10624	0.105	0.10389	0.1029	0.102	0.1013	0.1007	0.10013	0.0997	0.09927	0.0989	0.09861	0.09835	0.09811	0.0979	0.0977	0.0975	0.094288	0.006858	0.025201	0.010479	**0.897**	**0.359**
28.02.2014	0.12016	0.12463	0.02253	0.1141	0.10492	0.09855	0.0944	0.09165	0.0898	0.0885	0.08754	0.0868	0.08625	0.0858	0.08541	0.0851	0.08482	0.08458	0.08437	0.08418	0.084	0.0839	0.081053	0.034196	-0.0348	0.080044	**0.897**	**0.359**
31.03.2014	0.10775	0.10338	0.02464	0.1025	0.10486	0.10662	0.1078	0.1085	0.109	0.1093	0.10955	0.1097	0.10987	0.11	0.11007	0.1101	0.11021	0.11026	0.11031	0.11036	0.1104	0.1104	0.111099	0.000329	0.008414	-0.04045	**0.897**	**0.359**
30.04.2014	0.09033	0.08702	0.00436	0.0879	0.09083	0.09318	0.0949	0.09612	0.097	0.0978	0.09832	0.0988	0.09914	0.0995	0.09972	0.0999	0.10014	0.10032	0.10047	0.1006	0.1007	0.1008	0.102898	-0.00966	3.76E-05	-0.03356	**0.897**	**0.359**
30.05.2014	0.08264	0.07868	-0.0079	0.08	0.08389	0.0871	0.0895	0.09137	0.0928	0.0939	0.09481	0.0955	0.09615	0.0967	0.09711	0.0975	0.09781	0.0981	0.09835	0.09858	0.0988	0.099	0.102419	-0.0163	-0.00649	-0.03945	**0.897**	**0.359**
30.06.2014	0.08083	0.07882	-0.0101	0.0792	0.08128	0.08314	0.0847	0.08588	0.0869	0.0877	0.08835	0.0889	0.08937	0.0898	0.09011	0.0904	0.09066	0.09089	0.09109	0.09127	0.0914	0.0916	0.094291	-0.01175	-0.01165	-0.01742	**0.897**	**0.359**
31.07.2014	0.05522	0.04781	0.01105	0.0681	0.08476	0.09605	0.1032	0.10785	0.1109	0.1129	0.11441	0.1155	0.11633	0.117	0.11753	0.118	0.11837	0.1187	0.11899	0.11925	0.1195	0.1197	0.123588	-0.05989	0.074241	-0.14469	**0.897**	**0.359**
29.08.2014	0.07822	0.07573	0.01068	0.0828	0.08855	0.09239	0.0948	0.09634	0.0973	0.098	0.09846	0.0988	0.09905	0.0993	0.09942	0.0996	0.09967	0.09977	0.09986	0.09994	0.1	0.1001	0.101229	-0.02012	0.027131	-0.04993	**0.897**	**0.359**
30.09.2014	0.08817	0.08999	0.0224	0.0951	0.09653	0.09715	0.0973	0.0973	0.0972	0.097	0.0968	0.0966	0.09647	0.0963	0.0962	0.0961	0.09599	0.0959	0.09582	0.09575	0.0957	0.0956	0.094558	-0.00739	0.020211	-0.00206	**0.897**	**0.359**

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
31.10.2014	0.08123	0.07868	-0.0023	0.08	0.08262	0.08465	0.0861	0.08714	0.0879	0.0885	0.08894	0.0893	0.0896	0.0898	0.09005	0.0902	0.09039	0.09052	0.09064	0.09075	0.0908	0.0909	0.092553	-0.00901	0.002171	-0.02819	**0.897**	**0.359**
28.11.2014	0.07013	0.06842	-0.0084	0.0715	0.07456	0.07675	0.0782	0.07926	0.08	0.0805	0.08091	0.0812	0.08148	0.0817	0.08186	0.082	0.08213	0.08224	0.08234	0.08243	0.0825	0.0826	0.083895	-0.01199	0.007942	-0.02671	**0.897**	**0.359**
31.12.2014	0.08637	0.08365	-0.004	0.0802	0.08019	0.08038	0.0806	0.08082	0.081	0.0812	0.0813	0.0814	0.08153	0.0816	0.0817	0.0818	0.08182	0.08188	0.08192	0.08197	0.082	0.082	0.082675	0.005669	-0.00714	-0.01415	**0.897**	**0.359**
30.01.2015	0.07619	0.07352	-0.0217	0.0689	0.06845	0.06857	0.0689	0.06936	0.0698	0.0702	0.07054	0.0709	0.07113	0.0714	0.07158	0.0718	0.07192	0.07206	0.07219	0.0723	0.0724	0.0725	0.074202	0.003778	-0.01988	-0.00755	**0.897**	**0.359**
27.02.2015	0.0838	0.07847	0.00494	0.0801	0.08456	0.08776	0.0898	0.09118	0.0921	0.0927	0.09311	0.0934	0.0937	0.0939	0.09407	0.0942	0.09433	0.09443	0.09453	0.09461	0.0947	0.0947	0.095981	-0.00742	0.017097	-0.05861	**0.897**	**0.359**
31.03.2015	0.09144	0.08974	0.00101	0.0856	0.08438	0.08372	0.0834	0.08316	0.0831	0.083	0.08298	0.083	0.08297	0.083	0.08298	0.083	0.08299	0.083	0.083	0.08301	0.083	0.083	0.083105	0.009365	-0.00956	-0.00194	**0.897**	**0.359**
30.04.2015	0.10243	0.10107	0.01993	0.098	0.09683	0.09597	0.0953	0.09473	0.0943	0.0939	0.09362	0.0934	0.09316	0.093	0.09283	0.0927	0.09259	0.09249	0.0924	0.09232	0.0923	0.0922	0.090991	0.012314	0.002865	-0.0045	**0.897**	**0.359**
29.05.2015	0.09062	0.08819	0.02362	0.0919	0.0953	0.09734	0.0984	0.09889	0.0991	0.0991	0.09906	0.099	0.09889	0.0988	0.09871	0.0986	0.09856	0.0985	0.09844	0.09839	0.0983	0.0983	0.097493	-0.00435	0.029402	-0.04012	**0.897**	**0.359**
30.06.2015	0.09852	0.09725	0.02062	0.0964	0.09642	0.09632	0.0961	0.09583	0.0956	0.0953	0.09509	0.0949	0.09472	0.0946	0.09445	0.0943	0.09424	0.09415	0.09407	0.09401	0.0939	0.0939	0.092839	0.006707	0.009625	-0.01153	**0.897**	**0.359**
31.07.2015	0.09175	0.08826	0.02645	0.0937	0.09879	0.10207	0.104	0.10504	0.1056	0.1059	0.10612	0.1062	0.10626	0.1063	0.10629	0.1063	0.10629	0.10628	0.10628	0.10627	0.1063	0.1063	0.106169	-0.01082	0.034295	-0.05605	**0.897**	**0.359**
31.08.2015	0.08921	0.08586	0.04762	0.0987	0.10755	0.11288	0.1158	0.11719	0.1178	0.1181	0.11809	0.118	0.11787	0.1177	0.11759	0.1175	0.11733	0.11722	0.11712	0.11703	0.1169	0.1169	0.115435	-0.02192	0.071751	-0.08454	**0.897**	**0.359**
30.09.2015	0.11394	0.1167	0.03641	0.1147	0.11142	0.10882	0.1069	0.10551	0.1044	0.1036	0.10298	0.1025	0.10202	0.1017	0.10135	0.1011	0.10086	0.10066	0.10048	0.10032	0.1002	0.1001	0.097644	0.013757	0.000575	0.031444	**0.897**	**0.359**
30.10.2015	0.10419	0.10369	0.02046	0.101	0.0997	0.09875	0.0981	0.09757	0.0972	0.0969	0.09668	0.0965	0.09635	0.0962	0.09612	0.096	0.09595	0.09588	0.09582	0.09577	0.0957	0.0957	0.094854	0.009519	-0.00164	0.00324	**0.897**	**0.359**
30.11.2015	0.11079	0.11272	0.02394	0.1076	0.1031	0.09993	0.0978	0.0963	0.0953	0.0945	0.09392	0.0935	0.0931	0.0928	0.09256	0.0923	0.09216	0.092	0.09186	0.09174	0.0916	0.0915	0.089623	0.018995	-0.01205	0.03564	**0.897**	**0.359**
31.12.2015	0.10548	0.10758	0.02959	0.108	0.10654	0.10533	0.1044	0.10368	0.1031	0.1027	0.10232	0.102	0.10178	0.1016	0.1014	0.1012	0.10111	0.101	0.10089	0.1008	0.1007	0.1006	0.099241	0.004495	0.004063	0.017756	**0.897**	**0.359**
29.01.2016	0.09702	0.09565	0.03151	0.1021	0.10661	0.10945	0.1111	0.11211	0.1127	0.113	0.11322	0.1133	0.11343	0.1135	0.11352	0.1136	0.11357	0.11359	0.11361	0.11362	0.1136	0.1136	0.113817	-0.01493	0.028094	-0.03783	**0.897**	**0.359**
29.02.2016	0.09049	0.08873	0.03777	0.0996	0.10666	0.11102	0.1135	0.1149	0.1156	0.116	0.11625	0.1163	0.11639	0.1164	0.11639	0.1164	0.11637	0.11635	0.11633	0.11632	0.1163	0.1163	0.116032	-0.02287	0.049288	-0.05883	**0.897**	**0.359**
31.03.2016	0.0981	0.09572	0.01213	0.0952	0.09669	0.0979	0.0988	0.09946	0.1	0.1004	0.10067	0.1009	0.10114	0.1013	0.10146	0.1016	0.1017	0.1018	0.10189	0.10197	0.102	0.1021	0.103277	-0.00321	-0.00174	-0.0205	**0.897**	**0.359**
29.04.2016	0.08885	0.08729	0.00664	0.0881	0.08979	0.09104	0.0919	0.09253	0.093	0.0933	0.09358	0.0938	0.09396	0.0941	0.09422	0.0943	0.09441	0.09449	0.09456	0.09462	0.0947	0.0947	0.095646	-0.00537	0.002121	-0.01762	**0.897**	**0.359**
31.05.2016	0.09446	0.09561	0.00015	0.0935	0.092	0.0913	0.0911	0.09128	0.0915	0.0918	0.0921	0.0924	0.09261	0.0928	0.09301	0.0932	0.09332	0.09345	0.09356	0.09367	0.0938	0.0938	0.095428	-0.00224	-0.0244	0.02237	**0.897**	**0.359**
30.06.2016	0.09113	0.09183	-0.0077	0.0877	0.08531	0.08411	0.0837	0.08361	0.0838	0.084	0.08425	0.0845	0.08472	0.0849	0.08511	0.0853	0.08542	0.08555	0.08566	0.08576	0.0859	0.0859	0.087513	0.002523	-0.03023	0.025333	**0.897**	**0.359**
29.07.2016	0.07332	0.07226	0.01371	0.0841	0.09169	0.09671	0.0999	0.10194	0.1033	0.1042	0.10485	0.1053	0.1057	0.106	0.10622	0.1064	0.10659	0.10674	0.10686	0.10698	0.1071	0.1072	0.108874	-0.03341	0.035178	-0.05197	**0.897**	**0.359**
31.08.2016	0.08414	0.0853	-0.0035	0.0872	0.08798	0.08884	0.0897	0.09047	0.0912	0.0918	0.09227	0.0927	0.09308	0.0934	0.09368	0.0939	0.09412	0.09431	0.09447	0.09462	0.0947	0.0949	0.097095	-0.01382	-0.01459	0.00882	**0.897**	**0.359**
30.09.2016	0.07821	0.07733	-0.0124	0.0809	0.08435	0.08727	0.0896	0.09154	0.0931	0.0943	0.09537	0.0962	0.09695	0.0976	0.09808	0.0985	0.09893	0.09928	0.09959	0.09986	0.1001	0.1003	0.104504	-0.02527	-0.01537	-0.01503	**0.897**	**0.359**

