BOND LIQUIDITY, ORDER FLOW, INFORMATION EFFICIENCY AND YIELDS OF TREASURY BONDS IN KENYA

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2022

DECLARATION

I declare that this research thesis is my original work and has not been presented to any other institution of learning for the award of an academic certificate.

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DEDICATION

To my family especially my Dad-Justus Kimwele Mbaya, mum-Pauline Mary Kimwele (councillor Kana), wife-Lilian Awino Adere, Sister-Francisca Kyambi Kimwele, brother-Antony Mutunga Kimwele and my children for their moral support, encouragement and drive in the pursuit of the doctoral studies.

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LIST OF ABBREVIATIONS AND ACRONYMS

AMH	-	Adaptive Markets Hypothesis
ANOVA	-	Analysis of Variance
APARCH	-	Asymmetric Power Autoregressive Conditional Heteroscedastic
ARCH	-	Autoregressive Conditional Heteroscedastic
ARFIMA	-	Autoregressive Fractional Integrated Moving Average
ARMA	-	Autoregressive Moving Average
ATS	-	Automated Trading System
BL	-	Bond Liquidity
BY	-	Bond Yield
CBK	-	Central Bank of Kenya
CDS/CSD	-	Central Securities Depository
CDSC	-	Central Depository & Settlement Corporation
CMA	-	Capital Markets Authority
CRSP	-	Center for Research in Security Prices
EMH	-	Efficient Markets Hypothesis
FIGARCH	-	Fractional Integrated Generalized Auto Regressive Conditional Heteroskedasticity
FTSE 100	-	Financial Times Stock Exchange 100 Index
FEM	-	Fixed Effects Model
IE	-	Information Efficiency
GARCH	-	Generalized Auto Regressive Conditional Heteroskedasticity

GDP	**-**	Gross Domestic Product
GLS	-	Generalized Least Squares
HFT	**-**	High Frequency Trading
LM	-	Lagrange Multiplier
LIFFE	**-**	London International Financial Futures and Options Exchange
MD	-	Median
MN	-	Mean
MQI	-	Market Quality Index
MTDS	-	Medium-Term Debt Strategy
NASDAQ	**-**	National Association of Securities Dealers Automated Quotation System
NBER	**-**	National Bureau of Economic Research
NSE	**-**	Nairobi Securities Exchange
NYSE	**-**	New York Stock Exchange
OF	-	Order Flow
OLS	-	Ordinary Least Square
OTC	**-**	Over-The-Counter
REM	-	Random Effects Model
RWH	**-**	Random Walk Hypothesis
SD	-	Standard Deviations
S & P 500	**-**	Standard & Poor's 500
UK	**-**	United Kingdom
USA	-	United States of America

VAR	-	Vector Auto Regression
VIF	-	Variance Inflation Factor
YTM	-	Yield to Maturity

ABSTRACT

Treasury bonds are secure units of government debt, they offer medium to long-term investment to traders. Auctioned by the Central Bank of Kenya (CBK) on monthly basis. Government of Kenya in quest to promote economic growth and sustainability of financial system, designed and implemented policies that created regulatory organ. Implementation of debt-restructuring program meant to reduce the pressure on interest rates arising from frequent rollover of maturing securities and to develop a reliable yield curve to guide pricing at the primary and secondary markets. CBK reported that the reforms would eventually promote liquidity and stabilize the bonds yields. Bonds yields in Kenya are erratic and unpredictable making it of interest to establish what the cause. Scholars have attempted to explain factors that drive yields of treasury bonds and they have failed to reach to a consensus. Researchers have ascertained that bond liquidity influences the bond yields while others have found that liquidity has insignificant impact on yields. It was paramount to introduce the order flow and information efficiency as moderators to test their effect on the relationship between the bond liquidity and yields of Treasury bonds in Kenya. The general objective of this study was to determine the relationship among the bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. This study adopted descriptive, correlational and longitudinal research designs to collect measure and analyze the data for 10 years period beginning January 2009 to December 2018. Fixed Effects Model and Random-effects regression analysis were used to test the formulated null hypothesis of the study. The study found out that bond liquidity was a significant predictor of bond yields. Bond liquidity accounted for the variance in bond yields of treasury bonds in Kenya. Order flow and Information Efficiency had a moderating effect on the relationship between bond liquidity and Bond yields of treasury bonds in Kenya. The bond liquidity had a negative relationship with yields of treasury bonds. The joint analysis established that order flow was statistically insignificant predictor of bond yields. Though the order flow and information efficiency as standalone moderators positively influenced the Treasury bond yields and were statistically significant. It was also established that the moderators had caused big variance in treasury yields as compared to effect of individual variables.

This study contributes to the existing knowledge in academia and provides insights into the Treasury bond market. It assessed adequacy of the existing literature, theory and identified gaps that may serve as guide to future research. The combination of order flow and information efficiency strengthened the relationship between bonds liquidity and yields. It is crucial to policy makers concerned with financial development in Kenya. The study recommend the central bank of Kenya to engage the Nairobi Securities exchanges and design good policies that could increase trading of treasury bonds at the secondary market. To deepen the Treasury bond market and promote financial inclusion, the study recommended policy shift and improvement of understanding of the available government bond products and improved customer care practices that would increase trading and trader's subscription.

CHAPTER ONE: INTRODUCTION

1.1.Background of the Study

Bond liquidity is a crucial microstructure element because it is necessary for determination of bond yields. Liquidity attribute affects expected returns by way of liquidity premium embedded on bond prices (Goyenko, Subrahmanyam & Ukhov 2016). Vital considerations before traders decide to invest in bonds market is the bond yields, they would receive as returns for investments (Collins & Fabozzi, 2000). The growth of bond markets is facilitated by efficient and liquid bond market and in such markets, there is always a benchmark yield curve for pricing of assets (Dick-Nielsen, Feldhutter, & Lando, 2012). If this is, the argument then bond liquidity is expected to directly influence bond yields. Therefore, it can be argued from researchers' point of view that bond liquidity influence yields of treasury bonds. According to Huang, Yu, Chen, Jia, and Xu (2022), yields of treasury bonds are affected by rigid payment since it influences investors to setup default risk premium and the demand for flight quality and flight liquidity. Order flow and information efficiency are equally vital microstructure elements that are expected to affect the relationship between bond liquidity and yields. Order flow drives a wedge and provides conduit between bond liquidity and yields of bonds since it provides an ex post measure of net demand of assets in the market (Kijima & Ting 2019). If this case is true, then the net order flow is expected to affect contemporaneous and next-day returns of bond yields through liquidity. The order flow affects the bond yields through liquidity (Brandt & Kavajecz 2004). Information efficiency plays a major role in determination of asset prices and market efficiency that determines the level assets liquidity and yields. When new information is released in the market, it induces sharp price adjustment, widens the bid/ask spread thus slowing down trading and affecting bond yields (Fleming & Remolona,

2001). According to Kondor and Pinter (2021), information is passed by dealers of their informed client's to their affiliates, which enables informed traders predict the order flow intermediated by their clients. The information is related to maturity structure of the order flow. Hence private information and aggregate order flow is critical in determining the yield curve dynamics. It is through the bonds yields, which results into well-developed yield curves used by investors as a pricing tool for future investments (Subrahmanyam, 2009 & Green, 2004). Therefore yields are influenced by several common factors amongst them are prices, liquidity, order flow and information efficiency (Hasbrouck & Seppi 2001). Researchers have ascertained that bond liquidity influences the bond yields while others have found that liquidity has insignificant impact on yields. Other studies are of the view that bond yields enhance liquidity and not the vice versa (Acharya & Pedersen 2003; Chen, Lesmond & Wei 2007). Hence, scholars find securities markets a dynamic field and so it has attracted different schools of thought on the influence of bond liquidity on bond yields of treasury bonds and ultimately interesting to comprehend how and why, the elements influencing bond yields vary over time.

Liquidity preference theory anchored the relationship among bond liquidity, order flow, informational efficiency and yields of treasury bonds, with other theories offering diverse perspectives including, efficiency market hypothesis, microstructure theory and the expectations theory. Keynes (1936), developed the liquidity preference theory where he postulated that investors prefer liquid and high interest rates on long-term bonds as compared to short-term securities, which are illiquid. While, Fama (1965), posit that markets are efficient and that securities prices fully reflect current market information and traders cannot make abnormal profits despite the traders' expertise whether analytical or fundamental. The microstructure theory by O' Hara (1995), argues that assets are traded under specific and explicit laid down trading

mechanisms. Lastly, expectations theory advanced by Hicks (1939), and Lutz (1940), postulate that yield curve shape reflects investors' expectations about future interest rates.

Treasury bonds are the main source of government funding. There were deliberate reforms in 2001 to 2014 to develop Kenya's domestic government securities market to stabilize the treasury bonds liquidity and yields (Ngugi & Agoti, 2010; Thiong'o, 2012). Some of proposed reforms were introduction of benchmark bond program, infrastructure bonds, the horizontal repo for the money market, and trading automation of the primary and secondary markets. Despite government efforts to streamline, the bonds market, bonds market continues to exhibit unreliable and erratic yields, liquidity tightness, information asymmetry, bonds under subscriptions and severe structural shortage of bonds (Thotho, 2017; Ngugi & Agoti, 2010). Hence, these conditions have darkened trading activities in the secondary bond market. In bond markets, there is order flow and information efficiency that seem to conduit the link between the bond liquidity and yields. Consequently, it was critical to establish the relationship among the bond liquidity, order flow, information efficiency and yields of treasury bonds in Kenya.

1.1.1. Bond Liquidity

Alonso, Blanco, Rio and Sanchis (2004), define bond liquidity as the ability with which bond can be converted easily into money whereas, Díaz, Merrick and Navarro (2006), describe bond liquidity as capacity to trade bonds within short period with less effects on prices. Goyenko, Subrahmanyam and Ukhov (2016), defined liquidity as an ability of bond to be traded quickly in any quantity without causing significant movement in price and within a short period of time. On the other hand, Longstaff, Mithal, and Neis (2005), defines bond liquidity as buying or selling a bond without a loss in security value. Lack of liquidity may have sizable effects on the bond prices,

which in turn affect the investors' bond yields (Berenguer, Gimeno & Nave 2013). Therefore, different degrees of liquidity influence the asset yields differently. Hence, this study defined bond liquidity as readiness of the bonds to sell or buy without losing its value.

According to Amihud, Mendelson, and Pedersen (2005), liquidity is a crucial feature in the market for it affects bond yields by liquidity premiums attached in bond prices. Bonds yields respond positively across different maturities in response to decrease off the run bond liquidity (Brandt & Kavajecz, 2004). According to Chen, Lesmond and Wei (2007), wide yield spreads are due to illiquid bonds and there is reduction of yield spread when liquidity improves. A liquid bond market has reliable yields and pricing is efficient (Brunnermeier & Lasse, 2009). Brandt and Kavajecz (2004) argue that informed traders activities increase when they want to take advantage of order flow information, this shrinks the bid/ask spread and ultimately affecting the bond yields.

Indicators of liquidity are quoted spread, quoted depth and market quality index (Lin, Wang & Wu 2010). The operationalization of bond liquidity in earlier studies are price impacts, turnover rate, trading volume, market size, auction, quote size, time, frequency of trade, zero return percentage and trade size of bonds (Beber, Brandt & Kavajecz, 2009; Fleming, 2003; Ates & Wang 2005; Amihud & Mendelson 1991; Vayanos, & Wang, 2012; Hameed 2018; Thotho 2017; Ghosh & Revilla 2007; Sarr & Lybek 2002; and Koech 2012). This study used turnover rate that is the number of bonds traded divided by number of bonds issued as an indicator of bond liquidity.

1.1.2. Order Flow

Evans and Lyons (2002) define order flow as signed trade size. Garrison, Jain, and Paddrik, (2019) posit that order flow represents the activities associated with pricing and transacting an asset in electronic limit order book markets. It represents the direction of trade activity, the supply and

demand of assets. Rocha (2021), Order Flow trading is sometimes referred to as a form of volume trading. Beber, Brandt and Kavajecz, (2009), define order flow as the act of buying or selling securities, According to Girardi and Impenna (2013), order flow provides an ex post measure of net demand of assets. It is the balance or imbalance of buyers and sellers. Order flow is the difference between buy and sell volume (Boehmer & Wu 2007). Order flow anticipates price movements, hence predicting future movements of markets by understanding how orders enter markets via traders decisions (Green 2004). Order flow determines prices in every microstructure model (Evans & Lyons 2002).

Microstructure theory by O' Hara (1995) argue that the market microstructure elements influence the trading at securities markets. Therefore order flow is one of the market conditions which influence the linkage between the bond liquidity and the yields of bonds as opined by O'Hara (1995). Evans and Lyons (2002), state that order flow influences the liquidity and drives a wedge between liquidity and yields of bonds. According to Pasquariello and Vega (2006), the variance of the sale and buy initiated trades is vital as high order imbalance may indicate that private information is disseminated into the market hence increasing the bid/ask spread. Increased demand triggers increase in prices thus lowering bond yields, order flow and yields negatively correlated (Brandt & Kavajecz, 2004). Daily variations of yields are due to order flow imbalance on days without announcements (Brandt & Kavajecz, 2004). According to Chordia, Sarkar and Subrahmanyam (2005), argue that order flow positively affects yields when liquidity is controlled. Unexpected order flow has great effect on daily liquidity and bond yields during announcement days (Pasquariello & Vega, 2006).

Net order flow is the traded volume. That is the daily purchase minus the daily sales (Lee & Ready, 1991; Pasquariello & Vega, 2006; Evans & Lyons 2002). Order flow is measured by order imbalance which is the volume of buys minus volume of sells scaled by total trade volume (Chordia, Roll & Subrahmanyam, 2001; Griffin, Harris, and Topaloglu 2003). Proxies for order flow are order imbalance, face value, quantity traded, supply, demand, and volume of assets traded (Chordia, Roll, & Subrahmanyam 2001; Garrison, Jain, & Paddrik, 2019; Chordia & Subrahmanyam 2004; Hanke &Weigerding 2015; Pasquariello & Vega 2006; Muranaga & Shimizu 1999; Beber, Brandt & Kavejecz 2009; Evans & Lyons 2002; and Boehmer & Wu 2007). This study used the traded volume as the indicator for order flow.

1.1.3. Information Efficiency

Fama (1965) defines information efficiency as the rate at with information is fully captured into security prices. Efficient markets provide accurate signals for resource allocation. While Goldstein and Yang (2014), define information efficiency as quickness and correctness of information capturing into financial assets and thus the true value of underlying security. According to Growitsch, Stronzik and Nepal (2012), information efficiency is the market ability to respond to readily available information and incorporation of the same information in asset prices The degree to which information is captured on asset prices (Aktan, Sahin & Kucukkaplan, 2018). Information efficiency refers to the level of private information released and captured by security prices (Chordia et al., 2001).

According to Goldstein and Yang (2014), new information could trigger trading and influence the relationship between bids/ask spread and yield spread. Information efficiency influences the ability of liquidity on relationship of yields (Blommestein & Santiso, 2007). Yields changes are caused

by efficient interest rates on arrival of enhanced information (Elton & Green, 1998). According to Fleming and Remolona (2001), and Green (2004), shape of yields curves can be a reaction because of new information release. Therefore, variation of yields is significant before and after announcements. Asymmetric information influences the yield changes (Chordia et al., 2001).

Malkiel (1973) and Fama (1965) used random walk to measure information efficiency. Bariviera, Font-Ferrer, Sorrosal-Forradellas and Rosso (2019) adopted symbolic analysis and Shannon entropy. Lo and MacKinlay (1988) suggested variance ratio as an indicator of information efficiency. Dicky Fuller test was adopted by Thupayagale (2015) and Aktan, Sahin and Kucukkaplan, (2018) to measure information efficiency. The price dispersion and variations of daily bond prices were used as a measure of information efficiency (Kyle 1985; Muzhoba 2021; Hotchkiss & Ronen 2015; Ngugi & Agoti 2010). This study used the price dispersion as an indicator for information efficiency.

1.1.4. Bond Yields

Yie and Chen (2019), define bond yields as an expected return to a trader from sale of bonds. While, Boukhatem (2016), define, bond yields as income earned from sell of a bond. According to Zaja, Jakovevic and Visic (2018) traders demand higher expected returns for less liquid securities to compensate for liquidity costs. Therefore, bonds yields are an investment return of a bond. A bond's yield to maturity rises or falls depending on its market value and how many payments remain to be made. Relationship between remaining time to maturity and market remuneration rates of debt securities represent the yield curve (Haubrich & Dombrosky 1996).

Keynes (1936) opined that the liquidity was the prime determine of the yield spread of treasury bonds. In his Liquidity preference theory, he argues the slope of the yield curve is upward sloping.

According to Friewald, Jankowitsch, and Subrahmanyam (2012), bond liquidity accounted for significant bond yield changes during tranquil markets but it greatly changed during recessions and on other financial shocks. Bond yields change due to public, private information flow and liquidity of assets (Green, 2002). Bonds liquidity and order flow have different effects on yields. Periods of enhanced market, liquidity causes speedy adjustments of yields (Brandt & Kavajecz, 2004). Order flows have significant influence on bond yields on announcement days (Balduzzi, Elton & Green, 2001). Hence, information releases trigger yields adjustments (Elton & Green 1998).

Previous studies have used coupon rate as an indicator for bond yields (Brandt & Kavajecz 2004; Lartey & Li1, 2018; Thupayagale, 2015; Balozi & Njogo, 2017). Fabozzi (1989), Nevitt, and Fabozzi (2000) used current yield, yield to call and yield to maturity as indicators for bond yields. Nguyen and Dufour (2013), measure yields by calculating the bid-ask spread midpoints of bond prices. This study used yield to maturity (YTM) as a measure for bond yields.

1.1.5. Treasury Bonds in Kenya

Treasury bonds are medium to long-term investments auctioned by the Central Bank of Kenya (CBK) on monthly basis. Government of Kenya in quest to promote economic growth and sustainability of financial system, it designed and implemented policies that created regulatory organ in 1984 (Ngugi, Murinde & Green, 2003). Implementation of debt-restructuring program in May 2001, meant to reduce the pressure on interest rates arising from frequent rollover of maturing securities and to develop a reliable yield curve to guide pricing at the primary and secondary markets. CBK reports that the reforms would eventually promote liquidity and stabilize the bonds yields.

However, 2011 and 2014 Kenya bond market recorded significant under subscriptions of bonds due to unfavorable market conditions such as liquidity tightness, and unreliable yields. Kenya's Treasury bond market has many small bonds with different maturities scattered along the yield curve (Thotho, 2017). The fragmentation of bonds market led to reduced trades and low liquidity hence causing wide yield spread. Low liquidity at the secondary market, high bid spreads at the primary market, little or no corporate issuances, non-synchronization, non-trading and unstable yields characterized the operations at NSE (Ngugi & Agoti, 2010). Investors experienced low liquidity and erratic bonds yields. The deterioration of liquidity and unreliable bond yields bothered policy makers and economists. Hence, this study assumed that the bond liquidity, order flow and information efficiency influenced the bond yields of Kenyan treasury bonds.

1.2.Research Problem

Scholars have attempted to explain factors that drive yields of treasury bonds and they have failed to reach to a consensus. Researchers have ascertained that bond liquidity influences the bond yields while others have found that liquidity has insignificant impact on yields. Other studies are of the view that bond yields enhance liquidity and not the vice versa. The common position is that bond liquidity determines changes in yields a trader would get as compensation for bond investment. This area is highly contentious and it has attracted divergent views from researchers. According to Acharya and Pedersen (2003), Chen, Lesmond and Wei (2007), sensitive securities are more liquid and have substantially higher yields. They argue that the growth of bond markets is facilitated by efficient and liquid bond market, which in turn translates to better yields of treasury bonds. Differing views are that bond yields determine the liquidity premium demanded from investors for longer-term investments (Goyenko, Subrahmanyam & Ukhov (2016). This argument gives a

reverse relationship that bond yields actually affect the bonds liquidity of treasury bonds. On contrary Codogno, Favero and Missale (2003) assert that liquidity differences have no impact on bond yields and they are insignificant without other market factors. This school of thought complicates the matter more by arguing that there was no at all relationship between the bond liquidity and bond yields of treasury bonds. Crinkum and crankum surrounding this area has elicited different narratives. These arguments are contradictory and inconclusive, hence leaving conceptual gap and knowledge gap. Hence, understanding the dynamics of bond liquidity and bond yields is paramount to most economists and ultimately interesting to comprehend how and why, the elements influencing bond yields vary over time. To unravel these contractions, there was need to introduce the order flow and information efficiency as moderators to test their effect on the relationship between the bond liquidity and yields.