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
31.10.2016	0.08609	0.0886	0.00024	0.0905	0.09033	0.09042	0.0907	0.09111	0.0915	0.0919	0.09223	0.0925	0.09278	0.093	0.0932	0.0934	0.09352	0.09365	0.09377	0.09388	0.094	0.0941	0.095657	-0.01159	-0.01492	0.02156	**0.897**	**0.359**
30.11.2016	0.0856	0.08597	0.01836	0.0957	0.10124	0.10503	0.1075	0.10924	0.1104	0.1113	0.11192	0.1124	0.11281	0.1131	0.1134	0.1136	0.11382	0.11399	0.11414	0.11427	0.1144	0.1145	0.116506	-0.03024	0.019285	-0.02872	**0.897**	**0.359**
30.12.2016	0.0789	0.08213	0.02076	0.0961	0.1021	0.10602	0.1086	0.11024	0.1114	0.1122	0.1128	0.1133	0.11361	0.1139	0.11413	0.1143	0.1145	0.11465	0.11478	0.11489	0.115	0.1151	0.116832	-0.03931	0.025975	-0.01534	**0.897**	**0.359**
31.01.2017	0.10229	0.10237	0.03193	0.1063	0.10826	0.10942	0.11	0.11033	0.1104	0.1105	0.11047	0.1104	0.11039	0.1104	0.11031	0.1103	0.11024	0.11021	0.11018	0.11016	0.1101	0.1101	0.109718	-0.00708	0.017182	-0.01426	**0.897**	**0.359**
28.02.2017	0.11024	0.11271	0.025	0.1097	0.10624	0.10378	0.1022	0.10108	0.1003	0.0998	0.09943	0.0991	0.09889	0.0987	0.09854	0.0984	0.09829	0.09819	0.0981	0.09803	0.098	0.0979	0.096699	0.011113	-0.01159	0.034484	**0.897**	**0.359**
31.03.2017	0.10481	0.10107	0.02987	0.105	0.10975	0.11308	0.1152	0.11664	0.1176	0.1182	0.11869	0.119	0.11931	0.1195	0.1197	0.1199	0.11998	0.1201	0.12019	0.12028	0.1204	0.1204	0.121747	-0.01331	0.018881	-0.0507	**0.897**	**0.359**
28.04.2017	0.10683	0.10577	0.04498	0.1087	0.11042	0.11104	0.111	0.11059	0.1101	0.1095	0.10904	0.1086	0.10817	0.1078	0.1075	0.1072	0.10698	0.10677	0.10657	0.1064	0.1063	0.1061	0.103486	0.004642	0.035224	-0.02638	**0.897**	**0.359**
31.05.2017	0.11902	0.1208	0.02547	0.1124	0.10621	0.10193	0.0991	0.09721	0.0959	0.095	0.09429	0.0938	0.09335	0.093	0.09272	0.0925	0.09228	0.0921	0.09194	0.0918	0.0917	0.0916	0.089451	0.02719	-0.02188	0.045749	**0.897**	**0.359**
30.06.2017	0.08575	0.0778	0.04438	0.0945	0.10898	0.11849	0.1243	0.12771	0.1298	0.1311	0.13197	0.1325	0.13294	0.1332	0.13347	0.1337	0.1338	0.13393	0.13404	0.13413	0.1342	0.1343	0.135708	-0.04134	0.082019	-0.14116	**0.897**	**0.359**
31.07.2017	0.09884	0.0926	0.05216	0.1034	0.11297	0.11898	0.1223	0.12413	0.125	0.1254	0.1256	0.1256	0.1256	0.1255	0.12546	0.1254	0.12531	0.12525	0.12518	0.12513	0.1251	0.125	0.124113	-0.01871	0.071126	-0.10557	**0.897**	**0.359**
31.08.2017	0.10305	0.10167	0.04844	0.1079	0.11173	0.11368	0.1144	0.11454	0.1143	0.114	0.1136	0.1132	0.11288	0.1126	0.11229	0.112	0.11182	0.11163	0.11145	0.1113	0.1112	0.111	0.10863	-0.00366	0.0471	-0.04156	**0.897**	**0.359**
29.09.2017	0.11137	0.10774	0.04661	0.111	0.11477	0.11699	0.1181	0.11851	0.1186	0.1185	0.11838	0.1182	0.11803	0.1179	0.11771	0.1176	0.11746	0.11735	0.11725	0.11716	0.1171	0.117	0.115668	-0.00077	0.036521	-0.05178	**0.897**	**0.359**
31.10.2017	0.1214	0.12083	0.05915	0.123	0.12397	0.124	0.1235	0.12287	0.1222	0.1215	0.12085	0.1203	0.11982	0.1194	0.11904	0.1187	0.11844	0.11819	0.11797	0.11777	0.1176	0.1174	0.114419	0.007783	0.033608	-0.01927	**0.897**	**0.359**
30.11.2017	0.13428	0.14102	0.08184	0.1412	0.13547	0.13025	0.126	0.12255	0.1198	0.1175	0.11563	0.1141	0.11277	0.1117	0.1107	0.1099	0.10916	0.10853	0.10798	0.10748	0.107	0.1066	0.099027	0.029616	0.033057	0.055467	**0.897**	**0.359**
29.12.2017	0.12055	0.11686	0.08497	0.1257	0.13175	0.13474	0.1357	0.13558	0.135	0.1341	0.13331	0.1325	0.13178	0.1311	0.13055	0.13	0.12958	0.12918	0.12883	0.12851	0.1282	0.128	0.123039	0.001759	0.084783	-0.07903	**0.897**	**0.359**
31.01.2018	0.12351	0.12184	0.06311	0.1245	0.12631	0.12695	0.1269	0.12639	0.1258	0.1252	0.12458	0.124	0.12358	0.1232	0.1228	0.1225	0.12221	0.12196	0.12174	0.12154	0.1214	0.1212	0.11819	0.007117	0.039415	-0.03214	**0.897**	**0.359**
28.02.2018	0.12481	0.12453	0.06397	0.1263	0.12661	0.12617	0.1253	0.12436	0.1234	0.1225	0.12175	0.1211	0.12048	0.12	0.11952	0.1191	0.11879	0.11849	0.11823	0.11799	0.1178	0.1176	0.113943	0.01138	0.035528	-0.01561	**0.897**	**0.359**
30.03.2018	0.1303	0.13261	0.08501	0.1369	0.13656	0.13508	0.1332	0.13135	0.1296	0.128	0.12668	0.1255	0.12449	0.1236	0.12285	0.1222	0.12161	0.1211	0.12065	0.12025	0.1199	0.1196	0.113364	0.015555	0.054804	-0.00311	**0.897**	**0.359**
30.04.2018	0.13317	0.13427	0.08659	0.138	0.13799	0.13685	0.1352	0.13348	0.1318	0.1303	0.12903	0.1279	0.1269	0.126	0.12531	0.1247	0.1241	0.1236	0.12316	0.12276	0.1224	0.1221	0.116043	0.016712	0.055906	-0.01281	**0.897**	**0.359**
31.05.2018	0.16453	0.16562	0.12797	0.1664	0.16396	0.1606	0.1571	0.15374	0.1508	0.1482	0.14591	0.144	0.14235	0.1409	0.13972	0.1387	0.13773	0.13692	0.13619	0.13555	0.135	0.1345	0.124548	0.039366	0.074583	-0.00873	**0.897**	**0.359**
29.06.2018	0.19553	0.20629	0.11738	0.1921	0.17534	0.16267	0.1536	0.14714	0.1423	0.1387	0.13581	0.1335	0.13164	0.1301	0.12875	0.1276	0.12663	0.12577	0.12501	0.12434	0.1237	0.1232	0.112885	0.072067	-0.01529	0.145395	**0.897**	**0.359**
31.07.2018	0.19585	0.21465	0.15983	0.2133	0.19778	0.18482	0.175	0.16748	0.1617	0.1571	0.15343	0.1504	0.1479	0.1458	0.14399	0.1424	0.14109	0.13991	0.13886	0.13793	0.1371	0.1363	0.122107	0.057664	0.031766	0.173542	**0.897**	**0.359**
31.08.2018	0.25076	0.30398	0.30036	0.3047	0.26356	0.22899	0.2026	0.18251	0.1669	0.1546	0.14472	0.1366	0.12982	0.1241	0.11925	0.1151	0.11142	0.10822	0.1054	0.10289	0.1006	0.0986	0.060148	0.145508	0.0924	0.477944	**0.897**	**0.359**
28.09.2018	0.27955	0.29629	0.23935	0.268	0.23595	0.21045	0.1912	0.17658	0.1653	0.1563	0.14917	0.1433	0.13842	0.1343	0.13082	0.1278	0.12519	0.1229	0.12088	0.11908	0.1175	0.116	0.088431	0.174312	0.041624	0.229247	**0.897**	**0.359**

Date/Maturity (year)	0.08	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Beta 0	Beta 1	Beta 2	Beta 3	Lambda 1	Lambda 2
31.10.2018	0.25328	0.2573	0.20686	0.239	0.2223	0.20846	0.1975	0.18873	0.1817	0.1761	0.17143	0.1676	0.16436	0.1616	0.1593	0.1573	0.15554	0.154	0.15264	0.15143	0.1503	0.1494	0.130821	0.117509	0.058531	0.077165	**0.897**	**0.359**
30.11.2018	0.19163	0.18297	0.14823	0.1839	0.18839	0.1903	0.1904	0.18954	0.1883	0.187	0.18578	0.1846	0.18362	0.1827	0.18194	0.1813	0.18065	0.18011	0.17963	0.17921	0.1788	0.1785	0.17192	0.027481	0.087238	-0.1038	**0.897**	**0.359**
31.12.2018	0.22373	0.22325	0.1357	0.2015	0.18766	0.17724	0.1696	0.16385	0.1595	0.1561	0.15335	0.1511	0.14932	0.1478	0.14649	0.1454	0.1444	0.14355	0.1428	0.14214	0.1415	0.141	0.130809	0.091307	-0.00073	0.057829	**0.897**	**0.359**

area refers that since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yields which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period. Therefore, estimated values in the area should not be taken into consideration.

Table F.2 Turkish Yield Curves Estimated via OLS Methodology

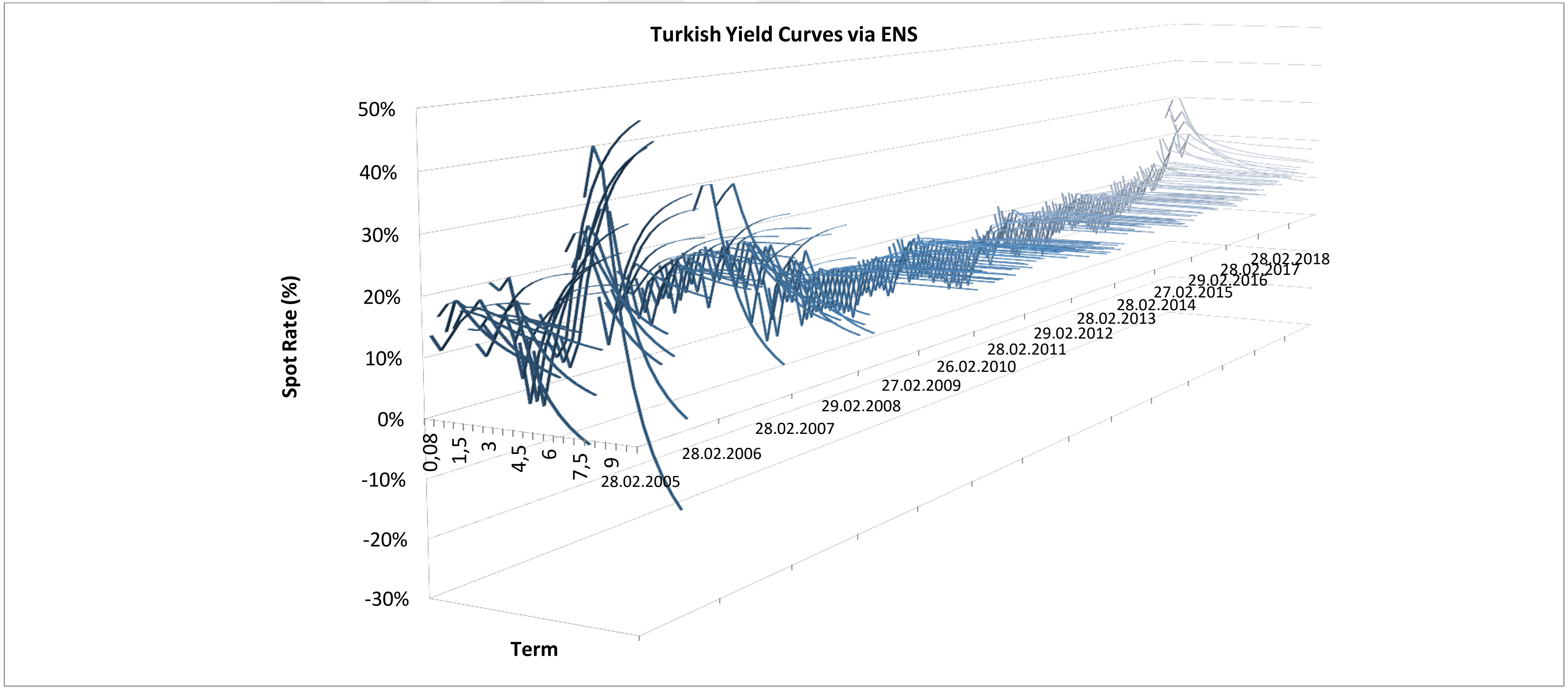
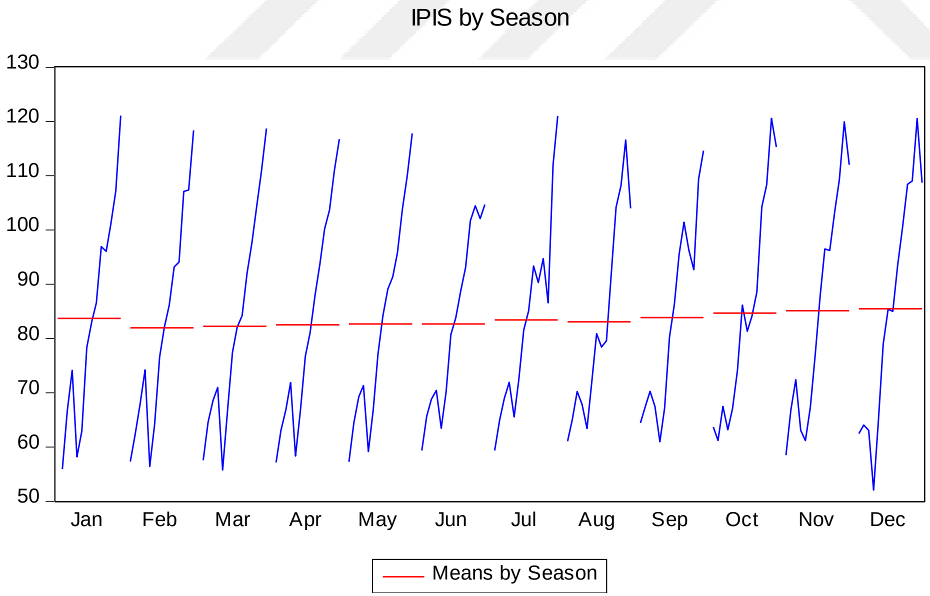


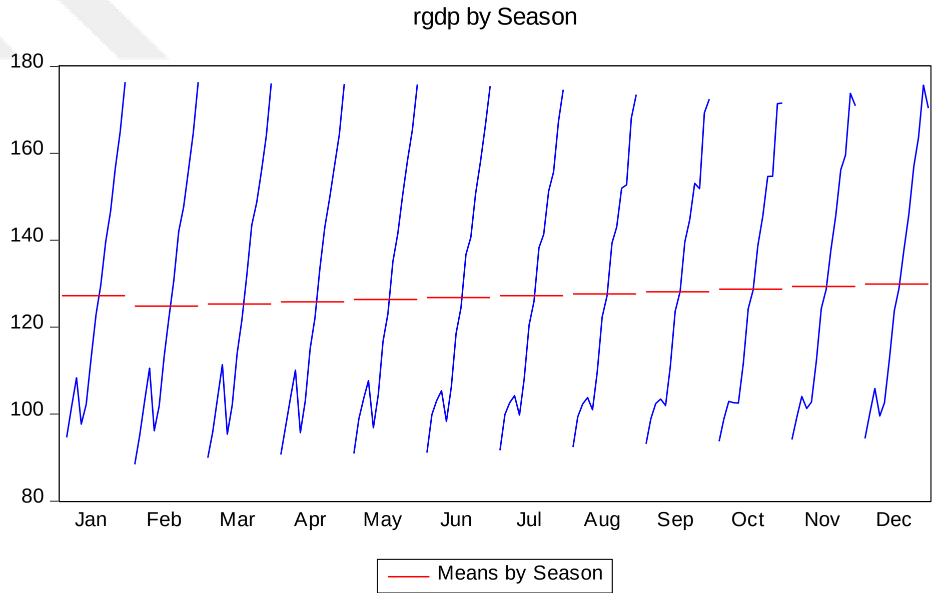
Table F.2 plots Turkey yield curves between 2005.02 and 2018.12 via ENS methodology with OLS technique. The sample consists of 167 observations. Since 10-year fixed coupon rate bonds were started to be traded after January 2010, estimated yield curves which have 5-year term to maturity are plotted in 2005-2010. And, 10-year yield curves (term to maturity) are plotted for 2010-2018 period.