Central bank of Kenya implemented bond-restructuring program to develop efficient and liquid government bond market to guide pricing at the primary and secondary bond markets in 2001 to 2014 (Ochenge, Muriu, & Ngugi, 2020). Despite implementation of market development reforms, the treasury bonds market remains informationally inefficient and characterized by lack of structural bonds and demand by traders exceeds the available supply, hence the lack of liquidity. There were deliberate reforms in 2001 to 2014 to develop Kenya's domestic government securities market to stabilize the treasury bonds liquidity and yields (Ngugi & Agoti, 2010; Thiong'o, 2012). Some of proposed reforms were introduction of benchmark bond program, infrastructure bonds, the horizontal repo for the money market, and trading automation of the primary and secondary markets. Notwithstanding government efforts to streamline, the bonds market, bonds market continues to exhibit unreliable, unpredictable and erratic yields of treasury bonds, (Thotho, 2017; Ngugi & Agoti, 2010). Hence, these conditions have darkened trading activities in the secondary

bond market. Thus, the effect of bond liquidity on yields is insignificant (Thupayagale 2015). Contrary, Thotho (2017) argued that liquid bonds offered lower prices and were more attractive to traders, hence translated to better yields .While on the other hand Weda, Namusonge, and Oloko (2014) found out that the benchmark bond yields affected the bonds liquidity at NSE. There was practical-knowledge gap in this area. It puzzled whether bond liquidity was a key factor to a reliable bond yield of Kenyan treasury bonds.

Empirical evidences from different studies on relationship between the bond liquidity and yields generated mixed results. Some Global studies found out that bond liquidity had effect on bond yields. Goyenko, Subrahmanyam and Ukhov (2016), of USA analyzed the data collected from the Center for Research of Security Prices (CRSP) using vector auto regression. They operationalized bond liquidity as Trades, Volume, turnover and Bzid-Ask Spread, calculated on a daily bond basis and then averaged across bonds to obtain the time series. They found that bond liquidity influenced the efficacy interest rate discovery and aided in yields formation. Contrary, Favero, Pagano and Thadden (2007), analyzed how liquidity affected government bond yields in Euro area using state space model. They found that bond liquidity was not economically important in determination of yields. Codogno, Favero and Missale (2003), reviewed government bond spreads. This study was conducted in USA using vector error correlation model to estimate daily data on national debt and bond yield spreads. They found that there was no relationship between the two variables. That liquidity differences had no impact on yield spreads and that the effect of liquidity was insignificant without factoring the risk factors of government bonds. Goyenko, Subrahmanyam, & Ukhov, (2016) studied the term structure of bond market liquidity and its implications for expected bond returns. They found that bond returns across maturities were forecastable by off-the-run but not on-the-run bond illiquidity. Thus, off-the-run illiquidity, by reflecting macro shocks first, was

the primary source of the liquidity premium in the Treasury market. To resolve the empirical gaps, more findings needed to be conducted to empirically verify the correct position.

Studies conducted in Africa had differing views on the relationship between bond liquidity and bond yields. Ngugi and Agoti (2010) analyzed microstructure elements of the bonds market in Kenya. He found insignificant influence of bond liquidity on yields. While, Thotho (2017) adopted generalized auto regressive conditional heteroskedasticity (GARCH) to analyze benchmark bond programmes and yield curve development in Kenya. He found out that little could be explained on the relationship between the illiquidity and yields. Nwiado and Deekor (2013), examined the domestic bond market and the development of the Nigerian Capital Market using applied financial econometrics model. They found high liquidity, lowered the bond yields. Lartey and Li1 (2018) examined daily frequency zero coupon yield curve of government bonds in Ghana. Piecewise cubic Hermite interpolation method was adopted to analyze data from the Central Securities Depository of Ghana for 3 months and 15 years. They found a positive relation between the liquidity of bonds and the yields. While, Weda, Namusonge, and Oloko (2014) examined the effect of government benchmark bonds to the liquidity of the bond market in Kenya during 2001 and 2012. Data from CBK and NSE contained bid-ask spread, tenor structure and volume of issuance of treasury bonds analyzed using the descriptive survey model. They found an inverse relationship between the bond liquidity and yields. That bond yields directly affected the liquidity of bonds. There were inadequate studies in Kenya concerning the Treasury bond trading hence creating the population gaps. There seemed to be no consensus, therefore there was need to test these relationships by introducing order flow and information efficiency as moderating variables which helped to resolve the existing differing views.

There were notable differences in the methodology adopted by studies on the bond liquidity and bond yields. Some studies assumed nonlinear relationship among the variables such as vector auto regression, the state space model and generalized autogressive conditional heteroskedasticity (GARCH). Presence of outliers in data analysis influences the results in nonlinear models and validation tools for detection of outliers are few. Hence, nonlinear methodologies are unable to account for heteroscedacity in data analysis. Goyenko, Subrahmanyam and Ukhov (2016) analyzed the data collected from the Center for Research of Security Prices (CRSP) using vector auto regression. Favero, Pagano and Thadden (2007) analyzed how liquidity affected government bond yields in Euro area using state space model. Nwiado and Deekor (2013) used applied financial econometrics model. Thotho (2017) adopted generalized auto regressive conditional heteroskedasticity (GARCH). These methodological gaps were resolved by using panel data linear regression equations to determine the relationship among bond liquidity, order flow, information efficiency and bond yields. Linear regression predicts results for a given data set and finds causal relationship between variables (Tishchenko, 2004).

Different studies adopted different approaches to conceptualize and operationalize bond liquidity and bond yields. Chordia, Sarkar and Subrahmanyam (2005), used trading volume and volatility to operationalize liquidity, Goyenko, Subrahmanyam & Ukhov (2016), analyzed liquidity using bid/ask spread, Atanasova and Li (2018), used market quality index (MQI) as an indicator for liquidity. Therefore, study will use turnover rate as an indicator of bond liquidity. Nguyen and Dufour (2013), Green (2004), measured yields by calculating the bid-ask spread midpoints of bond prices. Bonds yields were operationalized using the coupon rate by Lartey & Li1, 2018; Thupayagale, 2015; Balozi & Njogo, 2017. Fabozzi (1989) used the current yield and yield to

maturity (YTM) as measure of bond yields. This study used the YTM as an indicator for bond yields.

This study sought to establish the relationship among the bond liquidity, order flow, information efficiency and bond yields. Guided by this literature it was true that there was conceptual gap, contextual gap, methodological gap, empirical gap, knowledge gap, evidence gap, theoretical gap, population gap, application, implementation gap and the operationalization gaps. Hence, this research sought to answer this question: was there any relationship among the bond liquidity, order flow and information efficiency and bond yields of treasury bonds in Kenya?

1.3.Research Objectives

The general objective of this study was to determine the relationship among the bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.

The specific objectives were:

i. To establish the effect of bond liquidity on bond yields of treasury bonds in Kenya.

ii. To determine the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

iii. To assess the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

iv. To determine the joint effect of bond liquidity, order flow and information efficiency on bond yields.

1.4.Value of the Study

Academicians, practitioners and policy makers were the major beneficiaries of this study. First, the study findings helped to balance divergent interests of investors and firms thus enhancing investor sentiment and integrity of the bonds market. It identified the bonds that acted as the price leaders at the different parts of the yield curve and determined factors driving yields over time.

Secondly, it contributed to the existing knowledge in academia and provided insights into the Treasury bond market. It assessed adequacy of the existing literature, theory and identified gaps that served as a guide for future research. The study adopted methodology on how to operationalize and test research variables. Identification of relationship among variables helped securities exchange make decisions on how to build on the interactions between bond yields and market microstructure elements and provided better understanding of the behavior of yields in bonds markets.

Thirdly, the study was crucial to policy makers concerned with financial development in Kenya. It provided arguments on the operations at the Nairobi Securities Exchange and soundness of secondary bonds market in Nairobi Securities Exchange that Central bank of Kenya could use to design optimal regulatory framework. Evidence demonstrated relationship between the bond liquidity and bond yields in market. Introduction of moderating variables on the relationship between the bond liquidity and bond yields unraveled the differences among the existing empirical evidences.

1.5. **Division of Chapters**

This section outlines the flow of this thesis right from chapter one to chapter six. Chapter one focused on the background of the study, research variables, research objectives, research problem,

and the values of the study. Chapter two discussed the theoretical anchorage of the study and other relating theories, the empirical evidence surrounding the four study variables that is the Bond Liquidity, Order Flow, Information Efficiency and Bond Yields. A summary of empirical and research gaps was also discussed in this chapter. Finally, the conceptual framework and research hypothesis closed the chapter.

Chapter 3 assessed the research philosophy, research design, population, and data collection, operationalization of variables, data analysis and summary of research objectives, hypotheses, analytical methods, statistical test and interpretation. Chapter 4 focused on data analysis and interpretation of the results of statistical tests within the body of the study objectives and hypothesis. It discusses the descriptive statistics, models of data analysis and diagnostic tests. Chapter 5 tested hypothesis and interpreted findings of the study. Chapter 6 dealt with summary findings, conclusions, recommendations, limitations of the study, and suggestions for further research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter covered the theoretical foundations and reviewed empirical literature of bond liquidity, order flow, information efficiency and bond yields. It consisted of theoretical foundations, empirical evidence, conceptual framework and research hypothesis of the study.

2.2.1 Theoretical Anchorage

This section reviewed theories that helped to explain the relationship among variables. Liquidity preference theory was the anchoring theory with efficient markets hypothesis (EMH), market microstructure theory and expectation theory offered diverse perspective of the study. Liquidity preference theory postulated that liquidity premium would determine the yields of a bond. EMH provided that markets were informational efficient and any distortion of prices would affect the relationship between the bond liquidity and yields. Market microstructure theory argued that the bond yields are influenced by market conditions. Expectation theory supported the liquidity preference theory that investors expect certain returns after certain period of investment.

2.2.2 Liquidity Preference Theory

Liquidity preference theory as postulated by Keynes (1936), argue that traders prefer liquid and high interest rates on long-term bonds as compared to short-term securities that are illiquid. He stated that demand is derived by three motives that is transaction motive, precautionary motive and speculative motives. Howells and Bain (2002), posit that long term interest rates of bonds are derived from average interest rates on short-term bond that traders predict to take place over long term bonds' term to maturity bearing in mind that the liquidity premium that is accompanied by

the supply and demand of that particular bond. Hicks (1939), investors hold money because of cost as disturbance to move from money into earning assets and back to money.

Traders demand high premiums for assets which are illiquid. For such bonds government lose a lot of money as bond service costs (Christensen & Gillan, 2011, 2022). Liquidity is a crucial element in bond market growth that influences bond yields (Vayanos & Wang, 2012). Liquidity preference theory was critiqued for it unnecessarily used rates of interest as price essential to beat the desire for liquidity that was not always the case. Other forces like productivity of capital influence interest rates (Rothbard, 1995). Graziani (1989), critiqued and had reservations on liquidity preference theory as it failed to address empirical foundations in true monetary terms. The assumption that bonds with different term to maturities acted as substitutes may not be true as per this theory (Mishkin, 2001). Based on this theory, it assumed that liquidity of treasury bonds was key to bonds yields for it guided investors as per their motives towards interest rates of bonds. The theory anticipates a negative relationship between liquidity and yields of treasury bonds. Liquidity Preference theory anchors the linkage between bond liquidity and yields of treasury bonds. It connect the independent and the dependent variable by stating that liquidity is the main determiner of yields of bonds. This theory anchored the relationship between bond liquidity and bond yields.

2.2.3 Efficient Markets Hypothesis

Fama (1965), developed the Efficient Markets Hypothesis (EMH). He posits that markets are efficient when security prices entirely capture current market information about the value of the institution, and traders cannot make abnormal profits by using available information irrespective of their technical and fundamental know how. The theory is offered in three different versions that

are strong, semi-strong and the weak form efficiency. Fama (1965), argues that informational efficiency is when all available details are captured by asset prices. While, operational efficiency of the market is when traders buy and sale services or goods at fair market prices without exaggeration on cost conditions. Securities market to be efficient must ensure that investor buy and sale assets at fair market prices, (Lo & MacKinlay, 1988). Malkiel (1973), tested information efficiency using the random walk analysis and found out that movements of assets prices were unpredictable.

EMH assumes that securities are never overpriced or underpriced since the market has perfect information about the market trend which is available to every investor which always not the case. It also assumes that investors have rational expectation and therefore traders will be attracted to instruments with different maturities since they only care about market returns. Most behavioral economists have critiqued and challenged the grounds of efficiency market hypothesis since it is not in position to explain why there is variation in market efficiency (Lo, 2004; Brealey, Myers & Allen, 2005). The behavior of yields of securities has been tested by EMH using random walk analysis and momentum effect (Thotho, 2017). Efficiency market theory is rich of informational efficiency thus it predicts a relationship between bond liquidity and bond yields during release of news hence being useful in developing the conceptual framework. If this EMH is true, then the yield curve would not be influenced by the pricing information. This theory helped the current study to construct hypothesis especially on the moderating effect of information efficiency on relationship between bond liquidity and bond yields.

2.2.4 The Expectations Theory

The expectations theory by Hicks (1939), and Lutz (1940), submit that the mapping of the yield curve depicts the future expectations on interest rates. According to Kettel (2001), forwards rates are the same as the expected spot rate. Traders expect average short-term interest rates of bonds to be equal to life period of long-term bonds interest rates (Mishkin, 2001). Investors believe that lower rates are better than the higher interest rates in future as opposed to current interest rates level (Malkiel, 1966; Roll, 1971). At that moment, investors will perceive long-term bonds as more attractive as compared to short-term bonds if both issued at the same yields. Therefore, ascending and descending yield curve is expectation of future interest rates of longer issues as compared to short term ones.

Short-term securities markets controlled by central bank through monetary policies; on the other hand, interest rates of long-term securities are determined by firms' investment behavior that represents real economic activity (Malkiel, 1966). Expectation theory assumes that all investors hold common expectations about the course of short-term rates, which might not be the case. Howells and Bainn (2002), argue that traders expected increase in future interest rates of short-term bonds that is usually not the case. Expectation theory assumes that yield curve is flat and not slopped. This theory acted as a building block of the current study as traders' expectations on future interest rates are mapped on the yield curve. It supported the dependent variable that is bond yield which is the investors assessment of yields along the maturity period and which liquidity influenced returns.

2.2.5 Market Microstructure Theory

Market Microstructure Theory founded by O' Hara (1995), posits that microstructure as a process and results of trading securities under specific and explicit laid down laws. According to Madhavan (2000), market microstructure examines how prices vary from short term to long-term equilibrium values. Rusell and Engle (2010), argues that market microstructure primarily deals with securities market structure and trading rules, spreads, costs of transaction, quotes and intraday trading behavior. While O'Hara (1995), argues that microstructure is pivotal to adjustments of market prices whenever faced with announcements. He stresses that mechanism of trading influence security prices. Kissell (2014), provides that due to heterogeneity of frictions, in market microstructure prices of securities do not necessarily reflect expectations value. Madhavan (2000), posit that market microstructure studies analyze the behavior market structure on yields.

Kissell (2014), postulate that market microstructure experts' role is to not only understand the price discovery process and market liquidity but also how prices will change with the arrival of new information and competing customer orders. Microstructure is criticized for interfering with the main role of financial markets, namely, liquidity and price discovery (Teall, 2018). The Microstructure theory assumes that all traders are non-informed contrary to findings of (Fama, 1965). This theory suggests that that information efficiency and order flow influences both bond liquidity and yields in comparison to market regulation. This theory aided in explaining the role of yields in relation to other variables including bond liquidity, order flow and information efficiency. The above information helped in developing research hypothesis and construction of conceptual framework.

2.3 Empirical Evidence

This section carried out an in-depth empirical literature review on the relationship among the market liquidity, order flow, information efficiency and bond yield with the objective of identifying research gaps.

2.3.1 Bond Liquidity and Bond Yields

Different scholars have argued that bond liquidity leads to effective yields of bonds. Goyenko, Subrahmanyam and Ukhov (2016), of USA researched on the term structure of bond market liquidity of US treasury market. Daily quoted bid/ask prices from treasury was used from November 1967 to December 2005. The data was collected from the Center for Research of Security Prices (CRSP) and analyzed using vector auto regression. They find that bond liquidity influences the efficacy interest rate discovery and aids in yield curve formation. The findings indicated that bond liquidity correlated bond yields. However, the study conducted in developed economy that differed from Kenya in terms of economic growth rate and bond capitalization and its findings could be limited to USA. The study also used nonlinear models that are sensitive to outliers making the findings inaccurate since they do not account for the individuality of the data.

Daily frequency zero coupon yield curve of government bonds were examined in Ghana by Lartey and Li1 (2018). Piecewise cubic Hermite interpolation method was adopted to analyze data from the Central Securities Depository of Ghana for 3 months and 15 years. They found a positive relation between the liquidity of bonds and the yields. This study adopted nonlinear methodology that is unable to account for heteroscedasticity in data analysis and the results may differ when conducted under linear methodology. The current study adopted a correlational, descriptive and longitudinal research design and use of linear regression equations.

Contrary some other studies had a differing view on bond liquidity and yields. Codogno, Favero and Missale (2003), reviewed government bond spreads. This study was conducted in USA in 2002 using vector error correlation model to estimate daily data on national debt and bond yield spreads. They found there was no relationship between the two variables. That liquidity differences had no impact on yield spreads and that the effect of liquidity was insignificant without factoring the risk factors of government bonds. This study was limited to developed economies that have developed securities markets, advanced technology and high liquidity as compared to Kenya hence its findings were limited. There was a need to conduct a local study.

Weda, Namusonge, and Oloko (2014) examined the effect of government benchmark bonds to the liquidity of the bond market in Kenya during 2001 and 2012. Data from CBK and NSE contained bid-ask spread, tenor structure and volume of issuance of treasury bonds was analyzed using the descriptive survey model. They found an inverse relationship between the bond liquidity and yields. That bond yields directly affected the liquidity of bonds. This study contradicts the earlier studies that found out that bond yields were influenced by the bond liquidity. This study established the relationship between the bond liquidity and the bond yields in Kenya.

While, Favero, Pagano and Thadden (2007), analyzed on how liquidity affected government bond yields in Euro area. The daily benchmark prices and liquidity measures were collected from January 2002 to December 2003 and analyzed using descriptive statistics. They found that liquidity was not economically important in determination of yields. This study was only limited to developed economies hence its findings were limited. The relationship between bond liquidity and yield curve were inconclusive as evidenced by number of studies therefore there was need to introduce moderating variables to resolve the gaps identified.

2.3.2 Bond Liquidity, Order flow and Bond Yields

Considerable studies had been researched the effect of order flow on the link between bond liquidity and yields and revealed mixed effects. Brandt and Kavajecz (2004), surveyed the impact of order flow and liquidity on yield curve. Data collected was from GovPX on USA treasury security quote for a period spanning from January 1992 to December 1999 was examined by vector auto regression (VAR). They study found out that imbalances of order flow were responsible for daily changes of yield curve especially when liquidity was low. This study clearly shown how order flow strengthened the effects of bond liquidity on yields. The findings were limited to developed economies, which were advanced in terms of technology and structure. Use of nonlinear models are weaker since are sensitive to outliers. Therefore, there was a need to carry out a similar study in Nairobi Securities exchange.

A study conducted in USA treasury securities market on price discovery in financial markets by Fleming and Nguyen (2018), found out a significant moderating effect of order flow on the relationship between bond liquidity and yield curve of treasury bonds. They analyzed data from June 2015 to May 2016 using vector auto regression (VAR). Shocks in workup order flow explained the influence of bond liquidity on variation of the yield curve. The order flow either strengthens or weakens the relationship between bond liquidity and yields. Its findings were limited hence need to conduct a similar study in Kenya.

2.3.3 Bond Liquidity, Information efficiency and Bond Yields

Increased liquidity was influenced by the information efficiency that as well translated into reliable bond yields. A study conducted in China by Bai, Fleming and Horan (2013), on the microstructure of China's government bond market significant moderating effect of information efficiency on

bond liquidity and yield curve. The data of 384 unique bonds obtained from Bloomberg from October 15, 1999 to December 31, 2011. Using the Kendall Tau test, they found out that certain announcements had significant effects on relation between liquidity and yields, even when such yields were measured at a daily level. Anticipation of positive information by traders had impact on the spread of the bid/ask prices and yields. The study limited to China, hence there was a need to conduct a similar study in Kenya.

Thupayagale (2015) studied fixed income market efficiency of Kenya's 10-year local currency bond. He analyzed bond daily yields using the GARCH models, ARFIMA-FIGARCH models. He found out that the market was informational inefficient, illiquidity and had structural shortage of bonds. He recommended further study on causes of inefficiencies and investigation of other currencies. The paper used the nonlinear models, which might yield different results from linear models. This study adopted a linear regression models to analyse the study variables.

2.3.4 Bond Liquidity, Order Flow, Information Efficiency and Bond Yields.

Studies have been conducted but they yield mixed results. A study conducted in United States of America (USA) concluded that the order flow had insignificant influence on bond liquidity, yield curve. Wooldridge (2001), on his study conducted in 1995 to 2000 on the emergence of new benchmark yield curves of US Treasury and UK gilt markets. Using, the vector error correlation model, he found out that that liquidity was certainly crucial in determining bond yields. Benchmark yields movements were not driven by order imbalances but were exclusively influenced by new information fundamentals. This study concluded that order flow had no significant effect bonds liquidity and yields and only information efficiency mattered. An examination of similar study should be analyzed using linear regression in growing securities exchanges like Kenya.