Appendix G. Graphical Representations and Unit Root Test Results

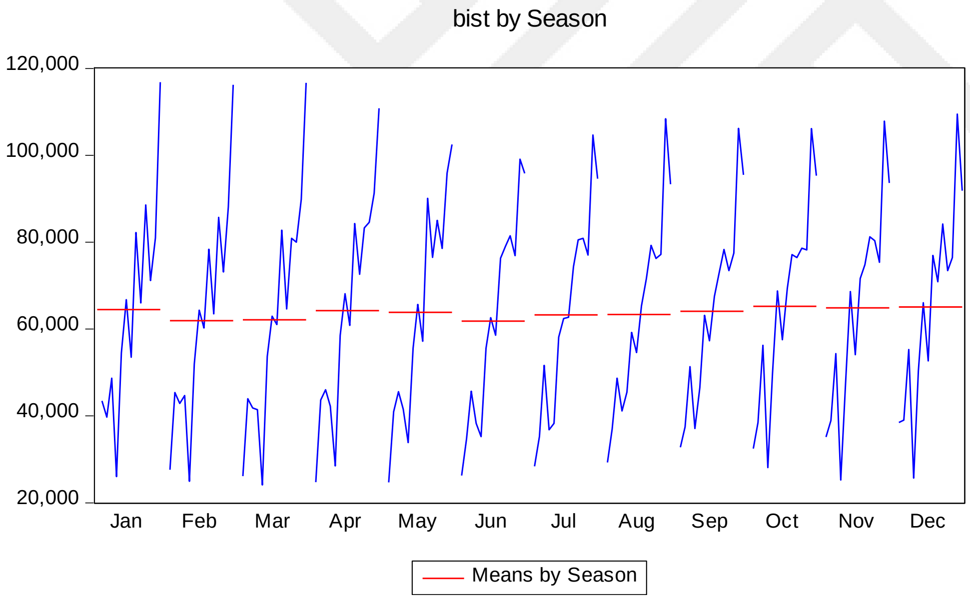
Table G.1 Graphical Representation of Seasonally Adjusted Dependent Variables



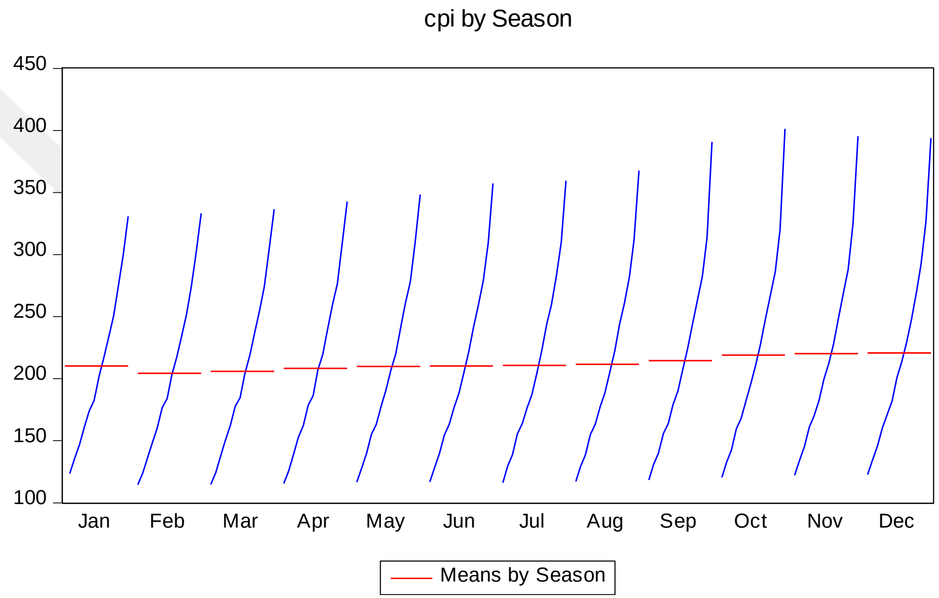
IPIS refers to seasonally adjusted industrial production index.



Rgdp refers to seasonally adjusted real GDP index. Rgdp is seasonally adjusted during monthly transformation via cubic spline interpolation.

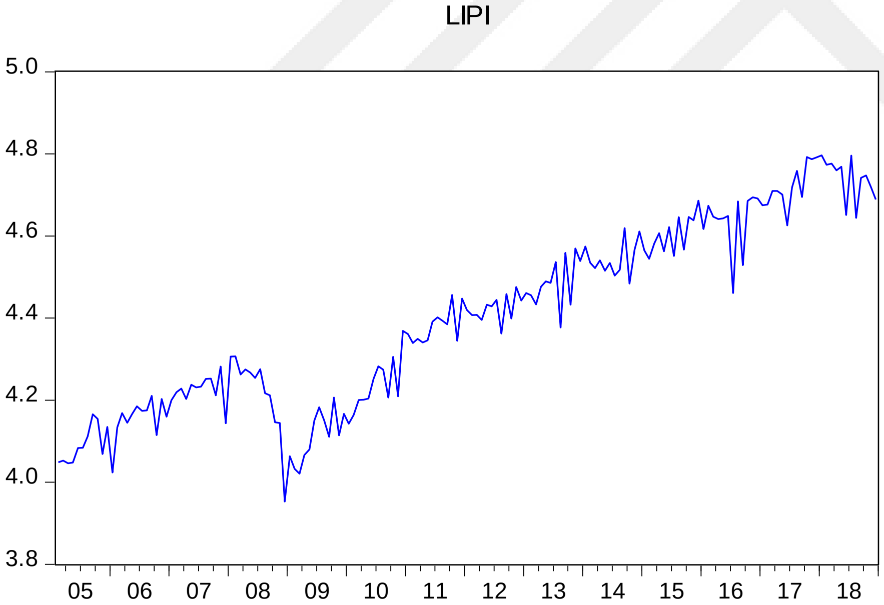


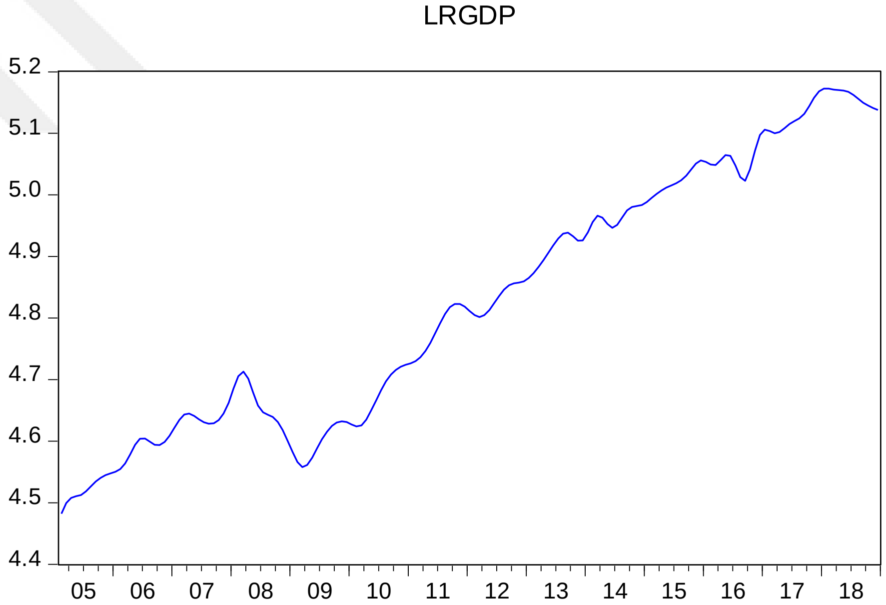
Bist refers to bist100 index data. Since the data has no seasonal effect, it is not seasonally adjusted.

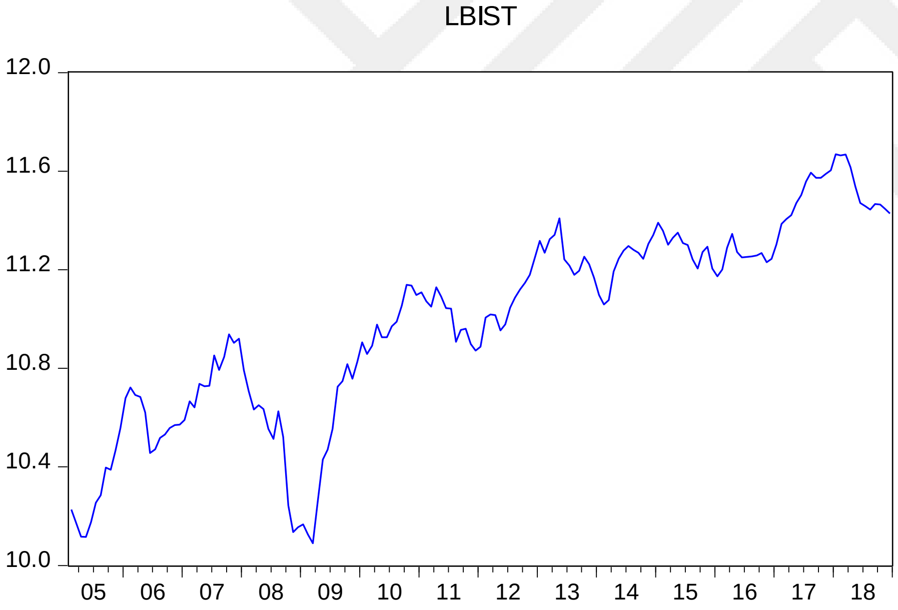


Cpi refers to consumer price index data. Since the data has no seasonal effect, It is not seasonally adjusted.

Table G.2 Graphs of Dependent Variables' Logarithm Forms



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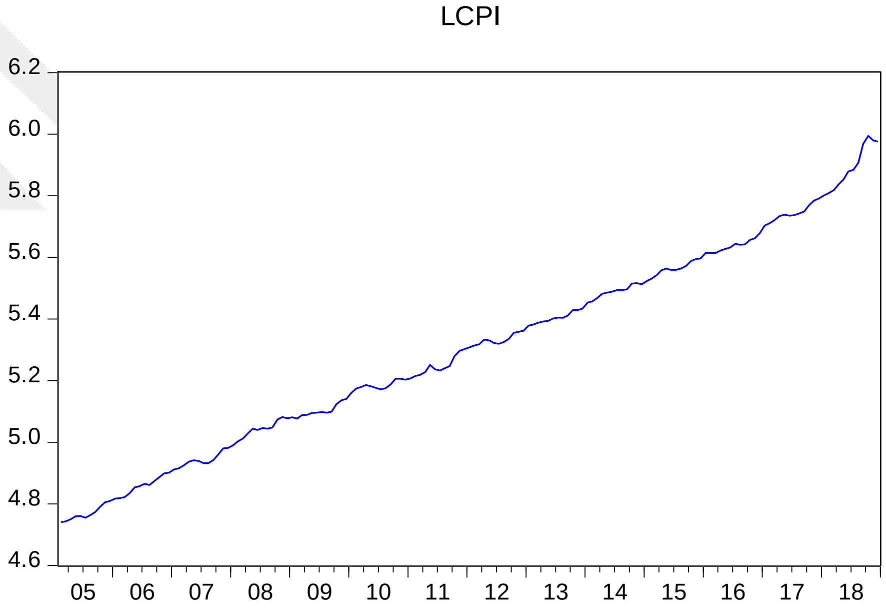
12.0
11.6
11.2
10.8
10.4
10.0
05 06 07 08 09 10 11 12 13 14 15 16 17 18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6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
05 06 07 08 09 10 11 12 13 14 15 16 17 18

Table G.3 Unit Root Test Results

➢ Level

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.18101	0.0000
Test critical values:	1% level	-2.579052	
	5% level	-1.942768	
	10% level	-1.615423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 05/18/19 Time: 23:11
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.165310	0.076761	-15.18101	0.0000

R-squared	0.584240	Mean dependent var	-6.86E-05
Adjusted R-squared	0.584240	S.D. dependent var	0.020311
S.E. of regression	0.013096	Akaike info criterion	-5.826944
Sum squared resid	0.028128	Schwarz criterion	-5.808120
Log likelihood	481.7229	Hannan-Quinn criter.	-5.819303
Durbin-Watson stat	2.050103		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.13763	0.0000
Test critical values:	1% level	-3.470179	
	5% level	-2.878937	
	10% level	-2.576124	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 05/18/19 Time: 23:12
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.165578	0.076999	-15.13763	0.0000
C	0.000203	0.001023	0.198170	0.8432

R-squared	0.584340	Mean dependent var	-6.86E-05
Adjusted R-squared	0.581790	S.D. dependent var	0.020311
S.E. of regression	0.013135	Akaike info criterion	-5.815064
Sum squared resid	0.028121	Schwarz criterion	-5.777416
Log likelihood	481.7428	Hannan-Quinn criter.	-5.799781
F-statistic	229.1477	Durbin-Watson stat	2.050133
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.10567	0.0000
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 05/18/19 Time: 23:14
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.166201	0.077203	-15.10567	0.0000
C	-0.000593	0.002078	-0.285255	0.7758
@TREND("2005M02")	9.47E-06	2.15E-05	0.440044	0.6605