Fleming and Remolona (2001), analyzed the treasury market of US on how liquidity influenced the price formation. The data was collected from GovPx Inc. and analyzed with vector error correlation model from August 1993 to August 1994. The data entailed quotes of bid/ask, prices of bonds and the trading size for each trade. They found out that arrival of new information induced sharp price adjustment, surging trade volume, widened the bid/ ask spread thus slowing down trading and yields. A declining liquidity would lead to a sloping yield curve. The findings were clear evidence that information efficiency was significant in treasury bonds trading. There was need to conduct similar study in Kenya to analyze the significance of information efficiency on the relationship between bond liquidity and yields.

A study conducted in Italy between January 2007 and February 2012 by Girardi and Impenna (2013), analyzed the Italian sovereign bonds market. Price discovery, order flow and the role of information in the secondary markets for Treasury bonds was the key focus. Using state space model, they found out that Liquidity was not necessary for formations of yields and only order flow mattered. Limited to Italy and therefore its finding could not be applied to the current study.

2.4 Summary of Literature Review and Research Gaps

The theoretical perspectives and concepts revealed intriguing views on the relationship among the variables under study. Liquidity preference theory as postulated by Keynes (1936), supported the linkage between the bond liquidity and the yields. Fama (1965) in his theory, efficient market, support the role of information efficiency in the explaining the influence of bond liquidity on yields. O' Hara (1995), in her theory of microstructure, explained that relationships among the micro variables The expectations theory by Hicks (1939), and Lutz (1940), explained investors'

expectations and market conditions influence the future expected returns. It was crucial to adopt the theories in hypothesis formulation that were tested in bonds market context.

The empirical evidences under this study had differing findings and seemed to be no consensus on the relationship among bond liquidity, order flow, information efficiency and yields in treasury bonds. Some observed that bond liquidity was correlated to yields, while other studies cited no relationship among the variables. Information efficiency played a critical role in moderating the relationship between the bond liquidity and yields. Some studies found out that order flow had negative effects on markets liquidity and yields while other studies gave conflicting conclusion that an informationally efficient bonds market provided a safe trading environment. There was evidence of methodological and data gaps. Some studies used nonlinear models that were considered weak for their inability to detect outliers and to account for heteroscedasticity of data. This was summarized and presented in the table 2.1 below.

Table 2. 1: Summary of Research Gaps

Researcher(s)	Study	Methodology	Findings	Knowledge gaps	How current study will address the gaps
Hasbrouck and Seppi (2001)	Common factors in prices, order flows, and liquidity	Canonical correlation analyses	Order flows explained relationship between liquidity and stock returns	The study was conducted in an equity market	The current study focused on the treasury bonds.
Brandt and Kavajecz (2004)	Price discovery in the U.S. treasury market: The impact of order flow and Liquidity on the yield curve	Vector auto regression (VAR)	The nature of order flow strengthened or weakened the relationship between bond liquidity and the yield curve	The finding were limited to this study and could not be applied locally.	This study addressed this gap by focusing on bonds in Kenya
Espinoza (2007)	Liquidity and the Slope of the Yield Curve	Vector error correlation model	The liquidity was responsible for upward slopping and flattening of the yield curve	The study adopted a nonlinear methodology in analysis.	The current study used linear regression model.

Espinoza, Goodhart and Tsomocos (2007)	Endogenous State Prices, Liquidity, Default, and the Yield Curve	Von Neumann-Morgenstern logarithmic utility functions,	Bond price was inversely related to liquidity. Upward yield curve was as a result of a liquid assets.	Study findings limited to USA	Study same variable in Kenya.
Favero, Pagano and Thadden (2007)	How Does Liquidity Affect Government Bond Yields?	Regression Analysis	Yields differentials increased as per the liquidity	The study didn't capture the other factors influencing the yields	This study introduced order flow and information efficiency as moderators
Ngugi and Agoti (2010)	Microstructure elements of the bonds market in Kenya.	Regression Analysis	Information efficiency influenced the bond liquidity.	The study established that there was no benchmarking yield curve for treasury bonds in Kenya.	The study sought to establish the micro elements influencing yield curve in Kenya's treasury bonds

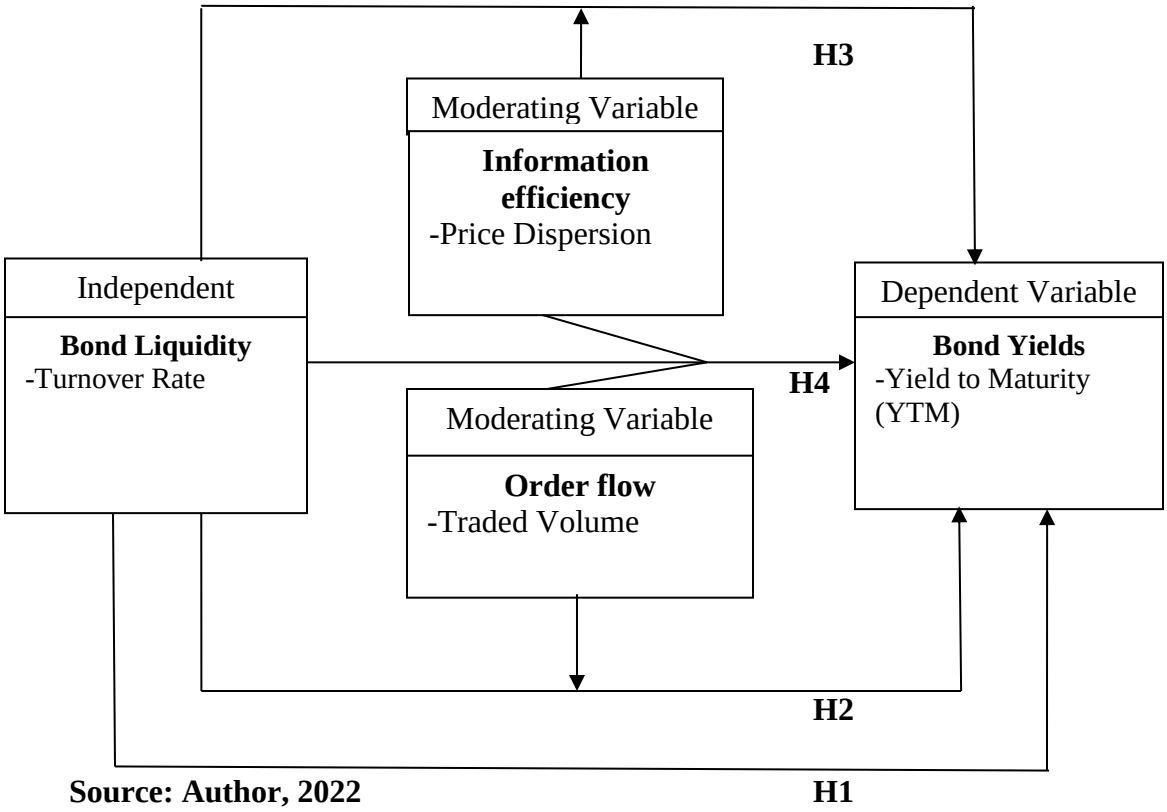
Girardi and Impenna (2013)	Price discovery in the Italian sovereign bonds market: the role of order flow	VEC	Trade imbalances had significant influence on the yield formation process when overall liquidity conditions were poorer.	The study was carried out in developed country	The research study was carried out in developing economies.
Thotho (2017)	Benchmark bond programme and yield curve development in Kenya	Generalized Auto Regressive Conditional Heteroskedasticity (GARCH)	Kenyan secondary market was illiquid with many inactive small bonds, which resulted in an inefficient benchmark yield curve.	Little could be explained on the relationship between the illiquidity and benchmark yield curve	The current study introduced order flow and information as moderating variables to establish the state of treasury bonds in Kenya

2.5 The Conceptual Framework

After review on the existing theoretical and empirical evidence, the paper conceptualized relationship among bond liquidity, order flow, information efficiency and bond yields. The dependent variable was bond yield while the independent variable is bond liquidity. Order flow and information efficiency acted as a moderator variables. The four variables had different relationships with each other. The bond yield was affected by the bond liquidity, order flow and information efficiency. Bond liquidity caused direct effect to bond yields. The effect of bond liquidity on yields was moderated by order flow and information efficiency.

Order flow and information efficiency were expected to strengthen, weaken or even modify the relationship between bond liquidity and bond yields. In an informationally efficient market, it was expected that prices of bonds were not distorted and reflected the true value of assets and therefore the bonds would be liquid hence leading to good yields. Order flow was the balance between the buyers and traders. When order flow was stable, it was expected to influence the bonds yields through the bond liquidity. Order flow, which represents the buy and sells volume; existed to enhance the bond liquidity in order for traders to get better yields in return for their investments (Kijima, Masaaki & Ting 2019).

Figure 2. 1: Conceptual Model



Source: Author, 2022

2.6 Research Hypothesis

Formulation of null hypotheses was from the theoretical and empirical literature review:

H_{01}: There is no significant effect of bond liquidity on bond yields of treasury bonds in Kenya.

H_{02}: There is no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

H_{03}: There is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

H_{04}: There is no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.

2.7. Chapter Summary

This chapter dealt with theoretical anchorage, empirical literature review and the hypothesis of the study. Liquidity preference theory as postulated by Keynes (1936) was the anchoring theory for it clearly stipulated the relationship between the Bond Liquidity and the Bond Yields of treasury bonds in Kenya. The anchoring theory supported by the Efficient Markets Hypothesis by Fama (1965), the Expectations Theory by Hicks (1939), and Lutz (1940) and the Market Microstructure Theory founded by O' Hara (1995). These theories supported the study objectives. Review of the empirical literature review brought out the relationship among variables. Study gaps were extracted from the empirical literature. Study hypothesis were formulated from the review of the literature. The next chapter dealt with research methodology.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This chapter dealt with research philosophy, research design, targeted population, method of data collection, operationalization of research variables, diagnostic tests and data analysis.

3.2 Research Philosophy

Research philosophy is a concerned with fundamental presumptions on field of inquiry and development of research (Galliers, 1991). It deals with how knowledge is generated by asking how we know what we know. Research philosophy is classified as ontology, epistemology and axiology (Saunders, Lewis, & Thornhill, 2007). Ontology deals with the nature of reality, axiology is concerned with ethics, judgments and aesthetics while, epistemology affects the way knowledge is acquired. Epistemology is therefore classified into two major research philosophies namely phenomenologist and positivists (Saunders, Lewis & Thornhill, 2007). Positivist, seek facts and believe that research should be guided by unchanging laws that predict future events, valued free and can be observed from an independent objective angle (Cresswel, 2014; Saunders et al., 2007). Positivist philosophy is based on quantitative, experimental and scientific approach that make deductive reasoning (Krauss, 2005). The approach reviews theories and formulate hypothesis, research questions and then test them after collecting and analyzing data. Quantitative research begins with concepts and building blocks of theory.

Phenomenologists believe human-interest guide's science and studying human behavior and experience over a period of time (Cresswel, 2014). Phenomenology thinks that world is subjective

and socially constructed. Their work is based on qualitative, humanistic and interpretive approach where emphasis is on immediate experience using human characteristics and holistic analysis. The study adopted the positivist research philosophy and used quantitative approach to generate data in quantitative form then the data was subjected to rigorous quantitative techniques and analysis to test hypothesis. This study embraced the positivist characteristics of independence, value freedom, causality and hypothetic-deductive method that involved quantitative operationalization of concepts (Saunders et al., 2007)

3.3 Research Design

Research design is the general strategy that you choose to interrogate different components of the research work. It is a plan on how to collect measure and analyze data (Cooper & Schindler, 2006). Zikmund, Babin, Carr and Griffin (2010), define research design as a blueprint that specifies procedures and methods for collection and analyzing data. This study adopted descriptive, correlational and longitudinal research designs to collect measure and analyze the data. Descriptive research design described the characteristics of population appropriately by answering what, when, where and how questions, while correlational research design sought to establish relationships between variables (Cresswel, 2014).

Longitudinal research design seeks to measure characteristics of same variable over repeated period. It is able to observe the variable change and variations over time (Mugenda & Mugenda, 2003). Panel data was the most appropriate for these methodologies for it employed multiple entities, measurements obtained for same entities (Saunders et. al., 2007). This design was necessary for it enabled the researcher to collect data on bond liquidity, order flow, information

efficiency and bond yields in different time. The justification of using longitudinal research design was that the design repeatedly observed patterns of indicators over long period (Campbell & Taksler, 2003; Hafner & Walders, 2017; Bernoth, & Erdogan, 2010; Maltritz, 2012).

3.4 Population of the Study

Kothari (2004), define population as total objects of study with the desired information. According to Mugenda and Mugenda (2003), a population is a group of entities with same observable traits. This study targeted all Kenyan treasury bonds at Nairobi Securities Exchange (NSE). However, this study used a population of seven Kenyan treasury bonds, which were actively trading at the secondary market and had bond tenor of 5 years and above. In 2009 is when the government automated the bonds trading at NSE. Using the criterion technique, the bonds that met these criteria were 5-year bond, 10-year bond, 12-year bond, 15-year bond, 20-year bond, 25-year bond and 30 years bond constituted in CBK Treasury bond series. The bonds traded at the NSE and constituted the yields data of 10 years period beginning January 2009 to December 2018. This period marked the implementation period where key reforms for public debt management and bonds market development envisaged in the government's Medium-Term Debt Strategy (MTDS) (Ngugi & Agoti, 2010).

The choice of bonds in this study was guided by the fact that government had heavily relied on bonds as a source of capital financing. A principal requirement for bonds market developed and growth is a reliable yield curve (Ngugi & Agoti, 2010). The statistical information in bonds markets was available since treasury bonds file reports with the CBK and NSE. The unit of analysis for this study was the individual bond.

3.5 Data Collection

The study used secondary panel data gathered from financial reports of CBK website and the NSE databank for the data on Bond Liquidity, Order Flow, Information Efficiency and Bond Yields. Secondary data is an unobtrusive measure, provides contextual and comparative information that can unravel unexpected findings and provides stability of data (Saunders et. al., 2007). Panel data was most appropriate for it constituted repeated observations for the same indicators each time and allowed for heterogeneity of data (Okiro 2014). The bond market was characterized by low trading and occasionally some days would go without trading, hence the unbalanced panel data was deemed fit for this study.

A data collection sheet shall captured information for treasury bonds on all relevant variables of the study. Data on bond liquidity, including the number of bonds traded and number of bonds issued were collected from the NSE databank. Order flow data measured by traded volume. Data on price dispersion as measure as the difference of daily opening price and the closing price of bonds for information efficiency and yield to maturity (YTM) as an indicator for bond yields was collected daily from NSE (see appendix III).

3.6 Reliability Testing

Existing literature was reviewed to assess the reliability of the secondary data. Simple analyses were performed on the sampled data by tracing to and from the source documents. The data collected from the Nairobi Securities Exchange (NSE) was compared with secondary data available at Central Bank of Kenya (CBK) website.

3.7 Operationalization and Measurement of Study Variables

The study measured the independent variable, which was bond liquidity with turnover rate. The turnover rate was the percentage of number of bonds traded divided by the number of bonds issued size, auction, quote size, time, frequency of trade, zero return percentage and trade size of bonds (Beber, Brandt & Kavajecz, 2009; Fleming, 2003; Ates & Wang 2005; Amihud & Mendelson 1991; Vayanos, & Wang, 2012; Hameed 2018; Thotho 2017; Ghosh & Revilla 2007; Sarr & Lybek 2002; and Koech 2012). Traded volume or the face value or trade size was an indicator for order flow measured by quantity traded and matched price of buy and sell that is the number of bonds traded multiplied by the price of the (Chordia, Roll, & Subrahmanyam 2001; Garrison, Jain, & Paddrik, 2019; Chordia & Subrahmanyam 2004; Hanke &Weigerding 2015; Pasquariello & Vega 2006; Muranaga & Shimizu 1999; Beber, Brandt & Kavejecz 2009; Evans & Lyons 2002; and Boehmer & Wu 2007).

Daily bond price dispersion was the measurement for information efficiency where bond closing price was subtracted from the daily opening price as suggested by efficiency (Kyle 1985; Muzhoba 2021; Hotchkiss & Ronen 2015; Ngugi & Agoti 2010). Inefficiency inferred when the dispersion between the two was high. The study assumed that closing price captured the information in the course of trading should be between the high and low quotations of the day. The measurement for bond yields was the yield to maturity (YTM), expressed as $[(\text{Face value} / \text{Present value})^{1/\text{Time period}}]-1$ (Brandt & Kavajecz 2004; Lartey & Li1, 2018; Thupayagale, 2015; Balozi & Njogo, 2017). Fabozzi (1989), Nevitt, and Fabozzi (2000). The operationalization of constructs in this section adopted indicators from previous similar studies. See (Table 3.1).

Table 3. 1: Operationalization of variables

Variable	Nature	Indicator	Measurement
Bond Liquidity	Independent Variable	Turnover Rate	The number of bonds traded divided by number of bonds issued.
Order Flow	Moderating Variable	Traded Volume	The number of bonds traded multiplied by the price of the bond.
Information Efficiency	Moderating Variable	Price Dispersion	Daily opening price minus the closing price.
Bond Yields	Dependent Variable	Yield to Maturity (YTM)	YTM- = [(Face value / Present value)$^{1/\text{Time period}}$]-1

Source: Author 2022

3.8 Diagnostic Tests

Heteroscedasticity is a problem that affects coefficients of a regression equation making the process less accurate. This can happen when variability of independent variable is larger for it causes the error variance to lack consistency. This implies that the he estimated standard error is wrong. Because of this, confidence intervals and hypotheses tests cannot be relied on. Therefore, residual value should be constant whenever regression analysis obtained from population (Albright, Zape & Winston, 2011). The Goldfeld-Quandt test and Breusch-Pagan are used to test heteroscedasticity. The study used Breuch-Pagan to test heteroscedasticity. If the statistic p-values output were below the set limits then the null hypothesis was rejected and if the p values were

above the set limit then the null hypothesis was accepted. Weighted least square methods was used in case of detection of heteroscedasticity.

Multicollinearity occurs when there is existence of strong relationship and high correlations between a set of independent variables (Albright, Zape & Winston, 2011). When independent variable are influencing each other, they are not actually independent; therefore, it becomes hard to test how much the combination of independent variable affects the dependent variable. There are three central criteria to test multicollinearity; correlation matrix, tolerance measures and variance inflation factor (VIF). The study used VIF to test the amount of multicollinearity where a score of 1 to 5 indicated a strong correlation between the independent variables. Values above 5 were considered as an indication of a problem of multicollinearity. If the problem was detected, centering the data that is deducting the mean of the variable from each score was done.

Autocorrelation occurs when the residuals in two different periods are not independent from each other (Mugenda & Mugenda, 2003). Regression model can be tested for autocorrelation with the of Durban-Watsun, *d*, test to test residuals of the null hypotheses, LM (Lagrange Multiplier) test, which is conducted for models with lagged variables or Wooldridge test for autocorrelation. In this study, the Wooldridge test for autocorrelation in panel data was used. Durban-Watsun d test values range between 0 and 4, score of 2 means no autocorrelation. 0 means positive correlation and score approaching 4 means negative correlation. As a rule of thumb scores of $1.5 < d > 2.5$ show that there is no autocorrelation in the data. If autocorrelation was detected, it was corrected by using the Newey-west estimator.

Normality test was conducted to determine if the data set was well modeled by a normal distribution (Cooper & Schindler, 2006). Violation of this requirement may lead to inaccurate hypothesis tests due exaggerated test statistics. The two well-known tests of normality, namely, the Kolmogorov–Smirnov test and the Shapiro–Wilk test are most widely used methods to test the normality of the data. The Shapiro–Wilk test is more appropriate method for small sample sizes (<50 samples) although it can also be handling on larger sample size while Kolmogorov–Smirnov test is used for n ≥50. For this reason, Kolmogorov–Smirnov test was used for assessing normality. If the p-value is smaller than the significance level of 0.05 the null hypothesis is rejected. Goodness of fit model was used to measure whether there was discrepancy between the observed values. The assumption was checked with Q-Q-Plots.

Linearity test aims to determine whether the relationship between the dependent variable and the independent variables is linear or not. The Analysis of Variance (ANOVA) test of linearity was used to determine the linearity of the relationships between the dependent and independent variables. The test calculates both the linear and nonlinear components of two variables. Nonlinearity was considered significant if the calculated F-value for the nonlinear components was less than 0.05. Data log transformation square root or inverse was used.

The stationarity test is a property of time series which states that the value of the variable doesn't change with time i.e. variation in time does not serve as a factor that brings changes in the value of a variable. To determine the stationarity of the data, Augmented Dickey–Fuller unit root test was used because it works well with an unbalanced panel data (Cooper & Schindler, 2006). The test was evaluated against their associated p-values at the conventional 5 percent Statistical level

of significance. The null hypothesis of this test is that all panels contain a unit root and the alternative hypothesis is at least one panel is stationary. Stationarity exists if Inverse normal Z statistic is significant ($p<0.05$). The study performed the diagnostic tests presented in table 3.2 below.