R-squared	0.584837	Mean dependent var	-6.86E-05
Adjusted R-squared	0.579711	S.D. dependent var	0.020311
S.E. of regression	0.013167	Akaike info criterion	-5.804137
Sum squared resid	0.028087	Schwarz criterion	-5.747665
Log likelihood	481.8413	Hannan-Quinn criter.	-5.781213
F-statistic	114.1039	Durbin-Watson stat	2.051507
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.315172	0.0000
Test critical values:	1% level	-2.579404	
	5% level	-1.942818	
	10% level	-1.615392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 05/18/19 Time: 23:15
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.191934	0.224251	-5.315172	0.0000
D(LEVEL(-1),2)	0.031555	0.201181	0.156847	0.8756
D(LEVEL(-2),2)	-0.088221	0.162129	-0.544142	0.5871
D(LEVEL(-3),2)	-0.265359	0.122986	-2.157635	0.0325
D(LEVEL(-4),2)	-0.040808	0.081805	-0.498844	0.6186

R-squared	0.625211	Mean dependent var	7.26E-06
Adjusted R-squared	0.615601	S.D. dependent var	0.020078
S.E. of regression	0.012448	Akaike info criterion	-5.903885
Sum squared resid	0.024174	Schwarz criterion	-5.808189
Log likelihood	480.2627	Hannan-Quinn criter.	-5.865029
Durbin-Watson stat	1.984119		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.295998	0.0000
Test critical values:	1% level	-3.471192	
	5% level	-2.879380	
	10% level	-2.576361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 05/18/19 Time: 23:20
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.194331	0.225516	-5.295998	0.0000
D(LEVEL(-1),2)	0.033713	0.202319	0.166633	0.8679
D(LEVEL(-2),2)	-0.086611	0.162988	-0.531397	0.5959
D(LEVEL(-3),2)	-0.264171	0.123623	-2.136902	0.0342
D(LEVEL(-4),2)	-0.040279	0.082137	-0.490384	0.6246
C	0.000149	0.000987	0.151108	0.8801

R-squared	0.625266	Mean dependent var	7.26E-06
Adjusted R-squared	0.613178	S.D. dependent var	0.020078
S.E. of regression	0.012488	Akaike info criterion	-5.891610
Sum squared resid	0.024171	Schwarz criterion	-5.776775
Log likelihood	480.2746	Hannan-Quinn criter.	-5.844982
F-statistic	51.72528	Durbin-Watson stat	1.984086
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.287269	0.0001
Test critical values:	1% level	-4.016064	
	5% level	-3.437977	
	10% level	-3.143241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 05/18/19 Time: 23:22
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.205353	0.227973	-5.287269	0.0000
D(LEVEL(-1),2)	0.043311	0.204429	0.211862	0.8325
D(LEVEL(-2),2)	-0.078939	0.164669	-0.479379	0.6323
D(LEVEL(-3),2)	-0.258892	0.124733	-2.075558	0.0396
D(LEVEL(-4),2)	-0.038317	0.082524	-0.464315	0.6431
C	-0.000551	0.002083	-0.264565	0.7917
@TREND("2005M02")	8.18E-06	2.14E-05	0.382017	0.7030

R-squared	0.625620	Mean dependent var	7.26E-06
Adjusted R-squared	0.611034	S.D. dependent var	0.020078
S.E. of regression	0.012522	Akaike info criterion	-5.880135
Sum squared resid	0.024148	Schwarz criterion	-5.746161
Log likelihood	480.3509	Hannan-Quinn criter.	-5.825736
F-statistic	42.89122	Durbin-Watson stat	1.983701
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.282030	0.0000
Test critical values:	1% level	-2.579315	
	5% level	-1.942805	
	10% level	-1.615400	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 06/16/19 Time: 13:05
Sample (adjusted): 2005M07 2018M12
Included observations: 162 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.244078	0.198038	-6.282030	0.0000
D(LEVEL(-1),2)	0.091722	0.160377	0.571911	0.5682
D(LEVEL(-2),2)	-0.034460	0.121718	-0.283110	0.7775
D(LEVEL(-3),2)	-0.218010	0.079090	-2.756498	0.0065

R-squared	0.626199	Mean dependent var	-9.59E-05
Adjusted R-squared	0.619102	S.D. dependent var	0.020059
S.E. of regression	0.012380	Akaike info criterion	-5.921155
Sum squared resid	0.024214	Schwarz criterion	-5.844918
Log likelihood	483.6136	Hannan-Quinn criter.	-5.890202
Durbin-Watson stat	2.010110		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.261123	0.0000
Test critical values:	1% level	-3.470934	
	5% level	-2.879267	
	10% level	-2.576301	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 06/16/19 Time: 13:11
Sample (adjusted): 2005M07 2018M12
Included observations: 162 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.246085	0.199019	-6.261123	0.0000
D(LEVEL(-1),2)	0.093243	0.161135	0.578663	0.5636
D(LEVEL(-2),2)	-0.033328	0.122286	-0.272546	0.7856
D(LEVEL(-3),2)	-0.217286	0.079455	-2.734724	0.0070
C	0.000162	0.000978	0.165581	0.8687

R-squared	0.626265	Mean dependent var	-9.59E-05
Adjusted R-squared	0.616743	S.D. dependent var	0.020059
S.E. of regression	0.012418	Akaike info criterion	-5.908984
Sum squared resid	0.024210	Schwarz criterion	-5.813688
Log likelihood	483.6277	Hannan-Quinn criter.	-5.870292
F-statistic	65.77082	Durbin-Watson stat	2.009461
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LEVEL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.255337	0.0000
Test critical values:	1% level	-4.015700	
	5% level	-3.437801	
	10% level	-3.143138	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEVEL,2)
Method: Least Squares
Date: 06/16/19 Time: 13:12
Sample (adjusted): 2005M07 2018M12
Included observations: 162 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEVEL(-1))	-1.254869	0.200608	-6.255337	0.0000
D(LEVEL(-1),2)	0.100500	0.162457	0.618627	0.5371
D(LEVEL(-2),2)	-0.028316	0.123172	-0.229890	0.8185
D(LEVEL(-3),2)	-0.214400	0.079951	-2.681628	0.0081
C	-0.000600	0.002043	-0.293734	0.7694
@TREND("2005M02")	8.94E-06	2.10E-05	0.425115	0.6713

R-squared	0.626697	Mean dependent var	-9.59E-05
Adjusted R-squared	0.614732	S.D. dependent var	0.020059
S.E. of regression	0.012450	Akaike info criterion	-5.897796
Sum squared resid	0.024182	Schwarz criterion	-5.783441
Log likelihood	483.7215	Hannan-Quinn criter.	-5.851366
F-statistic	52.37823	Durbin-Watson stat	2.008624
Prob(F-statistic)	0.000000		

- **Slope**

Null Hypothesis: SLOPE has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.757236	0.0002
Test critical values:	1% level	-2.578967	
	5% level	-1.942757	
	10% level	-1.615431	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE)
Method: Least Squares
Date: 05/18/19 Time: 22:26
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SLOPE(-1)	-0.168335	0.044803	-3.757236	0.0002

R-squared	0.078750	Mean dependent var	0.000148
Adjusted R-squared	0.078750	S.D. dependent var	0.017888
S.E. of regression	0.017170	Akaike info criterion	-5.285353
Sum squared resid	0.048641	Schwarz criterion	-5.266606
Log likelihood	439.6843	Hannan-Quinn criter.	-5.277743
Durbin-Watson stat	2.056754		

Null Hypothesis: SLOPE has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.764316	0.0040
Test critical values:	1% level	-3.469933	
	5% level	-2.878829	
	10% level	-2.576067	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE)
Method: Least Squares
Date: 05/18/19 Time: 22:33
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SLOPE(-1)	-0.170505	0.045295	-3.764316	0.0002
C	-0.000503	0.001347	-0.373142	0.7095

R-squared	0.079531	Mean dependent var	0.000148
Adjusted R-squared	0.073919	S.D. dependent var	0.017888
S.E. of regression	0.017215	Akaike info criterion	-5.274153
Sum squared resid	0.048600	Schwarz criterion	-5.236660
Log likelihood	439.7547	Hannan-Quinn criter.	-5.258934
F-statistic	14.17007	Durbin-Watson stat	2.053951
Prob(F-statistic)	0.000232		

Null Hypothesis: SLOPE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.941403	0.0125
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE)
Method: Least Squares
Date: 05/18/19 Time: 22:33
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SLOPE(-1)	-0.178951	0.045403	-3.941403	0.0001
C	-0.004230	0.002709	-1.561387	0.1204
@TREND("2005M02")	4.43E-05	2.79E-05	1.583436	0.1153

R-squared	0.093475	Mean dependent var	0.000148
Adjusted R-squared	0.082352	S.D. dependent var	0.017888
S.E. of regression	0.017136	Akaike info criterion	-5.277370
Sum squared resid	0.047863	Schwarz criterion	-5.221129
Log likelihood	441.0217	Hannan-Quinn criter.	-5.254542
F-statistic	8.403787	Durbin-Watson stat	2.067578
Prob(F-statistic)	0.000336		

Null Hypothesis: D(SLOPE) has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.244334	0.0000
Test critical values:	1% level	-2.579404	
	5% level	-1.942818	
	10% level	-1.615392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE,2)
Method: Least Squares
Date: 05/18/19 Time: 22:45
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SLOPE(-1))	-1.703280	0.272772	-6.244334	0.0000
D(SLOPE(-1),2)	0.473849	0.240622	1.969269	0.0507
D(SLOPE(-2),2)	0.142961	0.195414	0.731582	0.4655
D(SLOPE(-3),2)	-0.065597	0.147454	-0.444865	0.6570
D(SLOPE(-4),2)	0.022158	0.092610	0.239263	0.8112

R-squared	0.632418	Mean dependent var	0.000153
Adjusted R-squared	0.622992	S.D. dependent var	0.026732
S.E. of regression	0.016414	Akaike info criterion	-5.350816
Sum squared resid	0.042029	Schwarz criterion	-5.255121
Log likelihood	435.7407	Hannan-Quinn criter.	-5.311960
Durbin-Watson stat	1.989896		

Null Hypothesis: D(SLOPE) has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.253977	0.0000
Test critical values:	1% level	-3.471192	
	5% level	-2.879380	
	10% level	-2.576361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE,2)
Method: Least Squares
Date: 05/18/19 Time: 22:47
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SLOPE(-1))	-1.710816	0.273557	-6.253977	0.0000
D(SLOPE(-1),2)	0.479360	0.241242	1.987049	0.0487
D(SLOPE(-2),2)	0.146360	0.195864	0.747253	0.4560
D(SLOPE(-3),2)	-0.065103	0.147740	-0.440659	0.6601
D(SLOPE(-4),2)	0.021770	0.092790	0.234612	0.8148
C	0.000822	0.001299	0.633108	0.5276

R-squared	0.633366	Mean dependent var	0.000153
Adjusted R-squared	0.621539	S.D. dependent var	0.026732
S.E. of regression	0.016445	Akaike info criterion	-5.340977
Sum squared resid	0.041920	Schwarz criterion	-5.226142
Log likelihood	435.9486	Hannan-Quinn criter.	-5.294349
F-statistic	53.55290	Durbin-Watson stat	1.990599
Prob(F-statistic)	0.000000		

Null Hypothesis: D(SLOPE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.501021	0.0000
Test critical values:	1% level	-4.016064	
	5% level	-3.437977	
	10% level	-3.143241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE,2)
Method: Least Squares
Date: 05/18/19 Time: 22:48
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SLOPE(-1))	-1.808910	0.278250	-6.501021	0.0000
D(SLOPE(-1),2)	0.561166	0.244803	2.292312	0.0232
D(SLOPE(-2),2)	0.205330	0.197912	1.037482	0.3011
D(SLOPE(-3),2)	-0.029944	0.148392	-0.201791	0.8403
D(SLOPE(-4),2)	0.038049	0.092771	0.410140	0.6823
C	-0.003235	0.002750	-1.176312	0.2413
@TREND("2005M02")	4.75E-05	2.84E-05	1.671130	0.0967

R-squared	0.639896	Mean dependent var	0.000153
Adjusted R-squared	0.625866	S.D. dependent var	0.026732
S.E. of regression	0.016351	Akaike info criterion	-5.346526
Sum squared resid	0.041174	Schwarz criterion	-5.212552
Log likelihood	437.3954	Hannan-Quinn criter.	-5.292127
F-statistic	45.60901	Durbin-Watson stat	1.998285
Prob(F-statistic)	0.000000		

Null Hypothesis: D(SLOPE) has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.25783	0.0000
Test critical values:	1% level	-2.579226	
	5% level	-1.942793	
	10% level	-1.615408	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE,2)
Method: Least Squares
Date: 06/16/19 Time: 13:14
Sample (adjusted): 2005M06 2018M12
Included observations: 163 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SLOPE(-1))	-1.811515	0.160912	-11.25783	0.0000
D(SLOPE(-1),2)	0.555585	0.117838	4.714825	0.0000
D(SLOPE(-2),2)	0.210565	0.077015	2.734064	0.0070

R-squared	0.632040	Mean dependent var	-9.46E-05
Adjusted R-squared	0.627440	S.D. dependent var	0.026741
S.E. of regression	0.016322	Akaike info criterion	-5.374372
Sum squared resid	0.042625	Schwarz criterion	-5.317432
Log likelihood	441.0113	Hannan-Quinn criter.	-5.351255
Durbin-Watson stat	1.938763		

Null Hypothesis: D(SLOPE) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.24480	0.0000
Test critical values:	1% level	-3.470679	
	5% level	-2.879155	
	10% level	-2.576241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE,2)
Method: Least Squares
Date: 06/16/19 Time: 13:15
Sample (adjusted): 2005M06 2018M12
Included observations: 163 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SLOPE(-1))	-1.816185	0.161513	-11.24480	0.0000
D(SLOPE(-1),2)	0.558689	0.118248	4.724739	0.0000
D(SLOPE(-2),2)	0.212072	0.077241	2.745592	0.0067
C	0.000682	0.001283	0.531107	0.5961

R-squared	0.632692	Mean dependent var	-9.46E-05
Adjusted R-squared	0.625761	S.D. dependent var	0.026741
S.E. of regression	0.016359	Akaike info criterion	-5.363875
Sum squared resid	0.042550	Schwarz criterion	-5.287954
Log likelihood	441.1558	Hannan-Quinn criter.	-5.333052
F-statistic	91.29288	Durbin-Watson stat	1.938703
Prob(F-statistic)	0.000000		

Null Hypothesis: D(SLOPE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.49311	0.0000
Test critical values:	1% level	-4.015341	
	5% level	-3.437629	
	10% level	-3.143037	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SLOPE,2)
Method: Least Squares
Date: 06/16/19 Time: 13:15
Sample (adjusted): 2005M06 2018M12
Included observations: 163 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(SLOPE(-1))	-1.870537	0.162753	-11.49311	0.0000
D(SLOPE(-1),2)	0.597947	0.119106	5.020298	0.0000
D(SLOPE(-2),2)	0.234256	0.077505	3.022449	0.0029
C	-0.003723	0.002648	-1.405786	0.1618
@TREND("2005M02")	5.21E-05	2.75E-05	1.896645	0.0597

R-squared	0.640868	Mean dependent var	-9.46E-05
Adjusted R-squared	0.631776	S.D. dependent var	0.026741
S.E. of regression	0.016227	Akaike info criterion	-5.374117
Sum squared resid	0.041603	Schwarz criterion	-5.279216
Log likelihood	442.9905	Hannan-Quinn criter.	-5.335588
F-statistic	70.48743	Durbin-Watson stat	1.946529
Prob(F-statistic)	0.000000		

➢ Curvature

Null Hypothesis: CURVATURE has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.152819	0.0000
Test critical values:	1% level	-2.578967	
	5% level	-1.942757	
	10% level	-1.615431	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 05/18/19 Time: 23:23
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.179654	0.043261	-4.152819	0.0001

R-squared	0.094433	Mean dependent var	-0.000537
Adjusted R-squared	0.094433	S.D. dependent var	0.036512
S.E. of regression	0.034746	Akaike info criterion	-3.875522
Sum squared resid	0.199197	Schwarz criterion	-3.856775
Log likelihood	322.6683	Hannan-Quinn criter.	-3.867912
Durbin-Watson stat	2.183194		

Null Hypothesis: CURVATURE has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.664815	0.0002
Test critical values:	1% level	-3.469933	
	5% level	-2.878829	
	10% level	-2.576067	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 05/18/19 Time: 23:25
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.227560	0.048782	-4.664815	0.0000
C	0.006246	0.003041	2.053916	0.0416

R-squared	0.117143	Mean dependent var	-0.000537
Adjusted R-squared	0.111759	S.D. dependent var	0.036512
S.E. of regression	0.034412	Akaike info criterion	-3.888871
Sum squared resid	0.194202	Schwarz criterion	-3.851378
Log likelihood	324.7763	Hannan-Quinn criter.	-3.873652
F-statistic	21.76050	Durbin-Watson stat	2.132451
Prob(F-statistic)	0.000006		

Null Hypothesis: CURVATURE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.812362	0.0007
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 05/18/19 Time: 23:27
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.246138	0.051147	-4.812362	0.0000
C	0.012622	0.006146	2.053495	0.0416
@TREND("2005M02")	-6.97E-05	5.84E-05	-1.193141	0.2345

R-squared	0.124787	Mean dependent var	-0.000537
Adjusted R-squared	0.114048	S.D. dependent var	0.036512
S.E. of regression	0.034367	Akaike info criterion	-3.885519
Sum squared resid	0.192520	Schwarz criterion	-3.829278
Log likelihood	325.4981	Hannan-Quinn criter.	-3.862691
F-statistic	11.62014	Durbin-Watson stat	2.110608
Prob(F-statistic)	0.000019		

Null Hypothesis: CURVATURE has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.798842	0.0053
Test critical values:	1% level	-2.579315	
	5% level	-1.942805	
	10% level	-1.615400	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 05/18/19 Time: 23:27
Sample (adjusted): 2005M07 2018M12
Included observations: 162 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.141427	0.050531	-2.798842	0.0058
D(CURVATURE(-1))	-0.219531	0.084902	-2.585702	0.0106
D(CURVATURE(-2))	-0.220505	0.086676	-2.544016	0.0119
D(CURVATURE(-3))	-0.129188	0.084918	-1.521334	0.1302
D(CURVATURE(-4))	-0.055868	0.088706	-0.629807	0.5297

R-squared	0.160673	Mean dependent var	-0.000508
Adjusted R-squared	0.139289	S.D. dependent var	0.036148
S.E. of regression	0.033536	Akaike info criterion	-3.922009
Sum squared resid	0.176574	Schwarz criterion	-3.826712
Log likelihood	322.6827	Hannan-Quinn criter.	-3.883317
Durbin-Watson stat	1.967200		

Null Hypothesis: CURVATURE has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.087743	0.0294
Test critical values:	1% level	-3.470934	
	5% level	-2.879267	
	10% level	-2.576301	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 05/18/19 Time: 23:28
Sample (adjusted): 2005M07 2018M12
Included observations: 162 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.182216	0.059013	-3.087743	0.0024
D(CURVATURE(-1))	-0.190364	0.087491	-2.175803	0.0311
D(CURVATURE(-2))	-0.196750	0.088293	-2.228383	0.0273
D(CURVATURE(-3))	-0.111763	0.085719	-1.303830	0.1942
D(CURVATURE(-4))	-0.043005	0.089018	-0.483103	0.6297
C	0.004094	0.003080	1.329274	0.1857

R-squared	0.170073	Mean dependent var	-0.000508
Adjusted R-squared	0.143473	S.D. dependent var	0.036148
S.E. of regression	0.033455	Akaike info criterion	-3.920926
Sum squared resid	0.174596	Schwarz criterion	-3.806570
Log likelihood	323.5950	Hannan-Quinn criter.	-3.874496
F-statistic	6.393686	Durbin-Watson stat	1.967233
Prob(F-statistic)	0.000020		

Null Hypothesis: CURVATURE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.856244	0.1797
Test critical values:	1% level	-4.015700	
	5% level	-3.437801	
	10% level	-3.143138	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 05/18/19 Time: 23:30
Sample (adjusted): 2005M07 2018M12
Included observations: 162 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.183488	0.064241	-2.856244	0.0049
D(CURVATURE(-1))	-0.188938	0.092122	-2.050945	0.0420
D(CURVATURE(-2))	-0.195275	0.093179	-2.095690	0.0377
D(CURVATURE(-3))	-0.110460	0.089714	-1.231246	0.2201
D(CURVATURE(-4))	-0.041590	0.093513	-0.444749	0.6571
C	0.004403	0.006803	0.647201	0.5185
@TREND("2005M02")	-3.21E-06	6.30E-05	-0.051002	0.9594

R-squared	0.170087	Mean dependent var	-0.000508
Adjusted R-squared	0.137962	S.D. dependent var	0.036148
S.E. of regression	0.033562	Akaike info criterion	-3.908597
Sum squared resid	0.174593	Schwarz criterion	-3.775182
Log likelihood	323.5964	Hannan-Quinn criter.	-3.854429
F-statistic	5.294439	Durbin-Watson stat	1.967587
Prob(F-statistic)	0.000054		

Null Hypothesis: CURVATURE has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.152819	0.0000
Test critical values:	1% level	-2.578967	
	5% level	-1.942757	
	10% level	-1.615431	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 06/16/19 Time: 13:17
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.179654	0.043261	-4.152819	0.0001

R-squared	0.094433	Mean dependent var	-0.000537
Adjusted R-squared	0.094433	S.D. dependent var	0.036512
S.E. of regression	0.034746	Akaike info criterion	-3.875522
Sum squared resid	0.199197	Schwarz criterion	-3.856775
Log likelihood	322.6683	Hannan-Quinn criter.	-3.867912
Durbin-Watson stat	2.183194		

Null Hypothesis: CURVATURE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.664815	0.0002
Test critical values:	1% level	-3.469933	
	5% level	-2.878829	
	10% level	-2.576067	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 06/16/19 Time: 13:18
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.227560	0.048782	-4.664815	0.0000
C	0.006246	0.003041	2.053916	0.0416

R-squared	0.117143	Mean dependent var	-0.000537
Adjusted R-squared	0.111759	S.D. dependent var	0.036512
S.E. of regression	0.034412	Akaike info criterion	-3.888871
Sum squared resid	0.194202	Schwarz criterion	-3.851378
Log likelihood	324.7763	Hannan-Quinn criter.	-3.873652
F-statistic	21.76050	Durbin-Watson stat	2.132451
Prob(F-statistic)	0.000006		

Null Hypothesis: CURVATURE has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.812362	0.0007
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CURVATURE)
Method: Least Squares
Date: 06/16/19 Time: 13:18
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURVATURE(-1)	-0.246138	0.051147	-4.812362	0.0000
C	0.012622	0.006146	2.053495	0.0416
@TREND("2005M02")	-6.97E-05	5.84E-05	-1.193141	0.2345

R-squared	0.124787	Mean dependent var	-0.000537
Adjusted R-squared	0.114048	S.D. dependent var	0.036512
S.E. of regression	0.034367	Akaike info criterion	-3.885519
Sum squared resid	0.192520	Schwarz criterion	-3.829278
Log likelihood	325.4981	Hannan-Quinn criter.	-3.862691
F-statistic	11.62014	Durbin-Watson stat	2.110608
Prob(F-statistic)	0.000019		

➢ Lipi (Log of Industrial Production Index)

Null Hypothesis: LIPI has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.632549	0.8520
Test critical values:	1% level	-2.578967	
	5% level	-1.942757	
	10% level	-1.615431	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 05/18/19 Time: 23:35
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	0.000752	0.001190	0.632549	0.5279

R-squared	-0.000865	Mean dependent var	0.003858
Adjusted R-squared	-0.000865	S.D. dependent var	0.067450
S.E. of regression	0.067479	Akaike info criterion	-2.548000
Sum squared resid	0.751309	Schwarz criterion	-2.529253
Log likelihood	212.4840	Hannan-Quinn criter.	-2.540391
Durbin-Watson stat	3.341686		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.044417	0.2678
Test critical values:	1% level	-3.469933	
	5% level	-2.878829	
	10% level	-2.576067	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 05/18/19 Time: 23:36
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.047248	0.023111	-2.044417	0.0425
C	0.211615	0.101754	2.079677	0.0391

R-squared	0.024852	Mean dependent var	0.003858
Adjusted R-squared	0.018906	S.D. dependent var	0.067450
S.E. of regression	0.066809	Akaike info criterion	-2.561983
Sum squared resid	0.732005	Schwarz criterion	-2.524489
Log likelihood	214.6446	Hannan-Quinn criter.	-2.546764
F-statistic	4.179641	Durbin-Watson stat	3.267655
Prob(F-statistic)	0.042511		

Null Hypothesis: LIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.394333	0.0000
Test critical values:	1% level	-4.014288	
	5% level	-3.437122	
	10% level	-3.142739	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI)
Method: Least Squares
Date: 05/18/19 Time: 23:37
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIPI(-1)	-0.404083	0.063194	-6.394333	0.0000
C	1.632757	0.254743	6.409415	0.0000
@TREND("2005M02")	0.001771	0.000296	5.986502	0.0000

R-squared	0.200611	Mean dependent var	0.003858
Adjusted R-squared	0.190802	S.D. dependent var	0.067450
S.E. of regression	0.060675	Akaike info criterion	-2.748676
Sum squared resid	0.600070	Schwarz criterion	-2.692435
Log likelihood	231.1401	Hannan-Quinn criter.	-2.725847
F-statistic	20.45286	Durbin-Watson stat	2.696138
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.531468	0.0000
Test critical values:	1% level		-2.579404	
	5% level		-1.942818	
	10% level		-1.615392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 05/18/19 Time: 23:38
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-1.862234	0.285117	-6.531468	0.0000
D(LIPI(-1),2)	0.102871	0.257521	0.399465	0.6901
D(LIPI(-2),2)	0.029566	0.218473	0.135331	0.8925
D(LIPI(-3),2)	0.142888	0.162813	0.877618	0.3815
D(LIPI(-4),2)	0.110444	0.081322	1.358113	0.1764

R-squared	0.841110	Mean dependent var	-0.000189
Adjusted R-squared	0.837036	S.D. dependent var	0.125155
S.E. of regression	0.050524	Akaike info criterion	-3.102189
Sum squared resid	0.398211	Schwarz criterion	-3.006493
Log likelihood	254.7262	Hannan-Quinn criter.	-3.063333
Durbin-Watson stat	1.989264		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.858341	0.0000
Test critical values:	1% level		-3.471192	
	5% level		-2.879380	
	10% level		-2.576361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 05/18/19 Time: 23:39
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-2.031495	0.296208	-6.858341	0.0000
D(LIPI(-1),2)	0.250001	0.266658	0.937536	0.3499
D(LIPI(-2),2)	0.136208	0.223674	0.608958	0.5434
D(LIPI(-3),2)	0.205212	0.164687	1.246071	0.2146
D(LIPI(-4),2)	0.133416	0.081523	1.636538	0.1038
C	0.007921	0.004137	1.914843	0.0574

R-squared	0.844782	Mean dependent var	-0.000189
Adjusted R-squared	0.839775	S.D. dependent var	0.125155
S.E. of regression	0.050097	Akaike info criterion	-3.113147
Sum squared resid	0.389009	Schwarz criterion	-2.998312
Log likelihood	256.6083	Hannan-Quinn criter.	-3.066519
F-statistic	168.7192	Durbin-Watson stat	1.991400
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.837927	0.0000
Test critical values:	1% level		-4.016064	
	5% level		-3.437977	
	10% level		-3.143241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 05/18/19 Time: 23:40
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-2.032084	0.297178	-6.837927	0.0000
D(LIPI(-1),2)	0.250566	0.267535	0.936574	0.3504
D(LIPI(-2),2)	0.136684	0.224410	0.609081	0.5434
D(LIPI(-3),2)	0.205463	0.165220	1.243571	0.2155
D(LIPI(-4),2)	0.133421	0.081782	1.631424	0.1048
C	0.008957	0.008439	1.061371	0.2902
@TREND("2005M02")	-1.20E-05	8.52E-05	-0.140872	0.8882

R-squared	0.844802	Mean dependent var	-0.000189
Adjusted R-squared	0.838755	S.D. dependent var	0.125155
S.E. of regression	0.050256	Akaike info criterion	-3.100853
Sum squared resid	0.388959	Schwarz criterion	-2.966879
Log likelihood	256.6187	Hannan-Quinn criter.	-3.046454
F-statistic	139.7135	Durbin-Watson stat	1.991593
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-28.62009	0.0000
Test critical values:	1% level	-2.579052	
	5% level	-1.942768	
	10% level	-1.615423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 06/16/19 Time: 13:22
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-1.666950	0.058244	-28.62009	0.0000