Table 3. 2: Diagnostic tests summary table

Assumption	Description	Test	Interpretation	Treatment
Normality	Normality exists where data set is well modeled by normal distribution	Kolmogrov-Smirnov test	Normality exists where $p>0.05$	(Q-Q) plots for further tests and analysis on normality for non-significant results.
Heteroscedasticity	Heteroskedasticity is a problem that affect coefficients of a regression equation making the process less accurate.	Breuch-Pagan	Heteroscedasticity exists if chi-square statistic is statistically significant(<0.05)	Use Robust Standard Errors. Newey-West estimator was used.
Multicollinearity	Multicollinearity occurs when there is existence of strong relationship between a set of independent variables	Variance Inflation Factor (VIF) & Tolerance	Multi-collinearity exists where the VIF>10	Variable with highest VIF will be excluded from further analysis

Stationarity Tests	The time series variables is non stationarity.	Augmented-Dickey Fuller	Exists if Inverse normal Z statistic is significant ($p<0.05$)	To correct for this violation of OLS cardinal requirement, first difference of the variables was used, Data log transformation square root or inverse
Linearity	Application of linear regression assumes linearity between the dependent and independent variable	ANOVA	If the computed F-value for-non-linear component will be below 0.05, the non-linearity will be considered significant	Data log transformation square root or inverse

Source: Researcher (2022)

3.9 Data Analysis

Descriptive statistics and inferential statistics were employed to analyze data. The study used means, median, standard deviations, minimum and maximum to compare, analyze and draw findings on bonds liquidity, order flow, information efficiency and yields. Simple, stepwise, hierarchical and multiple linear regressions were used to test the statistical significance of the independent, dependent and moderating variables. Pearson's product moment correlation analysis was conducted to know the nature, magnitude and strength of the link between the study variables and to test hypothesized relationships. The *F*-test was used to test the equality and significance of

the regression model. Beta values were determined through parametric t-test at 95% confidence level (μ =0.05) with a 2-tailed.

To test the relationship among the variables panel regression model was used. Pooled Ordinary Least Squares (OLS), Random Effects model and Fixed effects Model of estimation technique were used to analyze the panel data (Kryeziu & Hoxha, 2021). Hausman Test and Lagrange Multiplier were used to choose the appropriated model from the approaches to be used to test hypotheses.

3.9.1. Pooled Least Square Model

There are several estimation methods in panel data analysis. The most frequently used panel data models are fixed effects model (FEM), random effects model (REM) and pooled Ordinary Least Square (OLS) model (Saragih, Raya, & Hendrawan, 2021; Li & Leung, 2021). The pooled OLS model does not use panel information such as time and individual dimensions. Sometimes pooled OLS model would give inconsistent estimates when inappropriately used or when appropriate model to be used was either FEM or REM (Li & Leung, 2021). In the pooled model, there is no model for group/individual heterogeneity. Thus, pooled regression may result in heterogeneity bias (Zulfikar, 2018). According to Wooldridge (2010), pooled OLS is employed when you select a different sample for each year/month/period of the panel data.

3.9.2. Fixed Effects Model

The difference between fixed effect model and random effect model is how the unobservable characteristics of the individual effects are modeled. Fixed effect models assume that the explanatory variable has a fixed or constant relationship with the response variable across all

observations (Miniesy & AbdelKarim, 2021). The individuals are fixed. The differences between them are not of interest, only beta is interesting. No intent on generalizing the results. This means that the unobservable effects with a constant and all time invariant characteristic of individual bonds are swept away under this formulation.

Fixed effects are estimated using least squares (or, more generally, maximum likelihood) (Snijders and Bosker, 1999). Effects model is that the unobservable effects correlated with the regression variables of the model. The Fixed Effects model, assume that the estimated value of all unit specific effects have the same constant variance. Fixed Effects model, the error is a random variable that is assumed to fluctuate around a mean value of zero with some unknown (but often assumed to be normal) probability distribution (Laureti, Costantiello, & Leogrande, 2022). The bond market was characterized by low trading and occasionally some days would go without selling, hence the unbalanced panel data was deemed fit for this study. Therefore, dummy variable technique was used to estimate the FEM with different intercepts between individuals (Li & Leung, 2021).

3.9.3. Random Effects Model

A random-effects model assumes that explanatory variables have fixed relationships with the response variable across all observations, but that these fixed effects may vary from one observation to another. A random-effects model, by contrast, allows predicting something about the population from which the sample is drawn. Random effects are estimated with shrinkage linear unbiased prediction (Robinson, 1991). The individuals come from a random sample drawn

from a larger population, and the variance between them is interesting and can be informative about the larger population.

In the Random Effects model, we assume that the unit-specific effects for all units are distributed around a common mean value according to some unknown probability distribution. Furthermore, this common mean is constant across all time periods in the data panel. the error term is assumed to have a constant variance around the zero mean for all units in the data panel and across all time periods (Li & Leung 2021; Laureti, Costantiello, & Leogrande, 2022).

3.9.4. Approaches for Selecting the Most Appropriate Model for Panel Data Analysis.

Hausman specification test was used to check the suitably of fixed or random effect for the study dataset (Saragih, Raya, & Hendrawan, 2021). This involved estimating both models in particular order, starting with fixed effects model (FEM) against the alternative hypothesis random effects model (REM) is appropriate at 5% confidence level. Based on the results of Huasman test the null hypothesis is accepted or rejected. The null hypothesis (H_o) is that the preferred model is random effects vs. the alternative the fixed effects (Saragih, Raya, & Hendrawan, 2021). If the p values were greater than 0.05, we accepted the $H_{0,}$ meaning that the appropriate model was the RE (Li & Leung 2021). If the $p<0.05$, we accepted the $H_{1,}$ implying that the most appropriate model was the FE (Laureti, Costantiello, & Leogrande, 2022).

The Breusch-pagan Lagrange multiplier (LM) test was used to select between a random effects regression and a simple OLS regression. The null hypothesis in the LM test was that variances across entities were zero, that is, there was no significant difference across units (i.e. No panel effect). Depending on the significance of the LM test, if result: $p>0.05$ the most appropriate model

was OLS and if p<0.05 the most appropriate model was REM. If (p> 0.05) of the simple OLS regression then choose the null hypothesis. If (p <0.05 select the rem and the alternative hypothesis (Laureti, Costantiello, & Leogrande, 2022; Saragih, Raya, & Hendrawan, 2021).

3.9.5. Testing the Hypothesized Relationships

Summary of Research objectives, hypotheses, Analytical Methods, Statistical Test and Interpretation presented in table 3.3 below.

Table 3. 3: Summary of Research objectives, Hypotheses, Analytical Methods, Statistical Test and Interpretation

Objective	**Hypothesis**	**Analytical Methods**	**Interpretation**
To establish the effect of bond liquidity on bond yields of treasury bonds in Kenya.	There is no significant effect of bond liquidity on bond yields of treasury bonds in Kenya.	Regression Model $BY_{it} = \beta 0 + \beta 1\ BL_{it} + \varepsilon_{it}$ Regress BY on BL Where: β0=Population Y intercept/ Regression constant, β1=Population slope coefficient, BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity where *i* = bond and time= *t* and ε_{it} is the error term	• Beta coefficient (β) on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was statistically significant if (value <0.05). • F-test statistic was statistically significant if (p<0.05). • R-squared (R^2) suggests how bond liquidity accounts for the variance in bond yields (YTM) of treasury bonds in Kenya.
To determine the effect of	There is no significant	**The Baron and Kenny (1986) approach for testing Moderation:**	• The Baron and Kenny (1986) approach for testing Moderation: The

order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.	moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.	Panel Regression Analysis Models: Model 1: $BY_{it}= \beta0 + \beta1\ BL_{it} +\varepsilon_{it}$ Model 2: $BY_{it}= \beta0 + \beta1 BL_{it} + \beta2 OF_{it} + \varepsilon_{it}$ Model 3: : $BY_{it}= \beta0 + \beta1 BL_{it} + \beta2 OF_{it} + \beta3 (BL*OF)_{it} + \varepsilon_{it}$ Where; BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity where *i* = bond and time= *t*, OF_{it} =Order Flow where *i* = *bond* and time= *t*, β0, β1, β2 and β3 = Regression coefficients and ε_{it} is the error term	relationship between BY and BL should be statistically significant. • F test to assessed overall robustness and significance of the panel regression model. F-test statistic was statistically significant when ($p<0.05$), which meant that the overall model was statistically significant. • Determine individual significance of the relationship between variables • Interaction term (BL*OF) was statistically significant if $p<0.01$).
To assess the effect of information	There is no significant moderating	**The Baron and Kenny (1986) approach for testing Moderation:** Panel Regression Analysis Models:	• The Baron and Kenny (1986) approach for testing Moderation:

efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.	effect of information efficiency on the relationship between bond liquidity and bond yields treasury bonds in Kenya.	Model 1: $BY_{it}= \beta0 +\beta1BL_{it} + \varepsilon_{it}$ Model 2: $BY_{it}= \beta0+\beta1BL_{it}+\beta2IE_{it} + \varepsilon_{it}$ Model 3: $BY_{it}=\beta0+\beta1BL_{it} + \beta2IE_{it} + \beta3(BL*IE)_{it} + \varepsilon_{it}$ Where; BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity where *i* = bond and time= *t*, IE_{it}=Information Efficiency where *i* = bond and time= *t*, $\beta0$, $\beta1$, $\beta2$ and $\beta3$ = Regression coefficients and ε_{it} is the error term	• Determine whether the moderator altered the robustness of the causal association between the BL and the BY. • F-test statistic was statistically significant if ($p<0.05$), which meant that the overall model was statistically significant, • Determine whether introducing the interaction term altered the direction or intensified the relationship between variable BL and BY. • Determine the statistical significance of the interaction term. • The moderating effect occurred when the relationship between BL and BY was significant and the interaction term was statistically significant if ($p<0.05$).

To determine the joint effect of bond liquidity, order flow and information efficiency on bond yields.	There is no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.	$BY_{it} = \beta 0 + \beta 1\ BL_{it} + \beta 2 OF_{it} + \beta 3\ IE_{it} + \varepsilon_{it}$ Where; BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity where *i* = bond and time= *t*, IE_{it}=Information Efficiency where *i* = bond and time= *t*, OF_{it}=Order flow where *i* = bond and time= *t*, β0, β1, β2 and β3 = Regression coefficients and ε_{it} is the error term	• A relationship existed if model regression coefficients β_1 β_2 β_3 were significant ($p<0.05$). • Test of R^2 using the F-statistics-F-Test was statistically significant if ($p<0.05$).

3.9.6. Test of Moderation

To test the moderation effects on the relation between the dependent and independent variable, hierarchical multiple regression was applied. The moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and Kenny (1986), discussed the steps for testing moderating effect as follows.

Step 1: In the Baron and Kenny (1986) approach for testing moderation, the independent variable presumed to cause the dependent variable. Bond liquidity (independent variable) assumed as a significant predictor of Bond yields (dependent variable).

Step 2: Relationship between dependent variable (Bond Yields), moderator (Order Flow or Information Efficiency) and independent variable (Bond Liquidity) was estimated using panel regression analysis as guided by Hausman specification test. The model was assumed to be statistically significant.

Step 3: An interaction term computed by multiplying centered independent variable and centered moderator. Centering was achieved by subtracting mean from a variable. Estimated relationship between dependent variable, independent variable, the moderator and the interaction term was determined and checked whether the moderator variable altered the strength of the causal relationship. The Interaction term (BL*OF) or (BL*IE) was also statistically significant when ($p<0.01$). R-squared (R^2) was checked to confirm that jointly, Bond liquidity, order flow and the interaction term (BL*OF) or (BL*IE) accounted for the variance in Bond Yields (dependent variable) and the interaction term was statistically significant if the ($p<0.01$).

3.10 Chapter Summary

This chapter suggested the use of positivist philosophy approach for it employed quantitative techniques to test and measure theory and hypothesis. This was informed by the studies in previous chapters required in addressing the research gaps, objectives and the research hypothesis. Longitudinal descriptive research design was put forward as an appropriated methodology for this study. Population of the study and data collection methods were highlighted. Possible diagnostic tests including linearity test, stationarity test, multicollinearity test, autocorrelation and heteroscedacity test were highlighted together with their interpretations and treatment. These guidelines were used in choosing appropriate panel data models in Chapter 4 and in testing of hypothesis in chapter five. This chapter links chapter two with chapter four, five and six.

CHAPTER FOUR: DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter presented descriptive statistics and trend analysis for the variables understudy with an effort to interpret the findings. The general objective of this study was to determine the relationship among the bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. This chapter is organized as per the four hypothesis of the study. Section 4.2 focused on reliability testing, descriptive statistics for all variables under study was outlined in section 4.3, section 4.4 discussed the bond characteristics, trend analysis was discussed under section 4.5, section 4.6 focused on panel data diagnostic tests and section 4.7examined the correlation analysis, analysis of statistical models for testing hypothesis was discussed under section 4.8, while section 4.9 looked at statistical approaches for choosing the most appropriate model for testing each hypothesis, lastly section 4.10 presented the chapter summary. In this study, the dependent variable was bond yield measured by yield to maturity (YTM) while the independent variable was bond liquidity measured by turnover rate. In the hypothesized relationship, Order flow and information efficiency moderated the relationship between bond liquidity and bond yields. Panel data regression analysis was conducted to test the hypothesized relationships using STATA statistical analysis software.

4.2 Reliability Testing

Existing literature was reviewed to assess the reliability of the secondary data. Simple analyses were performed on the sampled data by tracing to and from the source documents. The

secondary data collected from Nairobi Securities Exchange (NSE) was compared with the data available at the Central Bank of Kenya (CBK) website to establish authenticity.

4.3. Descriptive Statistics

Descriptive statistics summarized and organized characteristics of the study variables namely, bond liquidity, order flow, information efficiency and the bond yields. Descriptive statistics for the dependent variable, independent variable and moderating variables were reported in this section. This included counts, means, median, minimum, maximum, standard deviations, standard errors, skewness and Kurtosis. The study focused on 7 Central Bank of Kenya treasury bonds with tenors of 5, 10, 12, 15, 20, 25 and 30 years for a period of 10 years, between January 2009 and December 2018. In total, the study used 9262 treasury bonds traded value observations.

Mean is a measure of central tendency that indicates the average value of the study values while median indicated the middle value of data set when it is in ascending or descending order. Standard deviation is the variation of the data from the mean value (Kothari, 2010). Extreme values (outliers occur when the standard deviation is greater than the mean. Outliers indicate that the data does not fit normal distribution criteria, hence need for further analysis conducted to bring back normality of the data distribution (Cooper & Schindler, 2003). Skewness is a measure of symmetry, or the lack of symmetry. Data set is symmetric if it looks the same to the left and right of the center point. Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution. Data sets with high kurtosis tend to have heavy tails, or outliers. Data sets with low kurtosis tend to have light tails, or lack of outliers. A uniform distribution would be the extreme case (Cooper & Schindler, 2003). Hence, Skewness measures the symmetry of the

distribution, while kurtosis determines the heaviness of the distribution tails. The standard error (SE) explains how far the sample mean deviates from the actual population mean. The higher the standard error, the more spread out the data is .Table 4.1 below present summary of descriptive statistics for 10 years from 2009 to 2018.

Table 4. 1 Summary of Descriptive Statistics.

Variable	**N**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**	**Skewness**		**Kurtosis**	
						Statistic	**SE**	**Statistic**	**SE**
Bond Liquidity	9262	.00000	.26	.0051	.0085	6.96	.025	113.9	.051
Bond Yields	9262	2.0500	76.13	11.56	2.4623697	2.05	.025	67.76	.051
Information Efficiency	9262	-108.38	90.30	-.098	7.49363	-1.07	.025	49.54	.051
Order Flow	9262	50000	1000,000,000	91630690	96320681	2.301	.025	10.07	.051

Source: Researchers Computations (2022)

As presented in the above table 4.1, Bond liquidity was operationalized using turnover rate while bond yields was measured by yield to maturity. Information efficiency and Order flow operationalized using the price dispersion and the traded volume respectively. Bond Liquidity had a minimum of zero, maximum of .26, mean of .005 and standard deviation of .0085. Bond liquidity is positively distributed with skewness of 6.96 (standard error 0.25). The skewness for a normal

distribution should be zero, and any symmetric data should have a skewness near zero. Meaning that the data distribution is positive for the skewness indicating that data has the right tail is long relative to the left tail. Negative values for the skewness indicate data skewed left. The Kurtosis has a value of 113.9 with a standard error of 0.51. The kurtosis for a standard normal distribution is three. The standard normal distribution should have a kurtosis of zero. In addition, positive kurtosis indicates a "heavy-tailed" distribution and negative kurtosis indicates a "light tailed" distribution. This indicated excess kurtosis (leptokurtic distribution).

The minimum and maximum values of bond yields were 2.05 and 76.13 respectively with a mean of 11.56 and standard deviation of 2.46. The bond yields positively distributed with skewness of 2.05 indicating that data the right tail was long relative to the left tail. The kurtosis was above the value of three (67.76) with standard error of 0.51, implying the excess kurtosis (leptokurtic distribution).

Information efficiency had a minimum and maximum of -108.38 and 90.30 respectively (mean -.098, standard deviation 7.49). Information efficiency negatively distributed with skewness of -1.07 indicating data skewed to the left. By skewed left, it meant that the left tail was long relative to the right tail. The study indicator had a kurtosis of that was above the value of three (49.54 with a standard error of 0.51) implying the excess kurtosis (leptokurtic distribution).

The maximum traded volume as an indicator for order flow was 1,000,000,000 with a minimum of 50,000, mean of 91,630,690 and a standard deviation of 96,320,681. Traded volume positively distributed with skewness of 2.30 (standard error 0.25). The positive skewness indicated a long right tail distribution. The results also indicated the traded volume had kurtosis that was above the

value of 3, that was, 10.07 with standard error of 0.51, indicating a high-peaked leptokurtic distribution.

4.3.1 Descriptive statistics for Bond Liquidity, Bond Yields, Information Efficiency and Order Flow

This section presented descriptive statistics for the study variables that included measures of mean (MN), standard deviations (SD), median (MD), minimum, maximum and standard error of an estimate for the bond liquidity, Order Flow, Information Efficiency and the Bond Yields of treasury bonds in Kenya.

4.3.1.1 Bond Yields

Table 4.2 below presented descriptive statistics for bond yields for the period between 2009 and 2018. The study used 9262 treasury bonds traded value observations for the government bonds. A total of seven bonds were observed for 10 years from 2009 to 2018. The bond market was characterized by low trading and occasionally some days would go without selling, hence the unbalanced panel data was deemed fit for this study. The mean, median, minimum level, maximum level and standard deviations of bond yields for all the ten years were presented. The levels of bond yields were analyzed and classified as per Sarma and Pias (2011) five categorization. Where levels of bond yields greater than 75% up to the maximum level of 100% indicated high treasury yields; levels greater than 50% and less than 75% represented high medium Treasury bond yields and levels greater than 25% and less than 50% indicated medium bond yields. Lower medium treasury bond yields was represented by levels greater than 10% and less than 25% and finally, low yields of treasury bonds was represented by values between 0 and less than 10%.

Study findings (Table 4.2) indicated that the Kenya 5 Years Government Bond reached a maximum yield of 59.92% and a minimum yield of 2.7%. The mean bond yield for the 5 Year bonds was 10.81%, while standard deviation was 3.06, low compared to the mean bond yield of the 10, 12, 15, 20, 25 and 30 Year Bonds during the period of this study. This was an indication that 5 year bond had high medium yields. 10 Year bond yields ranged from 2.05% to 22.5%, with a mean of 11.24% and standard deviation of 2.32, a clear indication of low bond yields while the 12 Year bond yields emerged has a bond tenor with the highest bond yields that ranged from 3.81% to 76.13%, mean of 11.32% and standard deviation of 2.44. The Kenya 15 Years Government Bond had low medium yields of a maximum yield of 17.25% and a minimum yield of 3.33% with a mean of 11.54% and standard deviation of 2.3 as shown in table 4.2 below. 20-year bond yields ranged from 3.70% to 18.0%, with a mean of 12.56% and standard deviation of 1.64, a clear indication of low medium bond yields. The central bank treasury bonds of 25-year tenor had low medium yields of a maximum yield of 18.50% and a minimum yield of 6.26% with a mean of 10.86% and standard deviation of 2.32. Lastly, the 30-year bond tenor yields ranged between 8.10% and 19.53%, with a mean of 13.75% and standard deviation of 1.16, an indication of low medium yields.