R-squared	0.833182	Mean dependent var	-0.000206
Adjusted R-squared	0.833182	S.D. dependent var	0.123682
S.E. of regression	0.050516	Akaike info criterion	-3.127016
Sum squared resid	0.418504	Schwarz criterion	-3.108192
Log likelihood	258.9788	Hannan-Quinn criter.	-3.119374
Durbin-Watson stat	2.196896		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-28.82836	0.0000
Test critical values:	1% level	-3.470179	
	5% level	-2.878937	
	10% level	-2.576124	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 06/16/19 Time: 13:23
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-1.672824	0.058027	-28.82836	0.0000
C	0.006591	0.003918	1.682159	0.0945

R-squared	0.836028	Mean dependent var	-0.000206
Adjusted R-squared	0.835022	S.D. dependent var	0.123682
S.E. of regression	0.050236	Akaike info criterion	-3.132105
Sum squared resid	0.411363	Schwarz criterion	-3.094457
Log likelihood	260.3987	Hannan-Quinn criter.	-3.116823
F-statistic	831.0746	Durbin-Watson stat	2.225112
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LIPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-28.74445	0.0000
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LIPI,2)
Method: Least Squares
Date: 06/16/19 Time: 13:23
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LIPI(-1))	-1.672877	0.058198	-28.74445	0.0000
C	0.008062	0.007957	1.013203	0.3125
@TREND("2005M02")	-1.75E-05	8.24E-05	-0.212608	0.8319

R-squared	0.836074	Mean dependent var	-0.000206
Adjusted R-squared	0.834050	S.D. dependent var	0.123682
S.E. of regression	0.050384	Akaike info criterion	-3.120263
Sum squared resid	0.411248	Schwarz criterion	-3.063791
Log likelihood	260.4217	Hannan-Quinn criter.	-3.097339
F-statistic	413.1258	Durbin-Watson stat	2.225642
Prob(F-statistic)	0.000000		

➢ Lrgdp (Log of Real GDP Index)

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.067078	0.0001
Test critical values:	1% level	-2.579052	
	5% level	-1.942768	
	10% level	-1.615423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 05/18/19 Time: 23:42
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.173823	0.042739	-4.067078	0.0001

R-squared	0.091186	Mean dependent var	-0.000123
Adjusted R-squared	0.091186	S.D. dependent var	0.005655
S.E. of regression	0.005391	Akaike info criterion	-7.602178
Sum squared resid	0.004766	Schwarz criterion	-7.583354
Log likelihood	628.1796	Hannan-Quinn criter.	-7.594536
Durbin-Watson stat	0.661395		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.337626	0.0005
Test critical values:	1% level	-3.470179	
	5% level	-2.878937	
	10% level	-2.576124	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 05/18/19 Time: 23:44
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.202172	0.046609	-4.337626	0.0000
C	0.000684	0.000458	1.495314	0.1368

R-squared	0.103484	Mean dependent var	-0.000123
Adjusted R-squared	0.097984	S.D. dependent var	0.005655
S.E. of regression	0.005371	Akaike info criterion	-7.603681
Sum squared resid	0.004702	Schwarz criterion	-7.566033
Log likelihood	629.3037	Hannan-Quinn criter.	-7.588398
F-statistic	18.81500	Durbin-Watson stat	0.659943
Prob(F-statistic)	0.000025		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.321828	0.0037
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 05/18/19 Time: 23:45
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.202120	0.046767	-4.321828	0.0000
C	0.000652	0.000875	0.745236	0.4572
@TREND("2005M02")	3.84E-07	8.81E-06	0.043612	0.9653

R-squared	0.103495	Mean dependent var	-0.000123
Adjusted R-squared	0.092427	S.D. dependent var	0.005655
S.E. of regression	0.005387	Akaike info criterion	-7.591571
Sum squared resid	0.004702	Schwarz criterion	-7.535099
Log likelihood	629.3046	Hannan-Quinn criter.	-7.568647
F-statistic	9.350848	Durbin-Watson stat	0.659968
Prob(F-statistic)	0.000143		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.149896	0.0000
Test critical values:	1% level	-2.579404	
	5% level	-1.942818	
	10% level	-1.615392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 05/18/19 Time: 23:46
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.113736	0.022085	-5.149896	0.0000
D(LRGDP(-1),2)	1.461962	0.073829	19.80195	0.0000
D(LRGDP(-2),2)	-0.949019	0.137947	-6.879611	0.0000
D(LRGDP(-3),2)	0.104601	0.132424	0.789890	0.4308
D(LRGDP(-4),2)	0.209073	0.076889	2.719139	0.0073

R-squared	0.894990	Mean dependent var	-5.57E-05
Adjusted R-squared	0.892298	S.D. dependent var	0.005658
S.E. of regression	0.001857	Akaike info criterion	-9.709364
Sum squared resid	0.000538	Schwarz criterion	-9.613668
Log likelihood	786.6038	Hannan-Quinn criter.	-9.670508
Durbin-Watson stat	1.729741		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.683122	0.0000
Test critical values:	1% level	-3.471192	
	5% level	-2.879380	
	10% level	-2.576361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 05/18/19 Time: 23:47
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.178817	0.026756	-6.683122	0.0000
D(LRGDP(-1),2)	1.456813	0.070595	20.63630	0.0000
D(LRGDP(-2),2)	-0.820952	0.135788	-6.045822	0.0000
D(LRGDP(-3),2)	0.039817	0.127654	0.311913	0.7555
D(LRGDP(-4),2)	0.289238	0.076245	3.793536	0.0002
C	0.000703	0.000177	3.959884	0.0001

R-squared	0.904638	Mean dependent var	-5.57E-05
Adjusted R-squared	0.901562	S.D. dependent var	0.005658
S.E. of regression	0.001775	Akaike info criterion	-9.793311
Sum squared resid	0.000488	Schwarz criterion	-9.678476
Log likelihood	794.3615	Hannan-Quinn criter.	-9.746683
F-statistic	294.0766	Durbin-Watson stat	1.653661
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.661016	0.0000
Test critical values:	1% level	-4.016064	
	5% level	-3.437977	
	10% level	-3.143241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 05/18/19 Time: 23:48
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.178799	0.026843	-6.661016	0.0000
D(LRGDP(-1),2)	1.456703	0.070827	20.56698	0.0000
D(LRGDP(-2),2)	-0.820849	0.136226	-6.025641	0.0000
D(LRGDP(-3),2)	0.039658	0.128070	0.309655	0.7572
D(LRGDP(-4),2)	0.289288	0.076490	3.782017	0.0002
C	0.000732	0.000314	2.328209	0.0212
@TREND("2005M02")	-3.41E-07	3.02E-06	-0.112835	0.9103

R-squared	0.904646	Mean dependent var	-5.57E-05
Adjusted R-squared	0.900931	S.D. dependent var	0.005658
S.E. of regression	0.001781	Akaike info criterion	-9.780971
Sum squared resid	0.000488	Schwarz criterion	-9.646997
Log likelihood	794.3682	Hannan-Quinn criter.	-9.726572
F-statistic	243.5050	Durbin-Watson stat	1.653556
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: None
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.348800	0.0187
Test critical values:	1% level	-2.579870	
	5% level	-1.942883	
	10% level	-1.615351	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 06/16/19 Time: 13:27
Sample (adjusted): 2006M01 2018M12
Included observations: 156 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.042656	0.018161	-2.348800	0.0202
D(LRGDP(-1),2)	1.811846	0.079738	22.72247	0.0000
D(LRGDP(-2),2)	-1.356255	0.157588	-8.606330	0.0000
D(LRGDP(-3),2)	-0.674287	0.182794	-3.688776	0.0003
D(LRGDP(-4),2)	2.104493	0.190592	11.04188	0.0000
D(LRGDP(-5),2)	-1.728666	0.212787	-8.123907	0.0000
D(LRGDP(-6),2)	0.147202	0.190501	0.772710	0.4409
D(LRGDP(-7),2)	0.779850	0.180585	4.318478	0.0000
D(LRGDP(-8),2)	-0.712542	0.153950	-4.628390	0.0000
D(LRGDP(-9),2)	0.221645	0.079001	2.805609	0.0057

R-squared	0.953112	Mean dependent var	-3.86E-05
Adjusted R-squared	0.950221	S.D. dependent var	0.005740
S.E. of regression	0.001281	Akaike info criterion	-10.42084
Sum squared resid	0.000239	Schwarz criterion	-10.22534
Log likelihood	822.8258	Hannan-Quinn criter.	-10.34144
Durbin-Watson stat	1.992365		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.149025	0.0251
Test critical values:	1% level	-3.472534	
	5% level	-2.879966	
	10% level	-2.576674	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 06/16/19 Time: 13:28
Sample (adjusted): 2006M01 2018M12
Included observations: 156 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.083111	0.026393	-3.149025	0.0020
D(LRGDP(-1),2)	1.831622	0.079398	23.06897	0.0000
D(LRGDP(-2),2)	-1.312979	0.157167	-8.354061	0.0000
D(LRGDP(-3),2)	-0.641070	0.181415	-3.533723	0.0006
D(LRGDP(-4),2)	2.121981	0.188613	11.25046	0.0000
D(LRGDP(-5),2)	-1.719085	0.210421	-8.169748	0.0000
D(LRGDP(-6),2)	0.187641	0.189328	0.991091	0.3233
D(LRGDP(-7),2)	0.796017	0.178701	4.454467	0.0000
D(LRGDP(-8),2)	-0.728426	0.152391	-4.779972	0.0000
D(LRGDP(-9),2)	0.254679	0.079685	3.196084	0.0017
C	0.000312	0.000149	2.091307	0.0382

R-squared	0.954484	Mean dependent var	-3.86E-05
Adjusted R-squared	0.951345	S.D. dependent var	0.005740
S.E. of regression	0.001266	Akaike info criterion	-10.43774
Sum squared resid	0.000232	Schwarz criterion	-10.22269
Log likelihood	825.1437	Hannan-Quinn criter.	-10.35039
F-statistic	304.0727	Durbin-Watson stat	2.010896
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LRGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.110343	0.1076
Test critical values:	1% level	-4.017956	
	5% level	-3.438886	
	10% level	-3.143776	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LRGDP,2)
Method: Least Squares
Date: 06/16/19 Time: 13:28
Sample (adjusted): 2006M01 2018M12
Included observations: 156 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRGDP(-1))	-0.082682	0.026583	-3.110343	0.0023
D(LRGDP(-1),2)	1.830956	0.079745	22.96012	0.0000
D(LRGDP(-2),2)	-1.312908	0.157693	-8.325712	0.0000
D(LRGDP(-3),2)	-0.641804	0.182066	-3.525124	0.0006
D(LRGDP(-4),2)	2.121343	0.189276	11.20768	0.0000
D(LRGDP(-5),2)	-1.718614	0.211141	-8.139670	0.0000
D(LRGDP(-6),2)	0.186729	0.190025	0.982651	0.3274
D(LRGDP(-7),2)	0.795803	0.179303	4.438318	0.0000
D(LRGDP(-8),2)	-0.728216	0.152906	-4.762518	0.0000
D(LRGDP(-9),2)	0.254265	0.079983	3.178985	0.0018
C	0.000348	0.000243	1.431911	0.1543
@TREND("2005M02")	-4.19E-07	2.27E-06	-0.184608	0.8538

R-squared	0.954495	Mean dependent var	-3.86E-05
Adjusted R-squared	0.951019	S.D. dependent var	0.005740
S.E. of regression	0.001270	Akaike info criterion	-10.42516
Sum squared resid	0.000232	Schwarz criterion	-10.19055
Log likelihood	825.1622	Hannan-Quinn criter.	-10.32987
F-statistic	274.5913	Durbin-Watson stat	2.010869
Prob(F-statistic)	0.000000		

- **Lbist (Log of BIST100 Index)**

Null Hypothesis: D(LBIST) has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.628665	0.0000
Test critical values:	1% level	-2.579052	
	5% level	-1.942768	
	10% level	-1.615423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 05/18/19 Time: 23:50
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.720343	0.074812	-9.628665	0.0000

R-squared	0.361145	Mean dependent var	0.000218
Adjusted R-squared	0.361145	S.D. dependent var	0.077099
S.E. of regression	0.061624	Akaike info criterion	-2.729484
Sum squared resid	0.622795	Schwarz criterion	-2.710660
Log likelihood	226.1825	Hannan-Quinn criter.	-2.721843
Durbin-Watson stat	1.967175		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.709223	0.0000
Test critical values:	1% level	-3.470179	
	5% level	-2.878937	
	10% level	-2.576124	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 05/18/19 Time: 23:51
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.730456	0.075233	-9.709223	0.0000
C	0.005621	0.004824	1.165197	0.2456

R-squared	0.366422	Mean dependent var	0.000218
Adjusted R-squared	0.362535	S.D. dependent var	0.077099
S.E. of regression	0.061557	Akaike info criterion	-2.725658
Sum squared resid	0.617651	Schwarz criterion	-2.688010
Log likelihood	226.8668	Hannan-Quinn criter.	-2.710375
F-statistic	94.26901	Durbin-Watson stat	1.964604
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.714498	0.0000
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 05/18/19 Time: 23:51
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.732976	0.075452	-9.714498	0.0000
C	0.011359	0.009781	1.161330	0.2472
@TREND("2005M02")	-6.81E-05	0.000101	-0.674697	0.5008

R-squared	0.368197	Mean dependent var	0.000218
Adjusted R-squared	0.360397	S.D. dependent var	0.077099
S.E. of regression	0.061660	Akaike info criterion	-2.716343
Sum squared resid	0.615920	Schwarz criterion	-2.659871
Log likelihood	227.0983	Hannan-Quinn criter.	-2.693419
F-statistic	47.20458	Durbin-Watson stat	1.965446
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.398457	0.0000
Test critical values:	1% level	-2.579404	
	5% level	-1.942818	
	10% level	-1.615392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 05/18/19 Time: 23:53
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.594168	0.135085	-4.398457	0.0000
D(LBIST(-1),2)	-0.117662	0.127296	-0.924322	0.3567
D(LBIST(-2),2)	-0.214238	0.114574	-1.869859	0.0634
D(LBIST(-3),2)	-0.102513	0.096292	-1.064603	0.2887
D(LBIST(-4),2)	-0.097318	0.078932	-1.232935	0.2195