The mean of bond yields for 30-year bonds, was the highest at 13.75%. This was followed by 20-year bond, 15-year bonds, 12-year bonds, 10-year bonds and 25 year bonds at 12.56%, 11.54%, 11.32%, 11.24% and 10.86% respectively. The 5-year bond had the least with a score of 10.81%

Table 4. 2: Descriptive Statistics for Treasury Bonds Yields for the Period 2009 - 2018

Bond	N	Mean	Median	Min	Max	SD
10 Year Bonds	1798	11.24	11.95	2.05	22.50	2.32
12 Year Bonds	1931	11.32	11.35	3.81	76.13	2.44
15 Year Bonds	1777	11.54	12.20	3.33	17.25	2.20
20 Year Bonds	1268	12.56	13.00	3.70	18.00	1.64
25 Year Bonds	263	10.86	10.40	6.26	18.50	2.32
30 Year Bonds	557	13.75	13.60	8.10	19.53	1.16
5 Year Bonds	1668	10.81	11.33	2.70	59.92	3.06

Source: Research's Computations, 2022

Table 4.3 below indicated the level of bond yields for all treasury bonds had uneven increase since 2009 to 2018. In 2009 the margins were higher compared to years 2010 and 2011, there after there was consisted increase for 2012 and 2013. The study revealed that level of bond yields was at 11.63 in 2009, 8.26, 9.96, 11.30 and 12.36 in 2010, 2011 and 2013 respectively. In 2014, 2015 and 2016, the level increased to 11.91, 12.65 and 13.40 respectively. There was a decrease in 2017 and 2018 at 12.55 and 11.88 levels respectively. This indicated no consistent growth in the level of bonds yields. From the bond yields values, it was concluded that the treasury bonds yields in Kenya are low medium as per Sarma and Pias (2011) categorization. Further analysis of the highest values of bond yields per year contributed by individual bonds treasury tenors revealed that the level was

high at 76.13% in 2013. During the same year, the minimum value of treasury bonds yields was 7.42%.

Table 4. 3: Descriptive statistics for Bond Yields (2009 – 2018)

Year	N	Mean	Median	Min	Max	SD
2009	66	11.63	11.54	9.55	13.90	1.22
2010	1030	8.26	8.43	2.70	14.00	2.24
2011	1057	9.96	9.53	4.65	23.00	2.92
2012	1014	11.30	11.95	2.05	21.00	2.81
2013	924	12.36	12.25	7.42	76.13	2.32
2014	1032	11.91	11.95	4.77	15.86	0.95
2015	888	12.65	12.65	3.70	23.98	1.63
2016	948	13.40	13.45	7.36	59.92	1.85
2017	1136	12.55	12.63	7.55	16.10	1.01
2018	1167	11.88	11.88	7.80	15.30	0.93

Source: Research Data, 2022

4.3.1.2 Bond Liquidity

Table 4.4 below presented the seven treasury bonds under study on liquidity. For the 10 years under study the analysis reviewed 12-year bond were majority with 1931 observations with a mean of 0.003, ranged between 0 and 0.095 and standard deviation of 0.005.The 10 year, 15 year bond, 20 year bonds, 30year bonds and 25years bonds had observations of 1798, 1777, 1268, 557 and 263 respectively. The 25-year bond had the least number of observation. The total number of observation was 9262. The 5-year bond had the highest mean score of 0.009. This followed 10-

year bond at 0.006, with 15 years bond, 25 years bonds, 12 years bonds, 20 years bond and 30 years bonds lagging behind at 0.005, 0.005, 0.003, 0.003, and 0.001 respectively. The 30 years bond and the 20 years bond had the least mean value of bond liquidity at 0.003 and 0.001 respectively. The 5-year bond and 10-year bond were leading on treasury bonds liquidity in Kenya with a score of 0.009 and 0.006 respectively. The 10-year bond had a range of 0 and 0.256 an indication of medium bonds liquidity, followed by the low medium liquidity, 5 year bond with a range of 0 and 0.140. The 12year bond, 15 year bond, 20 year bond, 25 year bond and 30 year bond experienced low bonds yields with maximum values of 0.095, 0.68, 0.057, 0..40 and 0.021 respectively.

Table 4. 4: Descriptive statistics for Bond Liquidity for the Period 2009 – 2018

Bond	N	Mean	Median	Min	Max	SD
10 Year Bonds	1798	0.006	0.004	0	0.256	0.010
12 Year Bonds	1931	0.003	0.002	0	0.095	0.005
15 Year Bonds	1777	0.005	0.003	0	0.068	0.006
20 Year Bonds	1268	0.003	0.002	0	0.057	0.004
25 Year Bonds	263	0.005	0.002	0	0.040	0.006
30 Year Bonds	557	0.001	0.000	0	0.021	0.003
5 Year Bonds	1668	0.009	0.005	0	0.140	0.013

Source: Research Data, 2022

Table 4.5 presented the mean value of the degree of bond liquidity of treasury bonds in Kenya over each of the 10 years of study. The mean, median, minimum, maximum and the standard

deviation of bonds liquidity was for the 10 years were also presented. From the table below the level of bond liquidity had decreased marginally since 2009 to 2016. The year 2017 and 2018 saw increase in the bonds liquidity. The study revealed that the level of bond liquidity was at 0.010 in 2009, 0.010, 0.008, 0.006, 0.004, 0.004, 0.003 and 0.002 in 2010, 2011, 2012, 2013, 2014, 2015, and 2016 respectively. This indicated a diminishing liquidity levels throughout the period of study, then thereafter an increase in 2017 and 2018, both at 0.004 mean score. From the treasury bonds liquidity values it could be concluded that the level of liquidity in Kenya was low as per the Sarma and Pias (2011) categorization. Bond liquidity per year as contributed by individual bonds revealed that the level was medium low with turnover rate of 0.256, 0.140 in 2017 and 2010 respectively. During the same period, the minimums were zero.

Table 4. 5: Descriptive statistics for Bond Liquidity (2009 – 2018)

Year	N	Mean	Median	Min	Max	SD
2009	66	0.010	0.007	0.000	0.054	0.012
2010	1030	0.010	0.006	0.000	0.140	0.013
2011	1057	0.008	0.005	0.000	0.109	0.009
2012	1014	0.006	0.003	0.000	0.090	0.009
2013	924	0.004	0.003	0.000	0.038	0.005
2014	1032	0.004	0.003	0.000	0.067	0.006
2015	888	0.003	0.001	0.000	0.077	0.006
2016	948	0.002	0.001	0.000	0.024	0.003
2017	1136	0.004	0.002	0.000	0.256	0.010

2018	1167	0.004	0.002	0.000	0.091	0.007

Source: Research Data, 2022

4.3.1.3 Information efficiency

Table 4.6 below presented descriptive statistics for the information efficiency of treasury bonds in Kenya from 2009 to 2018. Table 4.6 revealed the 30-year bond had the lowest mean of-0.22, price dispersion of a minimum of -91 and a maximum of 55.98 and a standard deviation of 9.36. The price dispersion of the 25 years bond had the highest mean of 0.07, with a range of -73.69 and 76.73, with a standard deviation of 16.44. Other bonds lagged behind at a mean score of 0.01, 0.00, -0.12, -0.14, -0.18 and -0.22 for the 20 year bond, 5 year bond, 10year bond, 12 year bond, 15year bond and the 30 year bond respectively. The mean scores of price dispersion were inconsistent a clear indication of low information efficiency at the treasury bonds in Kenya.

Table 4. 6: Descriptive statistics for Information Efficiency for the Period 2009 – 2018

Bond	N	Mean	Median	Min	Max	SD
10 Year Bonds	1798	-0.12	0.06	-45.39	40.19	5.01
12 Year Bonds	1931	-0.14	0.02	-52.24	40.69	5.19
15 Year Bonds	1777	-0.18	0.05	-91.28	83.39	10.29
20 Year Bonds	1268	0.01	0.03	-108.38	90.30	9.06
25 Year Bonds	263	0.07	0.08	-73.60	76.73	16.44
30 Year Bonds	557	-0.22	0.00	-91.40	55.98	9.36
5 Year Bonds	1668	0.00	0.03	-36.16	36.09	2.60

Source: Research Data, 2022

The analysis as indicated in table 4.7 established that level of price dispersion was at 0.48, -0.17, -.02, -0.03, -0.03, -0.06, -0.06, -0.13, -0.24, -0.54 in 2009, 2014, 2017, 2011, 2016, 2013, 2018, 2010, 2015 and 2013 respectively. There was no consistency in price dispersion, a clear indication that the prices were random and unpredictable. Further analysis of highest values of price dispersion per year as contributed by individual bonds revealed that the level was high with price dispersion of 90.30%, 83.30% in 2011 and 2012 respectively. During the same period of 2011 and 2012 the minimums of price dispersion were -91.28 and -84.31 respectively. The year 2009, when the bonds markets had launched the bonds automated trading system saw maximum level of 9.09% followed steady increase in 2010 and 2011with maximums of 40.9% and 90.30% respectively. The minimums were -44.50 and -91.28 for year 2010 and 2011 respectively. Thereafter there was no consistency.

Table 4. 7: Descriptive statistics for Information Efficiency (2009 – 2018)

Year	N	Mean	Median	Min	Max	SD
2009	66	0.48	0.28	-5.81	8.09	1.90
2010	1030	-0.13	0.14	-44.50	40.69	5.67
2011	1057	-0.03	0.14	-91.28	90.30	11.50
2012	1014	-0.54	0.11	-84.31	83.30	14.38
2013	924	-0.06	0.02	-29.04	22.54	3.06
2014	1032	0.17	0.01	-73.60	70.44	5.21
2015	888	-0.24	0.01	-108.38	76.73	7.69
2016	948	-0.03	0.05	-34.47	36.09	3.64

2017	1136	-0.02	0.00	-50.47	55.98	4.15
2018	1167	-0.06	0.00	-91.40	29.95	3.71

Source: Research Data, 2022

4.3.1.4 Order Flow

Table 4.8 below presented the bonds under study by order flow. From the table, 12-year treasury bonds were the majority with 1931 observations with a mean of 81.48, a range of between 0.05 and 800 and a standard deviation of 93.71. The 25 years treasury bonds had the least number of observation of 263, with mean of 98.66 and a range between 0.05 and 800 and a standard deviation of 119.20. Order flow of treasury bonds in Kenya for the ten years under study revealed that the 5-year bonds had highest mean score at 113.51. This was followed by 10 years bond, 25 years bond, 15 years bond, 20-year bond, and 12-year bond and 30 year old at 101.33, 98.66, 94.75, 82.71, 81.48 and 37.04 respectively. Descriptive statistics reported were minimum, maximum, mean and standard deviation.

Table 4. 8: Descriptive statistics for Order Flow (Millions) for the Period 2009 – 2018

Bond	N	Mean	Median	Min	Max	SD
10 Year Bonds	1798	101.33	90.40	0.05	1000	90.95
12 Year Bonds	1931	81.48	50.65	0.05	800	93.71
15 Year Bonds	1777	94.75	78.78	0.05	800	86.61
20 Year Bonds	1268	82.71	66.67	0.05	600	79.14
25 Year Bonds	263	98.66	50.00	0.05	800	119.20
30 Year Bonds	557	37.04	5.00	0.05	600	75.78

5 Year Bonds	1668	113.51	91.37	0.05	1000	117.40

Source: Research Data, 2022

From table 4.9 below the mean value of the order flow of treasury bonds in Kenya as indicated by the trade size/face value was 89.84 in 2009 and gradual increase up to the year 2011. The values were 94.86, 107.51, 98.31, 102.56, 116.24, 80.93, 70.45, 74.29 and 80.50 for the years 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 respectively. A decrease in trade size experienced in 2012 at 98.31, then an increase in 2013 and 2014 with means of 102.56 and 116.24 respectively. There was a consisted drop in 2015 and 2016 with values of 80.93 and 70.45 respectively. However, an increase was noted in 2016, 2017 and 2018 where the mean was 70.45, 74.29 and 80.50 respectively. The year 2014 had the highest level as indicated by trade size with a mean of 116.24, range of 0.05 and 800, and a standard deviation of 117.46. The lowest mean was experienced in 2016, when the mean was 70.45, a range of 0.05 and 750.95 and a standard deviation of 84.49. as tabled below there was no consistency on the growth of order flow as indicated by the trade size over the ten years period.

Table 4. 9: Descriptive statistics for Order Flow (2009 – 2018)

Year	N	Mean	Median	Min	Max	SD
2009	66	89.84	83.33	0.10	300	77.07
2010	1030	94.86	93.33	0.07	800	72.33
2011	1057	107.51	100.00	0.05	700	88.72
2012	1014	98.31	83.33	0.05	800	94.20
2013	924	102.56	77.64	0.05	1000	106.55

2014	1032	116.24	100.00	0.05	800	117.46
2015	888	80.93	47.35	0.05	1000	105.90
2016	948	70.45	47.34	0.05	750.95	84.49
2017	1136	74.29	50.00	0.05	1000	89.52
2018	1167	80.50	50.55	0.05	750	93.86

Source: Research Data, 2022

4.4.Bond Characteristics

Table 4.10 below presented the summary of the bond characteristics of all the 7 treasury bonds traded over the 10 year period starting 2009 to 2018. In total, the study used the 9262 treasury bonds observations. The minimum coupon was 6.67% while the maximum was 15.4% with an average of 11.74% and a standard deviation of 1.34. The face value of treasury bonds traded within the same period of study had a minimum of 50,000, a maximum of 1,000,000,000 with a mean of 91,630,690 and a standard deviation of 96,320,681. The settled amount had a minimum of 34,028 and a maximum of 51,192,200, with an average of 98,030,139 and a standard deviation of 103,612,156. The present value of all treasury bonds had a mean of 101,072,857, with a minimum of 33,408 and a maximum of 1,002,820,000.

Table 4. 10: Bonds Characteristics

Bonds Characteristics	N	Minimum	Maximum	Mean	SD
Coupon	9262	6.67	15.04	11.74	1.34
Face Value Traded	9262	50000	1,000,000,000	91,630,690	96,320,681
Issued Quantity	9262	2,210,500,000	51,192,200,000	27,448,876,079	11,423,005,131
Settlement Amount	9262	34,028	1,040,283,000	98,030,139	103,612,156
Daily opening Price	9262	57.09	220.69	101.81	13.82
Present Value	9262	33,408	1,002,820,000	95,609,157	101,072,857
Daily Closing Price	9262	.00	208.82	101.71	13.47

Source: Research Data (2022)

4.5 Trend Analysis

Trend analysis is a method that compares past and recent data sets of a particular variable to forecast the future long-term uptrends, downtrends, stagnation and direction of a market sentiment. Trends showed peaks and troughs of bond charts that were analyzed to determine market trends accordingly. Trend analysis used historical data for all indicators of the study variables, such as turnover rate for bond liquidity, traded volume for order flow, price dispersion for the information efficiency and yield to maturity for the bond yield of Kenyan treasury bonds. Figure 4.1 presented changes in yields (yield to maturity) of treasury bonds in Kenya for the seven treasury bonds from 2009 to 2018. The graph indicated an irregular growth of bond yields and that Nairobi Securities market was developing and unsteady.

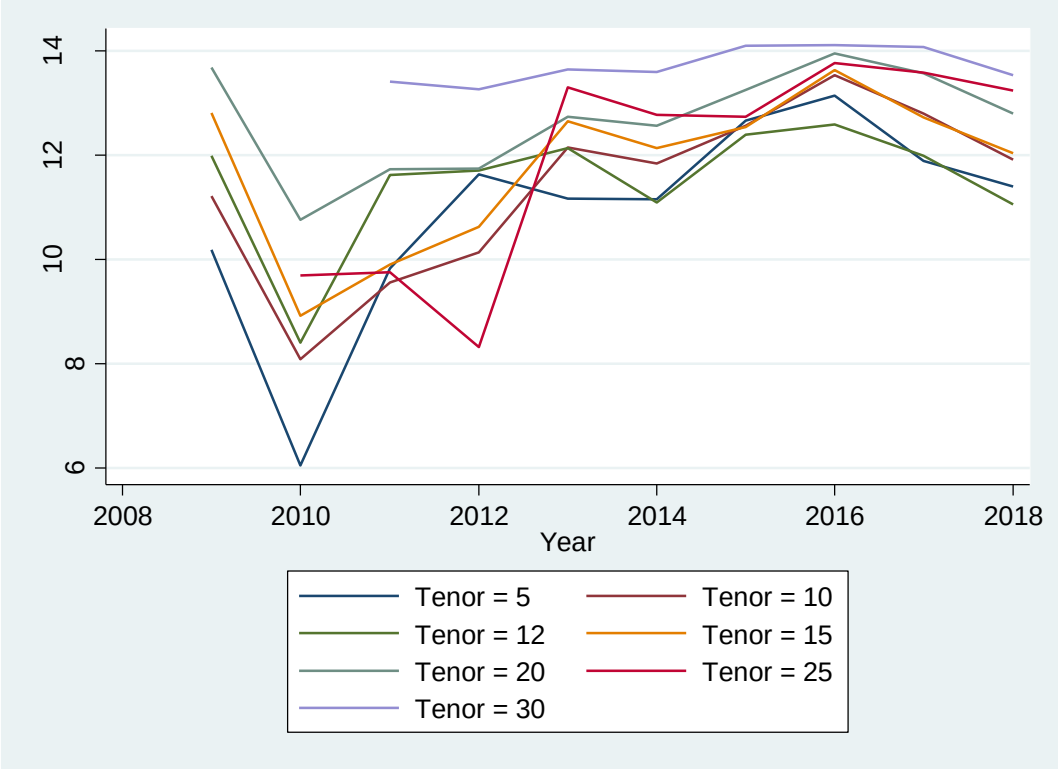


Figure 4. 1: Bond Yields

Figure 4.2 indicated that the information efficiency of treasury bonds at Nairobi securities exchange had registered unstable growth over the 10 years, though the period ending 2018, saw same little stability in prices. This could be attributed to macroeconomic factors such as interest rates, exchange rates, inflation among others. The 30-year bond recorded sharp decline in price dispersion.

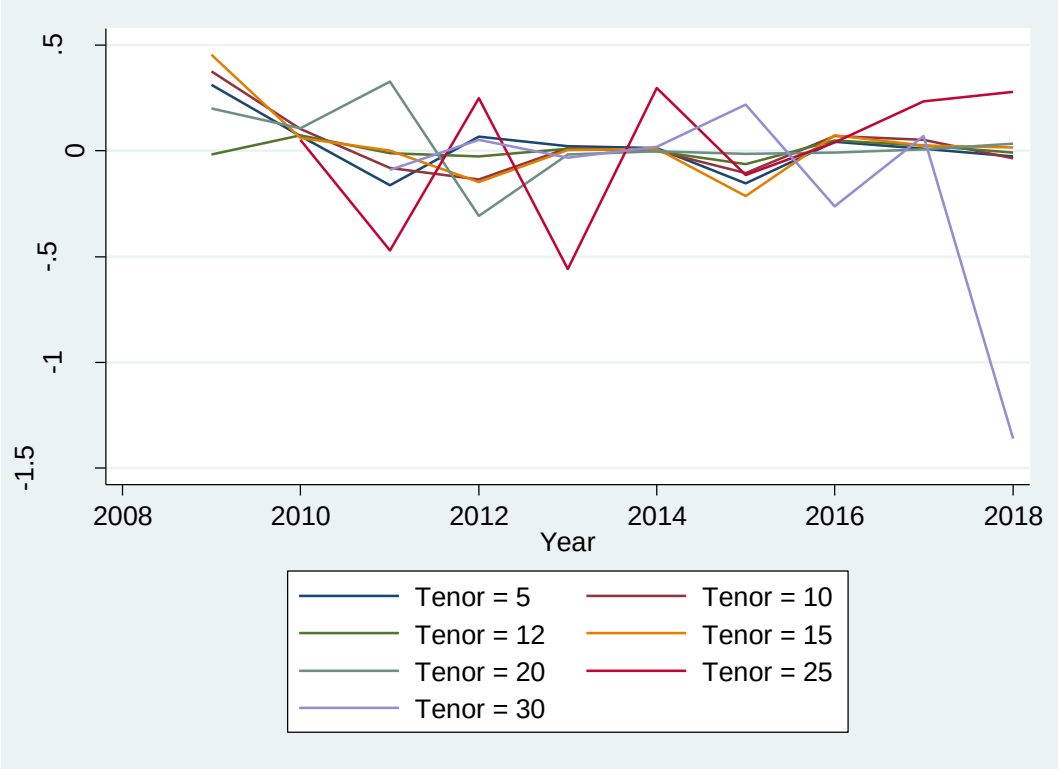


Figure 4. 2: Information efficiency

Figure 4.3 indicated that the bond liquidity of treasury bonds at Nairobi securities exchange had registered unstable growth over the 10 years. It was evident that there was an ascending curve in all bonds between 2009 and 2010. This could be associated with the automaton of treasury bonds at Nairobi securities, which had eased trading hindrances. Then as from 2011 to 2018 shown an erratic behavior of turnover rate. An indication of unstable traded and issued bonds at NSE. This could be attributed to other forces of the market like the demand and supply of treasury bonds in the market. The 30-year bond recorded sharp decline in price dispersion.