R-squared	0.383146	Mean dependent var	-0.000606
Adjusted R-squared	0.367329	S.D. dependent var	0.077774
S.E. of regression	0.061862	Akaike info criterion	-2.697251
Sum squared resid	0.597001	Schwarz criterion	-2.601556
Log likelihood	222.1287	Hannan-Quinn criter.	-2.658395
Durbin-Watson stat	1.983379		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.476594	0.0003
Test critical values:	1% level	-3.471192	
	5% level	-2.879380	
	10% level	-2.576361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 05/18/19 Time: 23:54
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.620762	0.138668	-4.476594	0.0000
D(LBIST(-1),2)	-0.096944	0.129645	-0.747763	0.4557
D(LBIST(-2),2)	-0.198373	0.116134	-1.708127	0.0896
D(LBIST(-3),2)	-0.092541	0.097062	-0.953415	0.3419
D(LBIST(-4),2)	-0.091661	0.079269	-1.156331	0.2493
C	0.004317	0.005005	0.862461	0.3898

R-squared	0.386092	Mean dependent var	-0.000606
Adjusted R-squared	0.366288	S.D. dependent var	0.077774
S.E. of regression	0.061913	Akaike info criterion	-2.689617
Sum squared resid	0.594150	Schwarz criterion	-2.574782
Log likelihood	222.5141	Hannan-Quinn criter.	-2.642989
F-statistic	19.49614	Durbin-Watson stat	1.982300
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.490015	0.0021
Test critical values:	1% level	-4.016064	
	5% level	-3.437977	
	10% level	-3.143241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 05/18/19 Time: 23:54
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.628070	0.139881	-4.490015	0.0000
D(LBIST(-1),2)	-0.091440	0.130496	-0.700707	0.4845
D(LBIST(-2),2)	-0.194417	0.116730	-1.665532	0.0978
D(LBIST(-3),2)	-0.090250	0.097429	-0.926322	0.3557
D(LBIST(-4),2)	-0.090630	0.079499	-1.140014	0.2561
C	0.008665	0.010510	0.824453	0.4110
@TREND("2005M02")	-4.99E-05	0.000106	-0.470871	0.6384

R-squared	0.386974	Mean dependent var	-0.000606
Adjusted R-squared	0.363090	S.D. dependent var	0.077774
S.E. of regression	0.062069	Akaike info criterion	-2.678633
Sum squared resid	0.593296	Schwarz criterion	-2.544659
Log likelihood	222.6300	Hannan-Quinn criter.	-2.624234
F-statistic	16.20216	Durbin-Watson stat	1.981759
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.628665	0.0000
Test critical values:	1% level	-2.579052	
	5% level	-1.942768	
	10% level	-1.615423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 06/16/19 Time: 13:30
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.720343	0.074812	-9.628665	0.0000

R-squared	0.361145	Mean dependent var	0.000218
Adjusted R-squared	0.361145	S.D. dependent var	0.077099
S.E. of regression	0.061624	Akaike info criterion	-2.729484
Sum squared resid	0.622795	Schwarz criterion	-2.710660
Log likelihood	226.1825	Hannan-Quinn criter.	-2.721843
Durbin-Watson stat	1.967175		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.709223	0.0000
Test critical values:	1% level	-3.470179	
	5% level	-2.878937	
	10% level	-2.576124	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 06/16/19 Time: 13:31
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.730456	0.075233	-9.709223	0.0000
C	0.005621	0.004824	1.165197	0.2456

R-squared	0.366422	Mean dependent var	0.000218
Adjusted R-squared	0.362535	S.D. dependent var	0.077099
S.E. of regression	0.061557	Akaike info criterion	-2.725658
Sum squared resid	0.617651	Schwarz criterion	-2.688010
Log likelihood	226.8668	Hannan-Quinn criter.	-2.710375
F-statistic	94.26901	Durbin-Watson stat	1.964604
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LBIST) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.714498	0.0000
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LBIST,2)
Method: Least Squares
Date: 06/16/19 Time: 13:31
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBIST(-1))	-0.732976	0.075452	-9.714498	0.0000
C	0.011359	0.009781	1.161330	0.2472
@TREND("2005M02")	-6.81E-05	0.000101	-0.674697	0.5008

R-squared	0.368197	Mean dependent var	0.000218
Adjusted R-squared	0.360397	S.D. dependent var	0.077099
S.E. of regression	0.061660	Akaike info criterion	-2.716343
Sum squared resid	0.615920	Schwarz criterion	-2.659871
Log likelihood	227.0983	Hannan-Quinn criter.	-2.693419
F-statistic	47.20458	Durbin-Watson stat	1.965446
Prob(F-statistic)	0.000000		

➢ Lcpi (Log of Consumer Price Index)

Null Hypothesis: D(LCPI) has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.799030	0.0000
Test critical values:	1% level	-2.579052	
	5% level	-1.942768	
	10% level	-1.615423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 05/18/19 Time: 23:57
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.439981	0.064712	-6.799030	0.0000

R-squared	0.219880	Mean dependent var	-4.01E-05
Adjusted R-squared	0.219880	S.D. dependent var	0.011088
S.E. of regression	0.009793	Akaike info criterion	-6.408214
Sum squared resid	0.015729	Schwarz criterion	-6.389390
Log likelihood	529.6777	Hannan-Quinn criter.	-6.400573
Durbin-Watson stat	2.006926		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.718623	0.0000
Test critical values:	1% level	-3.470179	
	5% level	-2.878937	
	10% level	-2.576124	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 05/18/19 Time: 23:58
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.737708	0.075907	-9.718623	0.0000
C	0.005501	0.000894	6.151682	0.0000

R-squared	0.366871	Mean dependent var	-4.01E-05
Adjusted R-squared	0.362987	S.D. dependent var	0.011088
S.E. of regression	0.008849	Akaike info criterion	-6.604867
Sum squared resid	0.012765	Schwarz criterion	-6.567219
Log likelihood	546.9015	Hannan-Quinn criter.	-6.589585
F-statistic	94.45164	Durbin-Watson stat	1.874400
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.792381	0.0000
Test critical values:	1% level	-4.014635	
	5% level	-3.437289	
	10% level	-3.142837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 05/18/19 Time: 23:59
Sample (adjusted): 2005M04 2018M12
Included observations: 165 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.750235	0.076614	-9.792381	0.0000
C	0.004188	0.001452	2.884650	0.0045
@TREND("2005M02")	1.68E-05	1.46E-05	1.147813	0.2527

R-squared	0.371979	Mean dependent var	-4.01E-05
Adjusted R-squared	0.364225	S.D. dependent var	0.011088
S.E. of regression	0.008841	Akaike info criterion	-6.600846
Sum squared resid	0.012662	Schwarz criterion	-6.544374
Log likelihood	547.5698	Hannan-Quinn criter.	-6.577922
F-statistic	47.97654	Durbin-Watson stat	1.870434
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: None
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.234834	0.0249
Test critical values:	1% level	-2.579404	
	5% level	-1.942818	
	10% level	-1.615392	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 05/19/19 Time: 00:01
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.188749	0.084458	-2.234834	0.0268
D(LCPI(-1),2)	-0.252174	0.097921	-2.575289	0.0109
D(LCPI(-2),2)	-0.523436	0.101712	-5.146256	0.0000
D(LCPI(-3),2)	-0.184276	0.097620	-1.887688	0.0609
D(LCPI(-4),2)	-0.371662	0.086429	-4.300203	0.0000

R-squared	0.365188	Mean dependent var	1.09E-05
Adjusted R-squared	0.348911	S.D. dependent var	0.011188
S.E. of regression	0.009027	Akaike info criterion	-6.546549
Sum squared resid	0.012713	Schwarz criterion	-6.450853
Log likelihood	531.9972	Hannan-Quinn criter.	-6.507693
Durbin-Watson stat	2.123260		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.471182	0.0000
Test critical values:	1% level	-3.471192	
	5% level	-2.879380	
	10% level	-2.576361	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 05/19/19 Time: 00:02
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.890630	0.162786	-5.471182	0.0000
D(LCPI(-1),2)	0.276934	0.140979	1.964360	0.0513
D(LCPI(-2),2)	-0.054970	0.134320	-0.409243	0.6829
D(LCPI(-3),2)	0.131921	0.111403	1.184180	0.2382
D(LCPI(-4),2)	-0.163447	0.091027	-1.795595	0.0745
C	0.006766	0.001373	4.927182	0.0000

R-squared	0.451152	Mean dependent var	1.09E-05
Adjusted R-squared	0.433448	S.D. dependent var	0.011188
S.E. of regression	0.008421	Akaike info criterion	-6.679634
Sum squared resid	0.010991	Schwarz criterion	-6.564799
Log likelihood	543.7106	Hannan-Quinn criter.	-6.633007
F-statistic	25.48197	Durbin-Watson stat	2.018017
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.658944	0.0000
Test critical values:	1% level	-4.016064	
	5% level	-3.437977	
	10% level	-3.143241	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 05/19/19 Time: 00:02
Sample (adjusted): 2005M08 2018M12
Included observations: 161 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.949514	0.167790	-5.658944	0.0000
D(LCPI(-1),2)	0.320551	0.144054	2.225219	0.0275
D(LCPI(-2),2)	-0.021212	0.136128	-0.155823	0.8764
D(LCPI(-3),2)	0.150463	0.111880	1.344860	0.1806
D(LCPI(-4),2)	-0.150698	0.091225	-1.651937	0.1006
C	0.005447	0.001668	3.264751	0.0014
@TREND("2005M02")	2.04E-05	1.48E-05	1.384096	0.1683

R-squared	0.457896	Mean dependent var	1.09E-05
Adjusted R-squared	0.436775	S.D. dependent var	0.011188
S.E. of regression	0.008396	Akaike info criterion	-6.679575
Sum squared resid	0.010856	Schwarz criterion	-6.545601
Log likelihood	544.7058	Hannan-Quinn criter.	-6.625176
F-statistic	21.67972	Durbin-Watson stat	2.010556
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: None
Lag Length: 5 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.591596	0.1048
Test critical values:	1% level	-2.579495	
	5% level	-1.942830	
	10% level	-1.615384	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 06/16/19 Time: 13:57
Sample (adjusted): 2005M09 2018M12
Included observations: 160 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.135232	0.084966	-1.591596	0.1135
D(LCPI(-1),2)	-0.371436	0.105946	-3.505905	0.0006
D(LCPI(-2),2)	-0.597334	0.103807	-5.754262	0.0000
D(LCPI(-3),2)	-0.344322	0.111800	-3.079794	0.0025
D(LCPI(-4),2)	-0.504093	0.096642	-5.216092	0.0000
D(LCPI(-5),2)	-0.252592	0.089619	-2.818494	0.0055

R-squared	0.394266	Mean dependent var	-7.81E-05
Adjusted R-squared	0.374600	S.D. dependent var	0.011166
S.E. of regression	0.008830	Akaike info criterion	-6.584545
Sum squared resid	0.012007	Schwarz criterion	-6.469226
Log likelihood	532.7636	Hannan-Quinn criter.	-6.537718
Durbin-Watson stat	1.989675		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.706885	0.0000
Test critical values:	1% level	-3.470427	
	5% level	-2.879045	
	10% level	-2.576182	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 06/16/19 Time: 13:58
Sample (adjusted): 2005M05 2018M12
Included observations: 164 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.920402	0.094820	-9.706885	0.0000
D(LCPI(-1),2)	0.242105	0.078001	3.103880	0.0023
C	0.006899	0.000987	6.987410	0.0000

R-squared	0.402044	Mean dependent var	-6.78E-05
Adjusted R-squared	0.394616	S.D. dependent var	0.011116
S.E. of regression	0.008649	Akaike info criterion	-6.644630
Sum squared resid	0.012044	Schwarz criterion	-6.587926
Log likelihood	547.8597	Hannan-Quinn criter.	-6.621610
F-statistic	54.12521	Durbin-Watson stat	1.959978
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LCPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.898810	0.0000
Test critical values:	1% level	-4.014986	
	5% level	-3.437458	
	10% level	-3.142936	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 06/16/19 Time: 13:58
Sample (adjusted): 2005M05 2018M12
Included observations: 164 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.952084	0.096182	-9.898810	0.0000
D(LCPI(-1),2)	0.260996	0.078389	3.329505	0.0011
C	0.005095	0.001459	3.492401	0.0006
@TREND("2005M02")	2.42E-05	1.45E-05	1.671526	0.0966

R-squared	0.412306	Mean dependent var	-6.78E-05
Adjusted R-squared	0.401287	S.D. dependent var	0.011116
S.E. of regression	0.008601	Akaike info criterion	-6.649747
Sum squared resid	0.011837	Schwarz criterion	-6.574141
Log likelihood	549.2793	Hannan-Quinn criter.	-6.619054
F-statistic	37.41688	Durbin-Watson stat	1.965648
Prob(F-statistic)	0.000000		

Appendix H. Variable Descriptions of Regression Analysis

Table H.1 Variable Descriptions of Model 2.3.1

$\log(ipi_t) = \beta_0 + \beta_1 \, slope_t + \beta_2 \, curvature_t + \varepsilon_t$

Name of Variable in Eviews	Explanation
lipi	logarithm of industrial production index
slope	slope parameter (β_2) of the yield curve estimated via DNS
curvature	curvature parameter (β_3) of the yield curve estimated via DNS

Table H.2 Variable Descriptions of Model 2.3.2

$\log(ipi_t) = \beta_0 + \beta_i \sum_1^i lipi_{t-i} + \beta_{i+1} \, level_t + \beta_{i+2} \, slope_t + \beta_{i+3} \, curvature_t + \varepsilon_t$

Name of Variable in Eviews	Explanation
lipi	logarithm of industrial production index
level	level parameter (β_1) of the yield curve estimated via DNS
slope	slope parameter (β_2) of the yield curve estimated via DNS
curvature	curvature parameter (β_3) of the yield curve estimated via DNS

Table H.3 Variable Descriptions of Model 2.3.3

$dlog(rgdp_t)$ / $dlog(bist_t)$ / $dlog(cpi_t) = \beta_0 + \beta_1$ $dlevel_t + \beta_2$ $dslope_t + \beta_3$ $dcurvature_t + \varepsilon_t$