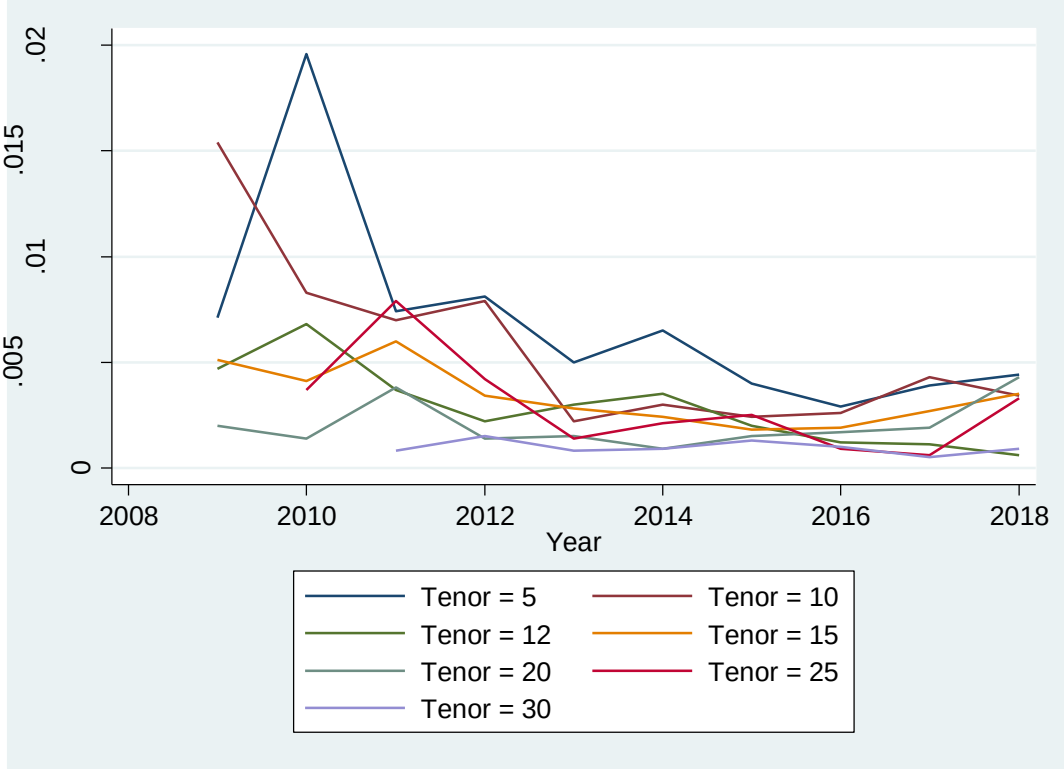


Figure 4. 3: Bond liquidity

4.5.1 Bond Yields

In order to comprehend the change of treasury yields growth over the study period the annual growth was computed. Yield to maturity (YTM) was used as proxy for Bond yields. The yield curves of 5, 10, 12, 15, 20, 25 and 30-year Kenyan treasury bonds issued between 2009 and 2018 by the Central Bank of Kenya are shown below. The yield to maturity (YTM), expressed as [(Face value / Present value) $^{1/\text{Time period}}$]-1 (Fabozzi 2000).The yield curve of bonds issued by the government usually demonstrates the tightness of the monetary policy. This was expressed as percentage and presented in figures below.

4.5.1.1 5-Year Bonds

The study used 1668 treasury bonds traded value observations for the 5-Years government bonds. The Kenya 5 Years Government Bond reached a maximum yield of 59.92% and a minimum yield of 2.7%. The figure below shows the average bond yields for the 5-year bonds for the period between January 2008 and December 2019. The average bond yield was 10.81% and the median yield was 11.33%

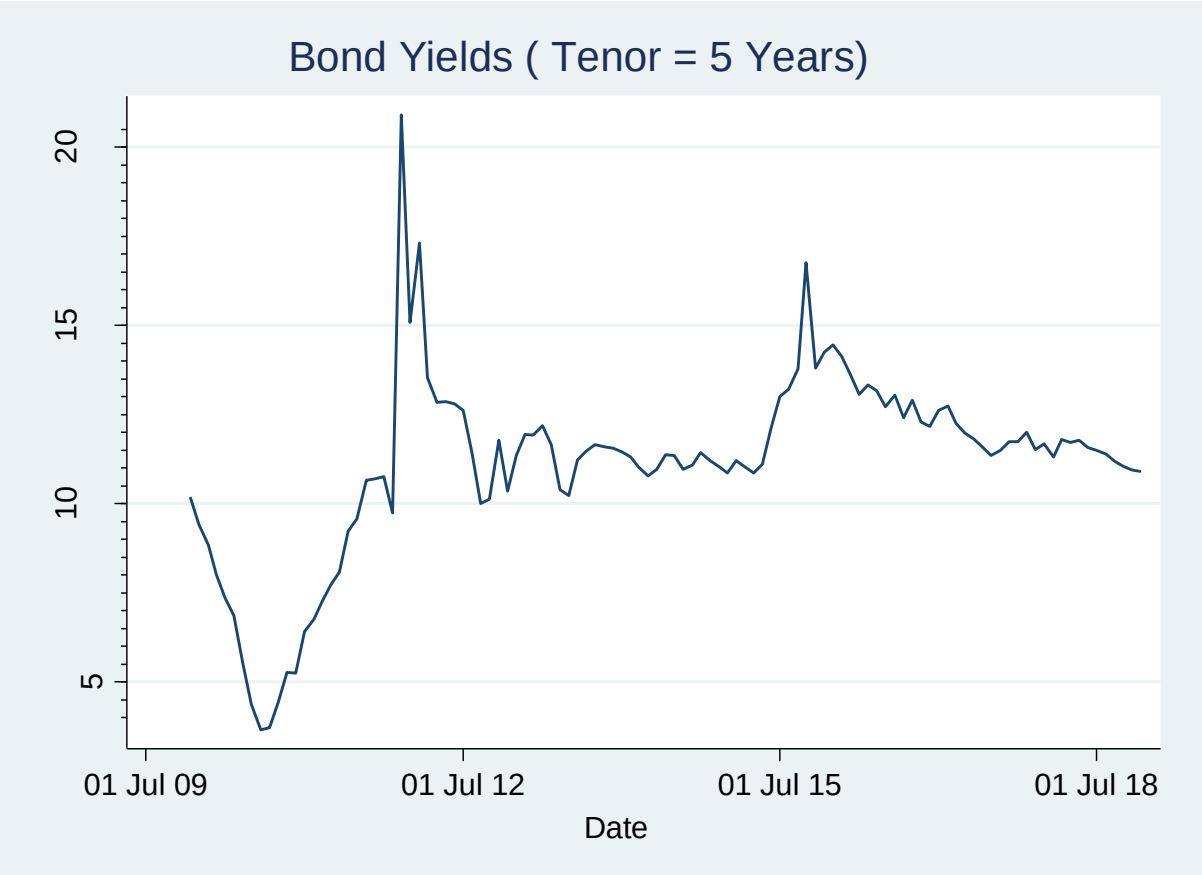


Figure 4. 4: Bond Yields of the 5-Year Bonds for the period between 2008 and 2018

4.5.1.2. 10 Year Bonds

Figure 4.5 below shows the graph for the 10 years bond. The study used 1798 treasury bonds traded value observations for the 10-Years government bonds. The Kenya 10 Years Government Bond reached a maximum yield of 22.50% and a minimum yield of 2.05%. The figure below shows the average bond yields for the 10-year bonds for the period between January 2008 and December 2019. The average bond yield was 11.24% and the median yield was 11.95%.

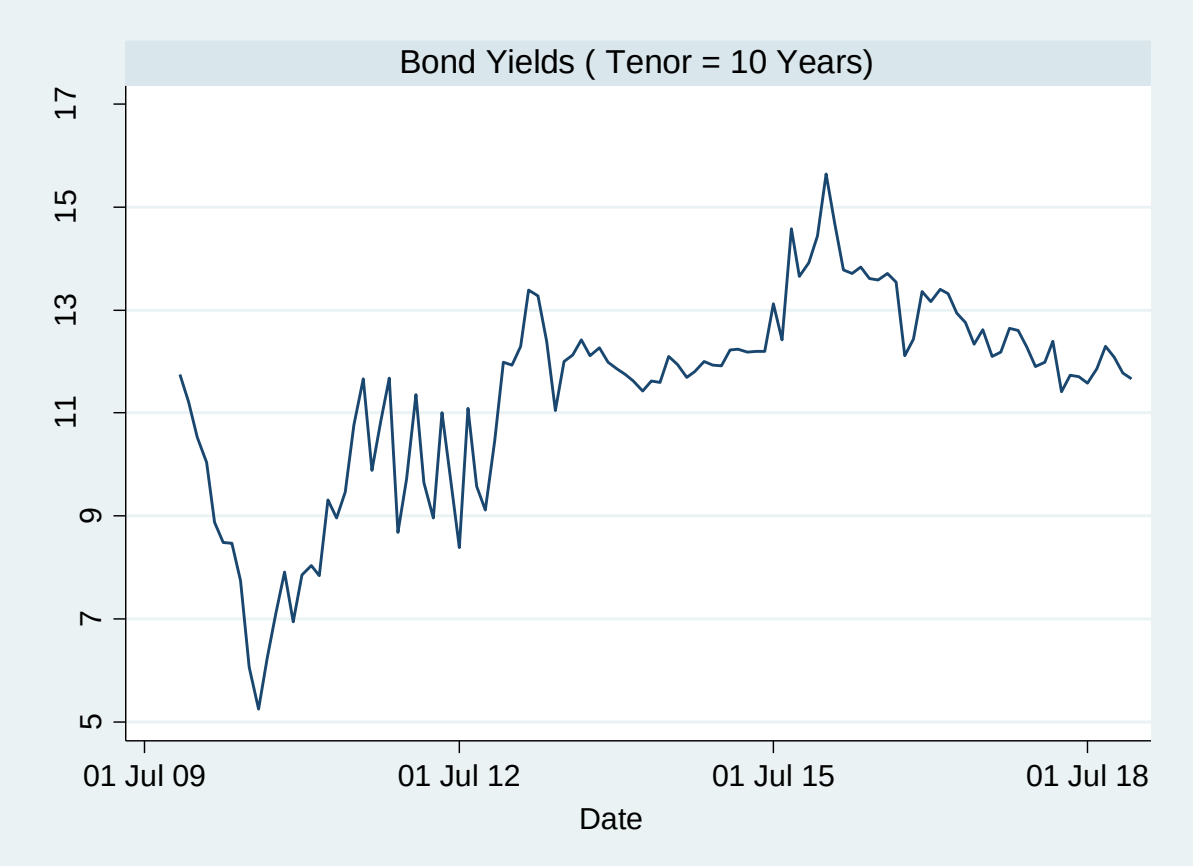


Figure 4. 5: Bond Yields of the 10-Year Bonds for the period between 2009 and 2018

4.5.1.3. 12-Year Bond

Figure 4.6 below shows the graph for the 12 years bond. The study used 1931 treasury bonds traded value observations for the 12-Years government bonds. The Kenya 12 Years Government Bond reached a maximum yield of 76.13% and a minimum yield of 3.81%. The figure below shows the average bond yields for the 12-year bonds for the period between January 2008 and December 2019. The average bond yield was 11.32% and the median yield was 11.35%.

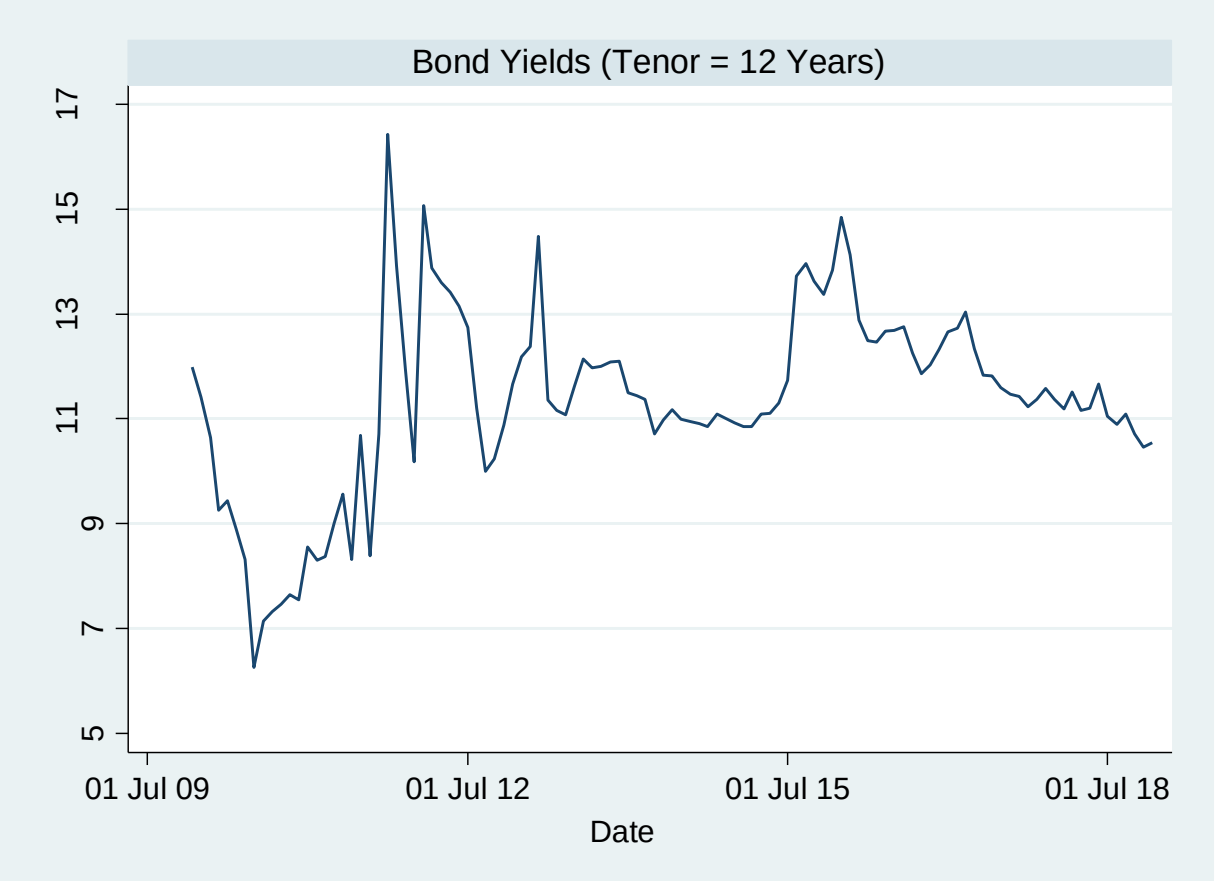


Figure 4. 6: Bond Yields of the 12-Year Bonds for the period between 2008 and 2018

4.5.1.4. 15-Year Bond

Figure 4.7 below shows the graph for the 15 years bond. The study used 1777 treasury bonds traded value observations for the 15-Years government bonds. The Kenya 15 Years Government Bond reached a maximum yield of 17.25% and a minimum yield of 3.33%. The figure below shows the average bond yields for the 15-year bonds for the period between January 2008 and December 2019. The average bond yield was 11.54% and the median yield was 12.20%.

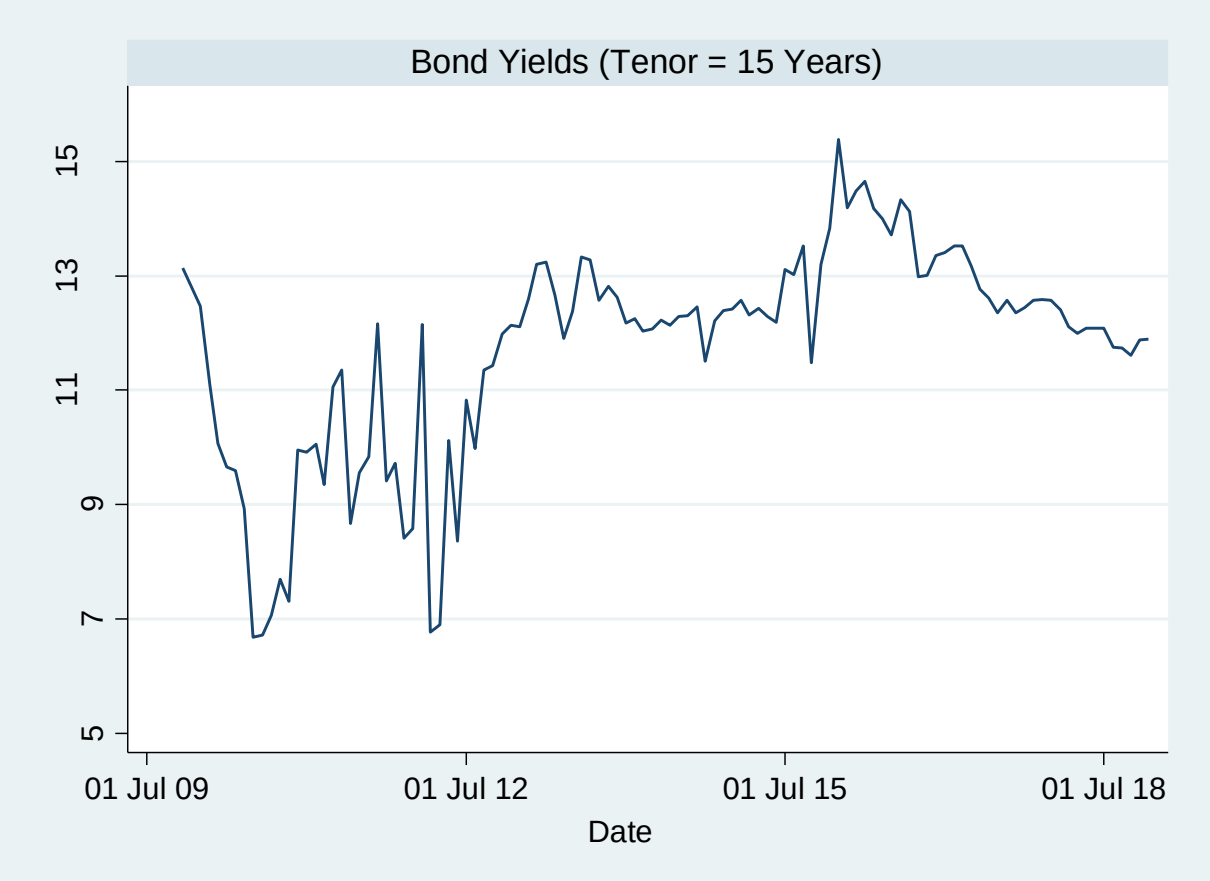


Figure 4. 7: Bond Yields of the 15-Year Bonds for the period between 2008 and 2018

4.5.1.5 20. Year Bonds

Figure 4.8 below shows the graph for the 20 years bond. The study used 1268 treasury bonds traded value observations for the 20-Years government bonds. The Kenya 20 Years Government Bond reached a maximum yield of 18.00% and a minimum yield of 3.70%. The figure below shows the average bond yields for the 20-year bonds for the period between January 2008 and December 2019. The average bond yield was 12.56% and the median yield was 13.00%.

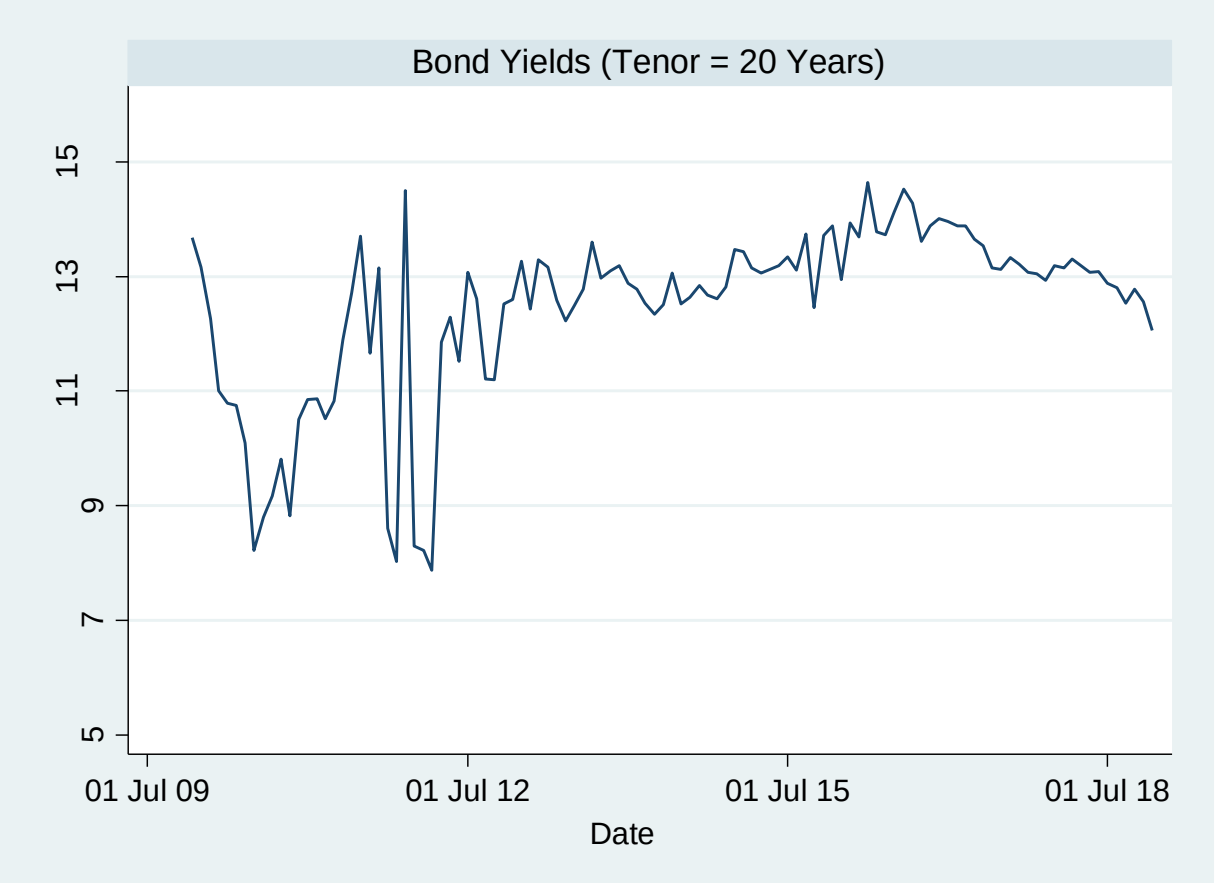


Figure 4. 8: Bond Yields of the 20-Year Bonds for the period between 2008 and 2018

4.5.1.6. 25-Year Bonds

Figure 4.9 below shows the graph for the 25 years bond. The study used 263 treasury bonds traded value observations for the 25-Years government bonds. The Kenya 25 Years Government Bond reached a maximum yield of 18.50% and a minimum yield of 6.26%. The figure below shows the average bond yields for the 25-year bonds for the period between January 2008 and December 2019. The average bond yield was 10.86% and the median yield was 10.40%.