Name of Variable in Eviews	Explanation
rgdp	real GDP index
lrgdp	logarithm of real GDP index
dlrgdp	first difference I(1) of logarithm of real GDP index
bist	bist100 index
lbist	logarithm of bist100 index
dlbist	first difference I(1) of logarithm of bist100 index
cpi	consumer price index
lcpi	logarithm of consumer price index
dlcpi	first difference I(1) of logarithm of consumer price index
dlevel	first difference I(1) of level parameter (β_1) of the yield curve estimated via DNS
dslope	first difference I(1) of slope parameter (β_2) of the yield curve estimated via DNS
dcurvature	first difference I(1) of curvature parameter (β_3) of the yield curve estimated via DNS

Appendix I. Supporting Regression Analysis Results

Table I.1 Econometric Analysis Results of Model 2.3.1

$$\log(ipi_t) = \beta_0 + \beta_1\, slope_t + \beta_2\, curvature_t + \varepsilon_t$$

Dependent Variable: LIPI
Method: Least Squares
Date: 05/19/19 Time: 20:34
Sample: 2005M02 2018M12
Included observations: 167

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SLOPE	3.905297	0.586669	6.656728	0.0000
CURVATURE	-1.814987	0.323692	-5.607149	0.0000
C	4.465829	0.018708	238.7137	0.0000

R-squared	0.238257	Mean dependent var	4.398879
Adjusted R-squared	0.228967	S.D. dependent var	0.225502
S.E. of regression	0.198010	Akaike info criterion	-0.383200
Sum squared resid	6.430092	Schwarz criterion	-0.327188
Log likelihood	34.99718	Hannan-Quinn criter.	-0.360466
F-statistic	25.64783	Durbin-Watson stat	0.362128
Prob(F-statistic)	0.000000		

Table I.2 Econometric Analysis Results of Model 2.3.2

$\log(ipi_{(t)}) = \beta_0 + \beta_i \sum_1^i lipi_{t-i} + \beta_{i+1}\, level_t + \beta_{i+2}\, slope_t + \beta_{i+3}\, curvature_t + \varepsilon_t$ (ARDL Model)

Akaike-Info Criterion with Max. 11 Lags

Dependent Variable: LIPI
Method: ARDL
Date: 05/20/19 Time: 00:34
Sample (adjusted): 2005M05 2018M12
Included observations: 164 after adjustments
Maximum dependent lags: 11 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (11 lags, automatic): LEVEL SLOPE CURVATURE

Fixed regressors: C
Number of models evalulated: 19008
Selected Model: ARDL(3, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LIPI(-1)	0.168354	0.078217	2.152410	0.0329
LIPI(-2)	0.599064	0.063080	9.496914	0.0000
LIPI(-3)	0.201363	0.078006	2.581382	0.0108
LEVEL	-0.338080	0.129485	-2.610961	0.0099
SLOPE	-0.102875	0.172631	-0.595927	0.5521
CURVATURE	0.057930	0.100561	0.576070	0.5654
C	0.183632	0.097154	1.890119	0.0606

R-squared	0.953054	Mean dependent var	4.405281
Adjusted R-squared	0.951259	S.D. dependent var	0.222466
S.E. of regression	0.049114	Akaike info criterion	-3.147583
Sum squared resid	0.378719	Schwarz criterion	-3.015272
Log likelihood	265.1018	Hannan-Quinn criter.	-3.093870
F-statistic	531.2067	Durbin-Watson stat	1.992087
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LIPI)
Selected Model: ARDL(3, 0, 0, 0)
Case 3: Unrestricted Constant and No Trend
Date: 05/20/19 Time: 00:35
Sample: 2005M02 2018M12
Included observations: 164

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.183632	0.097154	1.890119	0.0606
LIPI(-1)*	-0.031218	0.020768	-1.503170	0.1348
LEVEL**	-0.338080	0.129485	-2.610961	0.0099
SLOPE**	-0.102875	0.172631	-0.595927	0.5521
CURVATURE**	0.057930	0.100561	0.576070	0.5654
D(LIPI(-1))	-0.800428	0.078880	-10.14738	0.0000
D(LIPI(-2))	-0.201363	0.078006	-2.581382	0.0108

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEVEL	-10.82964	7.345071	-1.474409	0.1424
SLOPE	-3.295376	6.728585	-0.489758	0.6250
CURVATURE	1.855655	3.685835	0.503456	0.6153

EC = LIPI - (-10.8296*LEVEL -3.2954*SLOPE + 1.8557*CURVATURE)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	2.081855	10%	2.72	3.77
k	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61
Actual Sample Size	164		Finite Sample: n=80	
		10%	2.823	3.885
		5%	3.363	4.515
		1%	4.568	5.96

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-1.503170	10%	-2.57	-3.46
		5%	-2.86	-3.78
		2.5%	-3.13	-4.05
		1%	-3.43	-4.37

Hannan-Quinn Criterion with Max. 12 Lags

Dependent Variable: LIPI
Method: ARDL
Date: 05/20/19 Time: 00:27
Sample (adjusted): 2005M05 2018M12
Included observations: 164 after adjustments
Maximum dependent lags: 12 (Automatic selection)
Model selection method: Hannan-Quinn criterion (HQ)
Dynamic regressors (12 lags, automatic): LEVEL SLOPE CURVATURE
Fixed regressors: C
Number of models evalulated: 26364
Selected Model: ARDL(3, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LIPI(-1)	0.168354	0.078217	2.152410	0.0329
LIPI(-2)	0.599064	0.063080	9.496914	0.0000
LIPI(-3)	0.201363	0.078006	2.581382	0.0108
LEVEL	-0.338080	0.129485	-2.610961	0.0099
SLOPE	-0.102875	0.172631	-0.595927	0.5521
CURVATURE	0.057930	0.100561	0.576070	0.5654
C	0.183632	0.097154	1.890119	0.0606

R-squared	0.953054	Mean dependent var	4.405281
Adjusted R-squared	0.951259	S.D. dependent var	0.222466
S.E. of regression	0.049114	Akaike info criterion	-3.147583
Sum squared resid	0.378719	Schwarz criterion	-3.015272
Log likelihood	265.1018	Hannan-Quinn criter.	-3.093870
F-statistic	531.2067	Durbin-Watson stat	1.992087
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LIPI)
Selected Model: ARDL(3, 0, 0, 0)
Case 3: Unrestricted Constant and No Trend
Date: 05/20/19 Time: 00:28
Sample: 2005M02 2018M12
Included observations: 164

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.183632	0.097154	1.890119	0.0606
LIPI(-1)*	-0.031218	0.020768	-1.503170	0.1348
LEVEL**	-0.338080	0.129485	-2.610961	0.0099
SLOPE**	-0.102875	0.172631	-0.595927	0.5521
CURVATURE**	0.057930	0.100561	0.576070	0.5654
D(LIPI(-1))	-0.800428	0.078880	-10.14738	0.0000
D(LIPI(-2))	-0.201363	0.078006	-2.581382	0.0108

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEVEL	-10.82964	7.345071	-1.474409	0.1424
SLOPE	-3.295376	6.728585	-0.489758	0.6250
CURVATURE	1.855655	3.685835	0.503456	0.6153

EC = LIPI - (-10.8296*LEVEL -3.2954*SLOPE + 1.8557*CURVATURE)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	2.081855	10%	2.72	3.77
k	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61
Actual Sample Size	164		Finite Sample: n=80	
		10%	2.823	3.885
		5%	3.363	4.515
		1%	4.568	5.96

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-1.503170	10%	-2.57	-3.46
		5%	-2.86	-3.78
		2.5%	-3.13	-4.05
		1%	-3.43	-4.37

Table I.3 Econometric Analysis Results of Model 2.3.3

Model 2.3.3.a: $dlog(rgdp_t) = \beta_0 + \beta_1\, dlevel_t + \beta_2\, dslope_t + \beta_3\, dcurvature_t + \varepsilon_t$

Dependent Variable: DLRGDP
Method: Least Squares
Date: 05/20/19 Time: 19:57
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLEVEL	0.088152	0.072497	1.215940	0.2258
DSLOPE	0.069241	0.054450	1.271629	0.2053
DCURVATURE	0.017739	0.019513	0.909061	0.3647
C	0.003929	0.000699	5.617281	0.0000

R-squared	0.014397	Mean dependent var	0.003951
Adjusted R-squared	-0.003855	S.D. dependent var	0.008988
S.E. of regression	0.009005	Akaike info criterion	-6.558264
Sum squared resid	0.013137	Schwarz criterion	-6.483276
Log likelihood	548.3359	Hannan-Quinn criter.	-6.527826
F-statistic	0.788799	Durbin-Watson stat	0.412133
Prob(F-statistic)	0.501783		

Model 2.3.3.b: $dlog(bist_t) = \beta_0 + \beta_1 \, dlevel_t + \beta_2 \, dslope_t + \beta_3 \, dcurvature_t + \varepsilon_t$

Dependent Variable: DLBIST
Method: Least Squares
Date: 05/20/19 Time: 20:14
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLEVEL	-1.971699	0.478963	-4.116604	0.0001
DSLOPE	-0.997295	0.359736	-2.772298	0.0062
DCURVATURE	-0.451744	0.128919	-3.504090	0.0006
C	0.007631	0.004621	1.651448	0.1006

R-squared	0.144403	Mean dependent var	0.007239
Adjusted R-squared	0.128559	S.D. dependent var	0.063731
S.E. of regression	0.059493	Akaike info criterion	-2.782104
Sum squared resid	0.573392	Schwarz criterion	-2.707116
Log likelihood	234.9146	Hannan-Quinn criter.	-2.751666
F-statistic	9.113862	Durbin-Watson stat	1.617465
Prob(F-statistic)	0.000013		

VAR Lag Order Selection Criteria
Endogenous variables: DLBIST DLEVEL DSLOPE DCURVATURE
Exogenous variables: C
Date: 06/23/19 Time: 18:57
Sample: 2005M02 2018M12
Included observations: 162

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1485.166	NA	1.34e-13	-18.28600	-18.20977	-18.25505
1	1538.646	103.6586	8.47e-14	-18.74872	-18.36754*	-18.59395*
2	1561.683	43.51343*	7.76e-14*	-18.83559*	-18.14946	-18.55701
3	1575.295	25.03945	8.00e-14	-18.80611	-17.81503	-18.40372
4	1585.769	18.75072	8.58e-14	-18.73789	-17.44187	-18.21169

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/23/19 Time: 18:08
Sample: 2005M02 2018M12
Included observations: 164

Dependent variable: DLBIST

Excluded	Chi-sq	df	Prob.
DLEVEL	13.95288	2	0.0009
DSLOPE	3.121341	2	0.2100
DCURVATURE	3.809060	2	0.1489
All	18.02437	6	0.0062

Dependent variable: DLEVEL

Excluded	Chi-sq	df	Prob.
DLBIST	0.526374	2	0.7686
DSLOPE	0.905998	2	0.6357
DCURVATURE	2.541830	2	0.2806
All	3.735276	6	0.7124

Dependent variable: DSLOPE

Excluded	Chi-sq	df	Prob.
DLBIST	3.987312	2	0.1362
DLEVEL	6.122163	2	0.0468
DCURVATURE	46.08766	2	0.0000
All	53.31212	6	0.0000

Dependent variable: DCURVATURE

Excluded	Chi-sq	df	Prob.
DLBIST	1.429676	2	0.4893
DLEVEL	7.231618	2	0.0269
DSLOPE	0.195743	2	0.9068
All	19.59909	6	0.0033

Model 2.3.3.c: $dlog(cpi_t) = \beta_0 + \beta_1\, dlevel_t + \beta_2\, dslope_t + \beta_3\, dcurvature_t + \varepsilon_t$

Dependent Variable: DLCPI
Method: Least Squares
Date: 05/20/19 Time: 20:46
Sample (adjusted): 2005M03 2018M12
Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLEVEL	0.207193	0.068659	3.017720	0.0030
DSLOPE	0.264076	0.051568	5.120956	0.0000
DCURVATURE	0.014598	0.018480	0.789894	0.4307
C	0.007360	0.000662	11.11189	0.0000

R-squared	0.141439	Mean dependent var	0.007442
Adjusted R-squared	0.125540	S.D. dependent var	0.009120
S.E. of regression	0.008528	Akaike info criterion	-6.667054
Sum squared resid	0.011783	Schwarz criterion	-6.592066
Log likelihood	557.3655	Hannan-Quinn criter.	-6.636616
F-statistic	8.895948	Durbin-Watson stat	1.696482
Prob(F-statistic)	0.000017		

VAR Lag Order Selection Criteria
Endogenous variables: DLCPI DLEVEL DSLOPE DCURVATURE
Exogenous variables: C
Date: 06/23/19 Time: 18:59
Sample: 2005M02 2018M12
Included observations: 162

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1798.904	NA	2.80e-15	-22.15931	-22.08307	-22.12836
1	1850.908	100.7966	1.79e-15	-22.60380	-22.22261*	-22.44903*
2	1876.437	48.22181	1.59e-15	-22.72144	-22.03531	-22.44286
3	1888.611	22.39539	1.67e-15	-22.67421	-21.68313	-22.27182
4	1908.700	35.96150*	1.59e-15*	-22.72469*	-21.42867	-22.19849

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/23/19 Time: 19:02
Sample: 2005M02 2018M12
Included observations: 162

Dependent variable: DLCPI

Excluded	Chi-sq	df	Prob.
DLEVEL	25.02535	4	0.0000
DSLOPE	8.700200	4	0.0690
DCURVATURE	4.926286	4	0.2949
All	43.73576	12	0.0000

Dependent variable: DLEVEL

Excluded	Chi-sq	df	Prob.
DLCPI	3.331630	4	0.5039
DSLOPE	4.053076	4	0.3989
DCURVATURE	0.844588	4	0.9324
All	8.390279	12	0.7539

Dependent variable: DSLOPE

Excluded	Chi-sq	df	Prob.
DLCPI	2.279502	4	0.6845
DLEVEL	1.427680	4	0.8394
DCURVATURE	32.04018	4	0.0000
All	43.48257	12	0.0000

Dependent variable: DCURVATURE

Excluded	Chi-sq	df	Prob.
DLCPI	2.821398	4	0.5881
DLEVEL	11.20852	4	0.0243
DSLOPE	2.322895	4	0.6766
All	21.75502	12	0.0404