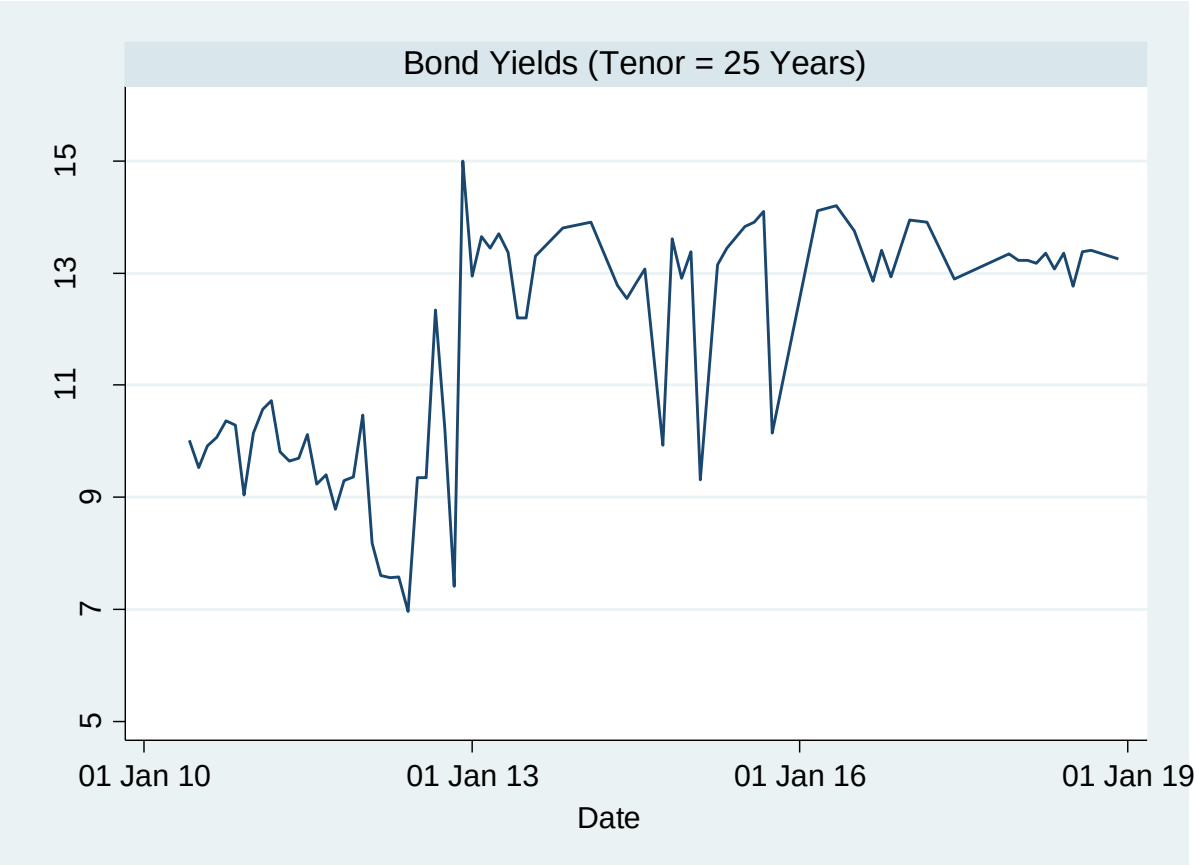


Figure 4. 9: Bond Yields of the 25-Year Bonds for the period between 2008 and 2018

4.5.1.7. 30-Year Bond

Figure 4.10 below shows the graph for the 30 years bond. The study used 557 treasury bonds traded value observations for the 30-Years government bonds. The Kenya 30 Years Government Bond reached a maximum yield of 19.53% and a minimum yield of 8.10%. The figure below shows the average bond yields for the 30-year bonds for the period between January 2008 and December 2019. The average bond yield was 13.05% and the median yield was 13.60%.

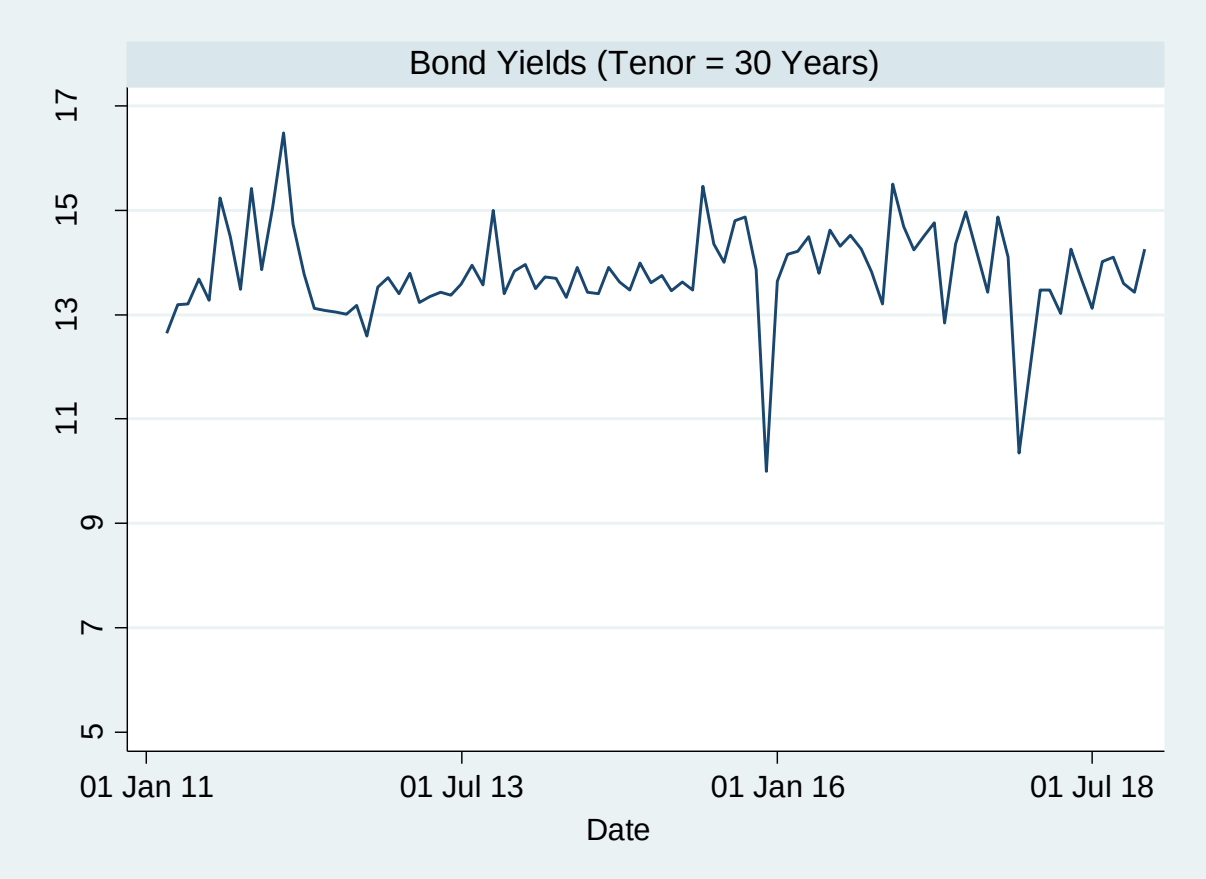


Figure 4. 10: Bond Yields of the 30-Year Bonds for the period between 2008 and 2018

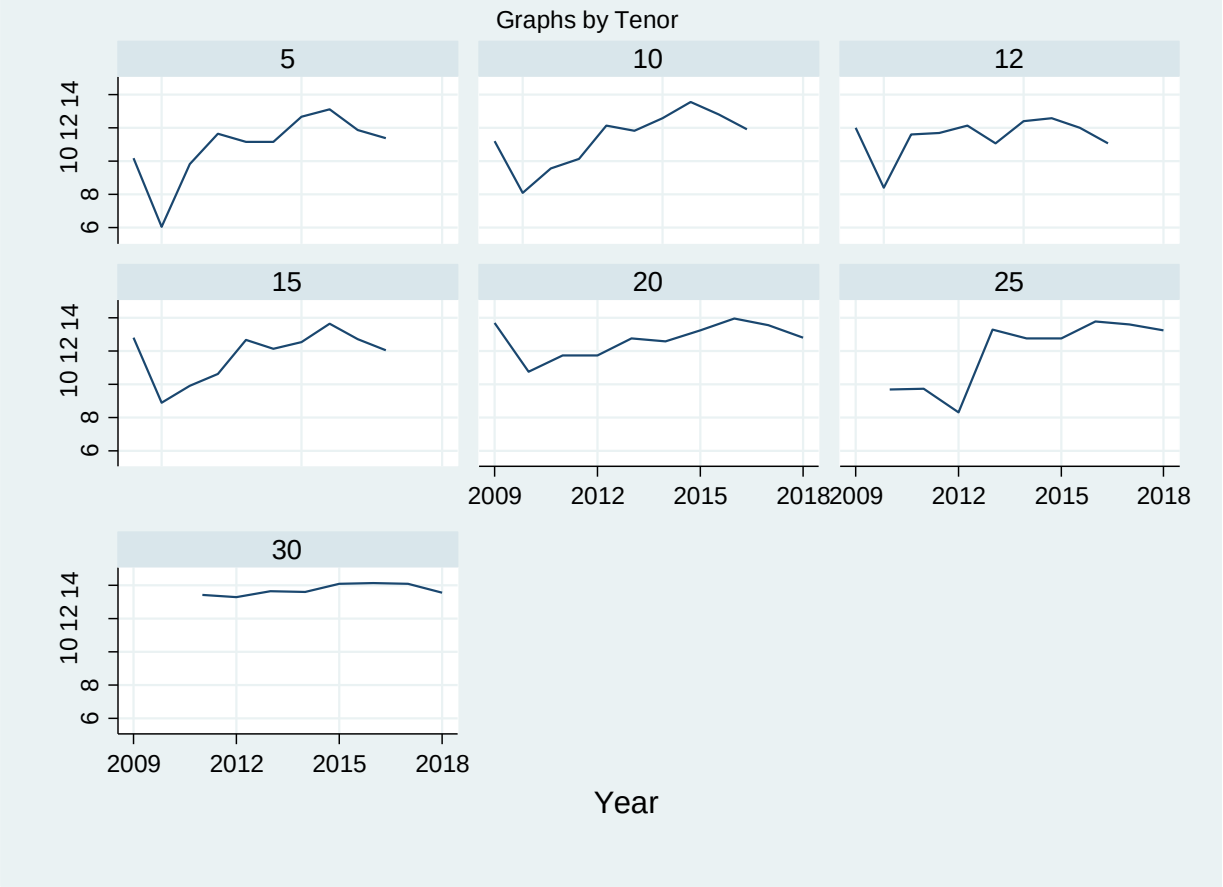


Figure 4. 11: Graphs by Tenor

4.5.2 Information Efficiency

In order to capture the behavior of information efficiency over the study period the weekly price dispersion was calculated. Daily bond price dispersion was the measurement for information efficiency where bond closing price was subtracted from the daily opening price as suggested by (Ngugi &Agoti 2010; Okumu 2010; Hotchkiss & Ronen, 1999). Inefficiency was inferred when the dispersion between the two was high. The study assumed that closing price captures the information in the course of trading should be between the high and low quotations of the day. The

graphs of 5, 10, 12, 15, 20, 25 and 30-year Kenyan treasury bonds issued between 2009 and 2018 are shown below.

4.5.2.1. 5-Year Bond

Figure 4.12 below shows the graph 5 years bond had irregular patterns all through the ten-year period. In 2011 and 2012, there was sharp price dispersion. Between 2012 and 2018, there was little stability in price dispersion. This was an indication that the prices of bonds were steady. The study used 1668 treasury bonds traded value observations for the 5-Years government bonds. The Kenya 5 Years Government Bond reached a maximum yield of 36.09% and a minimum yield of -36.09%. The figure below shows the price dispersion for the 5-year bonds for the period between January 2009 and December 2018. The average price dispersion was 0.00 and the median was 0.03%.

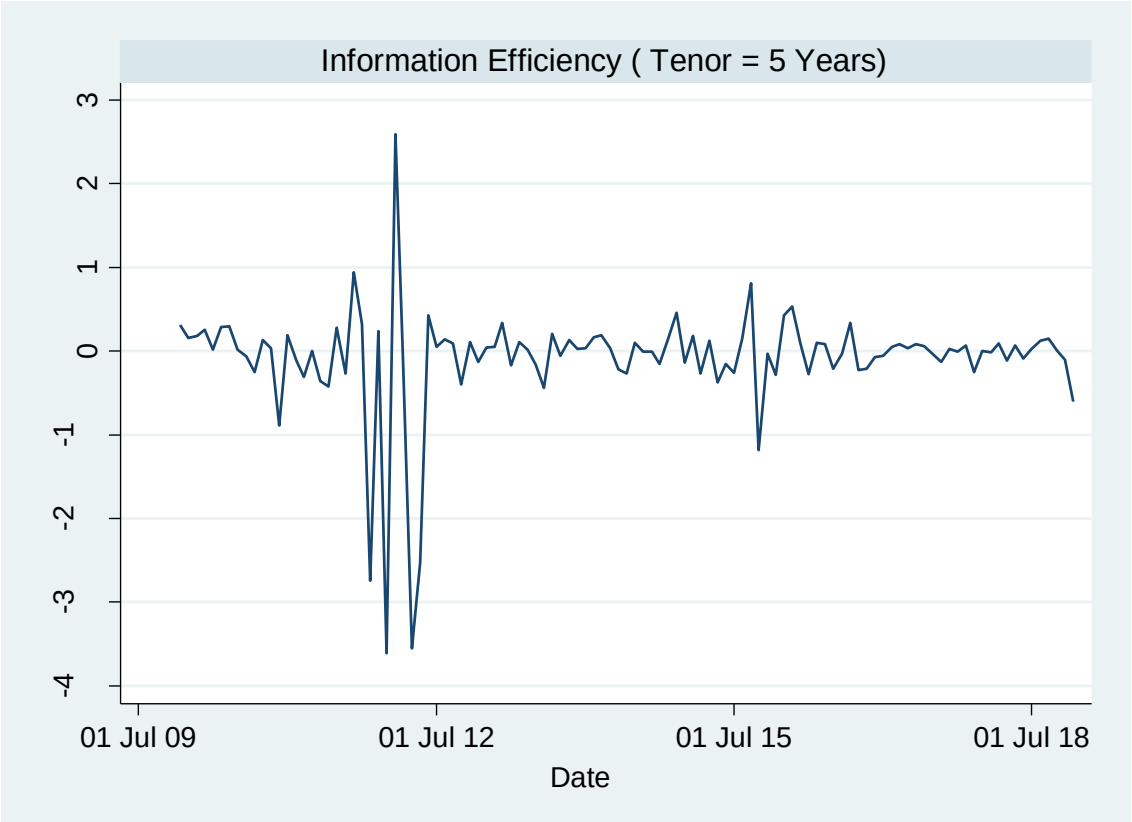


Figure 4. 12: Information efficiency of the 5-Year Bonds for the period between 2009 and 2018

4.5.2.2 10-Year Bond

Figure 4.13 below shows the graph 10 years bond had irregular patterns all through the ten-year period. Between 2015 and July 2018, there was little stability in price dispersion. This was an indication that the prices of bonds were steady. However, in 2018 shows a sharp decline in price dispersion. This could be attributed to other microeconomic factors. The study used 1798 treasury bonds traded value observations for the 10-Years government bonds. The Kenya 10 Years Government Bond reached a maximum of 40.19% and a minimum of -45.39%. The figure below

shows the price dispersion for the 10-year bonds for the period between January 2009 and December 2018. The average price dispersion was -0.12 and the median was 0.06%.

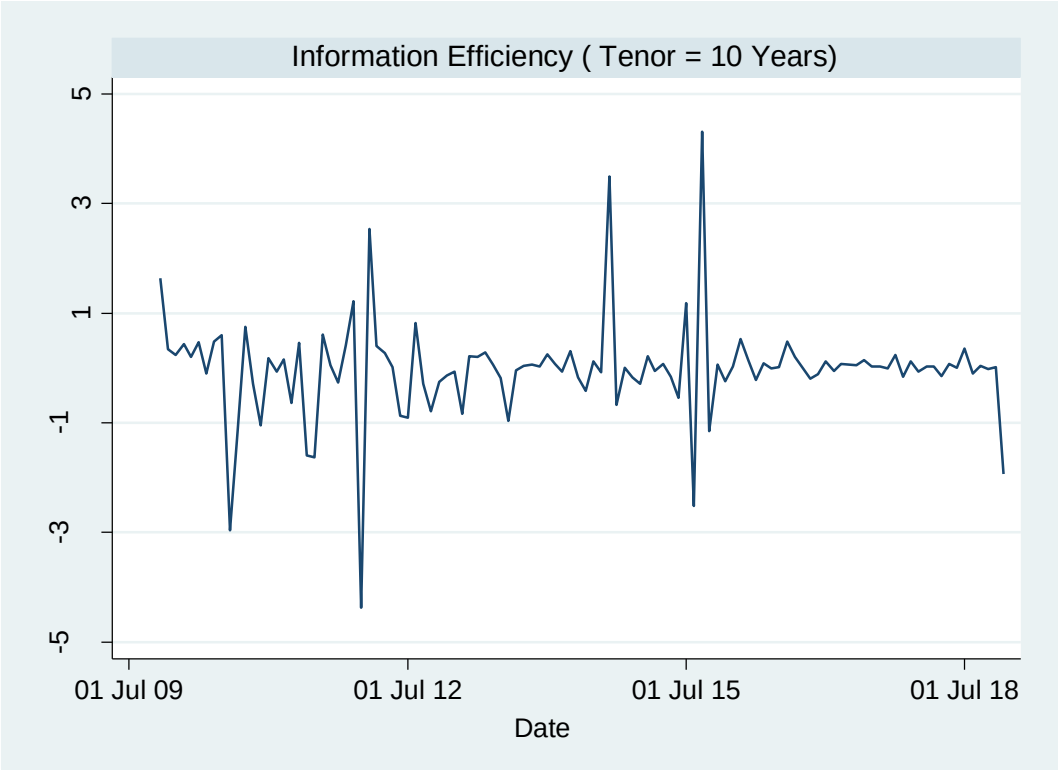


Figure 4. 13: Information efficiency of the 10-Year Bonds for the period between 2009 and 2018

4.5.2.3 12-Year Bond

Figure 4.14 below shows the graph 12 years bond had irregular patterns all through the ten-year period. Between 2010 and 2012, there was sharp in price dispersion. Between 2012 and 2018 there was regular pattern. This is an indication that the prices of bonds were steady. However, in 2018 shows a sharp decline in price dispersion. This could be attributed to other microeconomic factors. The study used 1931 treasury bonds traded value observations for the 12-Years government bonds.

The Kenya 12 Years Government Bond reached a maximum of 40.69% and a minimum of -52.24%. The figure below shows the price dispersion for the 12-year bonds for the period between January 2009 and December 2018. The average price dispersion was -0.14 and the median was 0.02%.

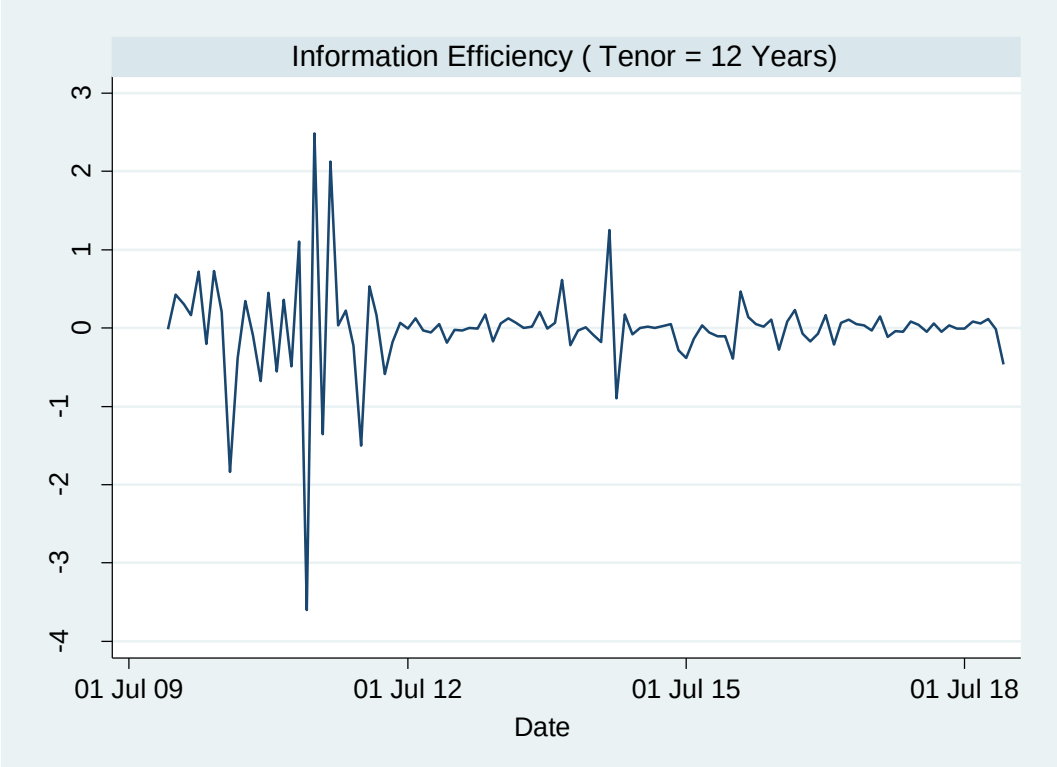


Figure 4. 14: Information efficiency of the 12-Year Bonds for the period between 2009 and 2018

4.5.2.4 15-Year Bond

Figure 4.15 below shows the graph 15 years bond had irregular patterns all through the ten-year period. This could be attributed to other microeconomic factors. The study used 1777 treasury bonds traded value observations for the 15-Years government bonds. The Kenya 15 Years Government Bond reached a maximum of 83.39% and a minimum of -91.28%. The figure below

shows the price dispersion for the 15-year bonds for the period between January 2009 and December 2018. The average price dispersion was -0.18 and the median was 0.05%.

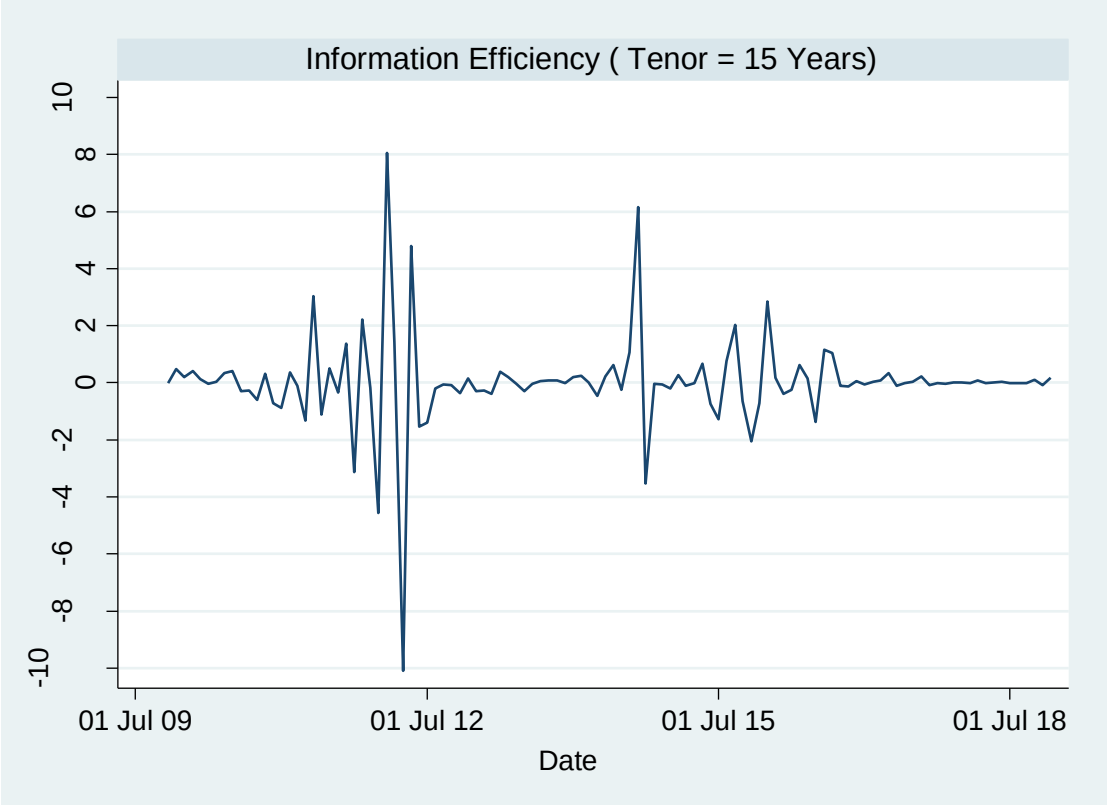


Figure 4. 15: Information efficiency of the 15-Year Bonds for the period between 2009 and 2018

4.5.2.5 20-Year Bond

Figure 4.16 below shows the graph 20 years bond had irregular patterns all through the ten-year period. Between 2010 and 2012, there was sharp in price dispersion. The study used 1268 treasury bonds traded value observations for the 20-Years government bonds. The Kenya 20 Years Government Bond reached a maximum of 90.30% and a minimum of -108.38%. The figure below

shows the price dispersion for the 20-year bonds for the period between January 2009 and December 2018. The average price dispersion was 0.01 and the median was 0.03%.

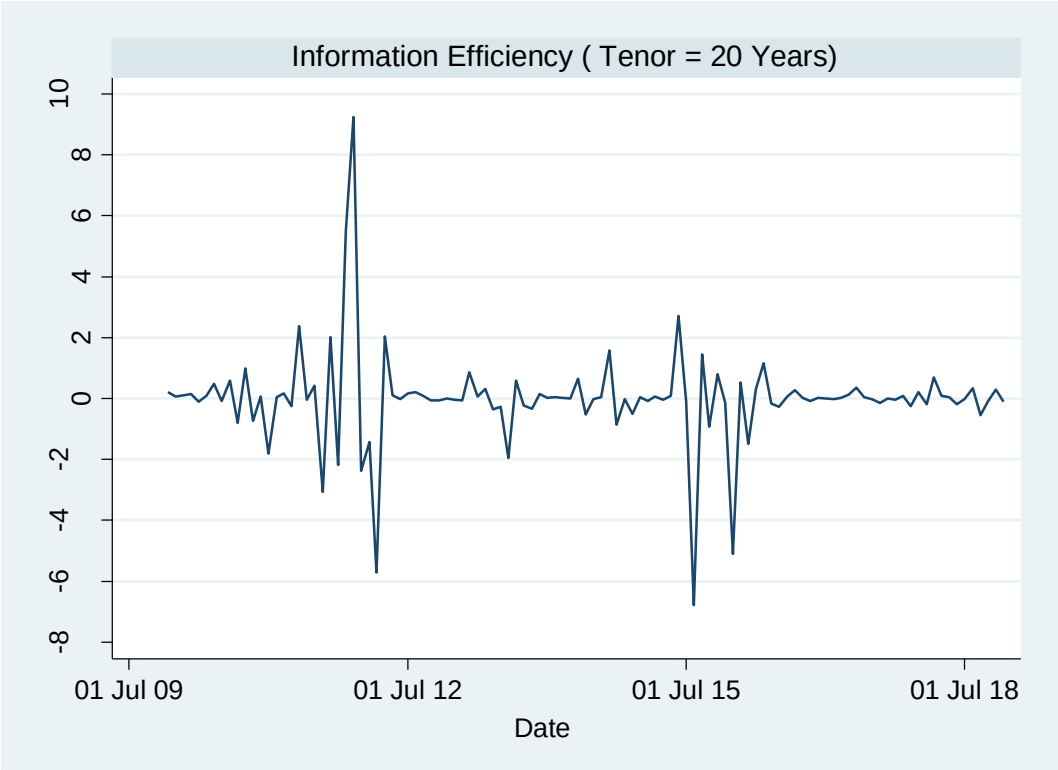


Figure 4. 16: Information efficiency of the 20-Year Bonds for the period between 2009 and 2018

4.5.2.6 25-Year Bond

Figure 4.17 below shows the graph 25 years bond had irregular patterns all through the ten-year period. Between 2014 and 2015, there was sharp in price dispersion. Between 2016 and 2017 there was steady pattern. This is an indication that the prices of bonds were steady. However, in 2018 shows a sharp growth in price dispersion. This could be attributed to other microeconomic factors. The study used 263 treasury bonds traded value observations for the 25-Years government bonds. The Kenya 25 Years Government Bond reached a maximum of 76.73% and a minimum of -

73.60%. The figure below shows the price dispersion for the 25-year bonds for the period between January 2009 and December 2018. The average price dispersion was 0.07 and the median was 0.08%.

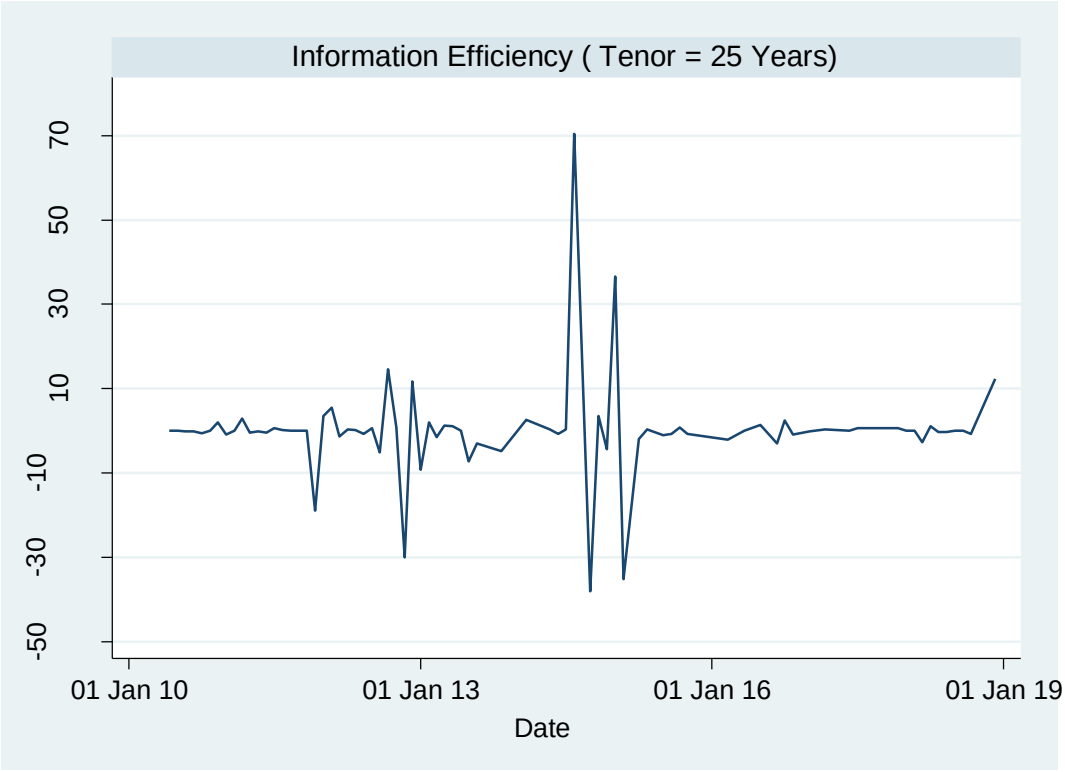


Figure 4. 17: Information efficiency of the 25-Year Bonds for the period between 2009 and 2018

4.5.2.7 30-Year Bond

Figure 4.18 below shows the graph 30 years bond had irregular patterns all through the ten-year period. Between 2009 and 2016, the graph had regular patterns an indication of steady in price dispersion. Between 2017 and 2018, there was irregular pattern and a sharp decline in 2018. This is an indication that the prices of bonds were not steady. This could be attributed to other microeconomic factors. The study used 557 treasury bonds traded value observations for the 30-

Years government bonds. The Kenya 30 Years Government Bond reached a maximum of 55.98% and a minimum of -91.40%. The figure below shows the price dispersion for the 30-year bonds for the period between January 2009 and December 2018. The average price dispersion was -0.22 and the median was 0.00%.

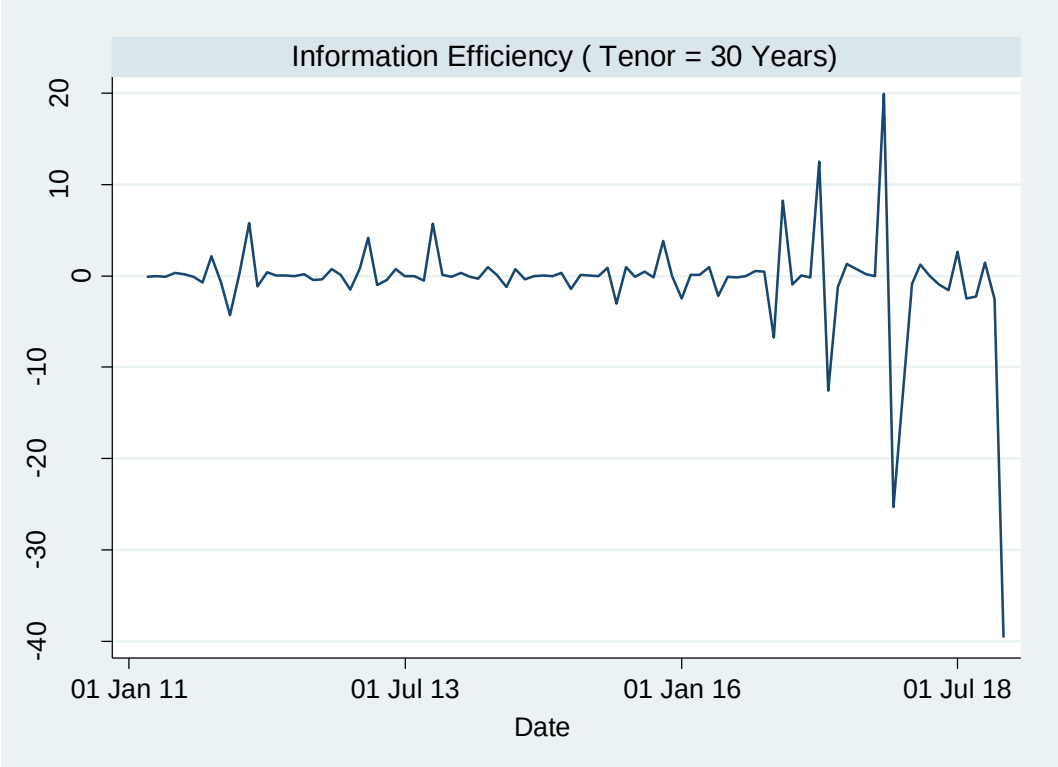


Figure 4. 18: Information efficiency of the 30-Year Bonds for the period between 2009 and 2018

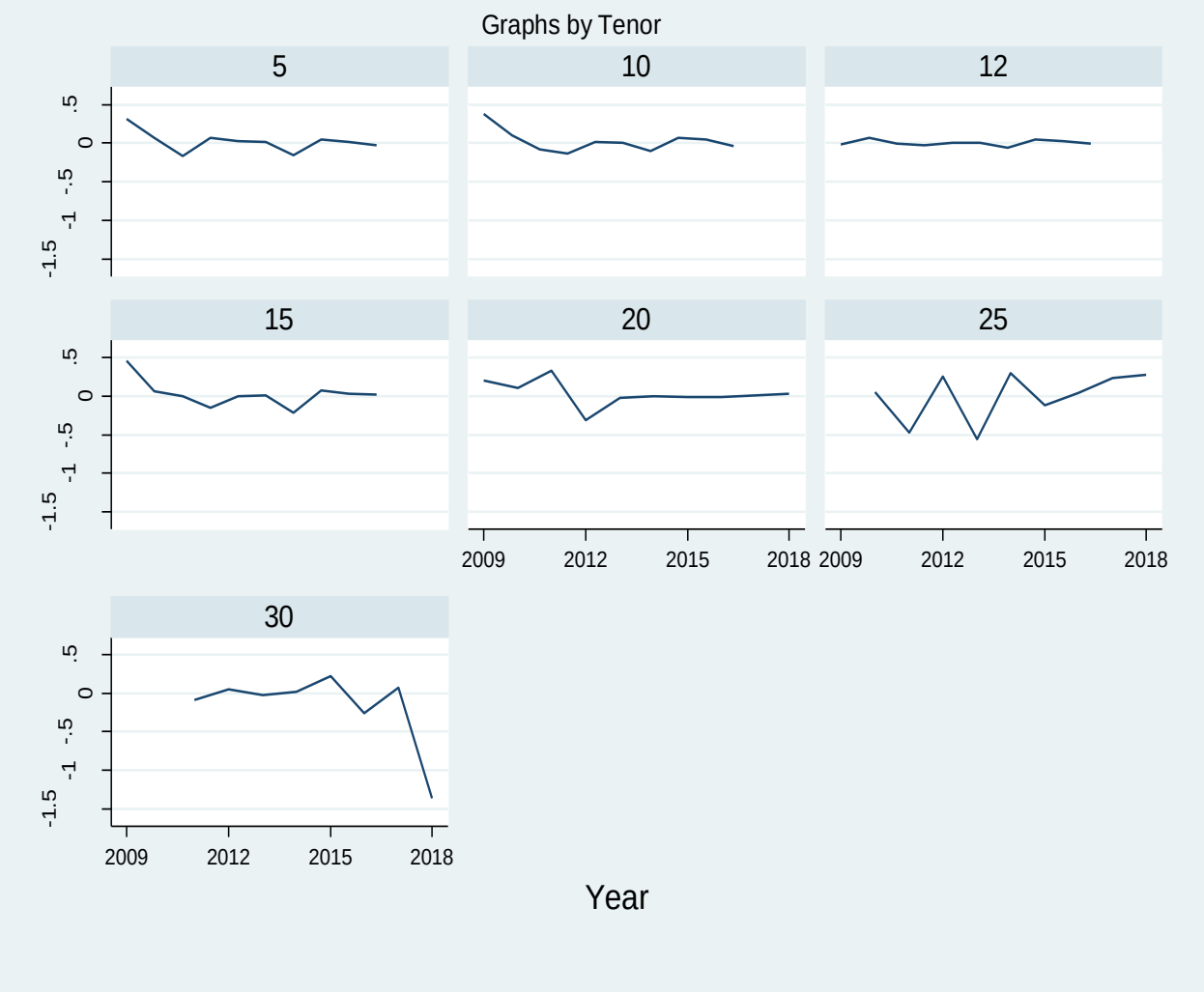


Figure 4. 19: Graphs by Tenor-Information Efficiency

4.5.3 Bond Liquidity

In order to capture the behavior of bond liquidity over the study period the turnover rate was calculated. The turnover rate was the number of bonds traded divided by the number of bonds issued (Koech 2008; Thotho 2017; Goyenko, Subrahmanyam & Ukhov 2016; Biais & Declerck, 2013; Chordia, Roll & Subrahmanyam, 2001; Beber, Brandt & Kavajecz, 2009; Nyongesa, 2012). Weekly and Monthly average spread was be computed for each bond tenure and then equally

weighted across different bonds tenures for each month. The graphs of 5, 10, 12, 15, 20, 25 and 30-year Kenyan treasury bonds issued between 2009 and 2018 shown below.

4.5.3.1 5-Year Bond

Figure 4.20 below shows the graph 5 years bond had irregular patterns all through the ten-year period. From 2009 to 2019, the curve ascended at high rate an indication of more traded and issued bonds. This could be attributed to bond trading automation, which occurred in 2009 hence easing the trading exercise. There was irregular pattern and a sharp decline from 2010 to 2018. This is an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. The study used 1668 treasury bonds traded value observations for the 5-Years government bonds. The Kenya 5 Years Government Bond reached a maximum of 14% and a minimum of 0. The figure below shows the turnover rate for the 5-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.9% and the median was 0.5%.

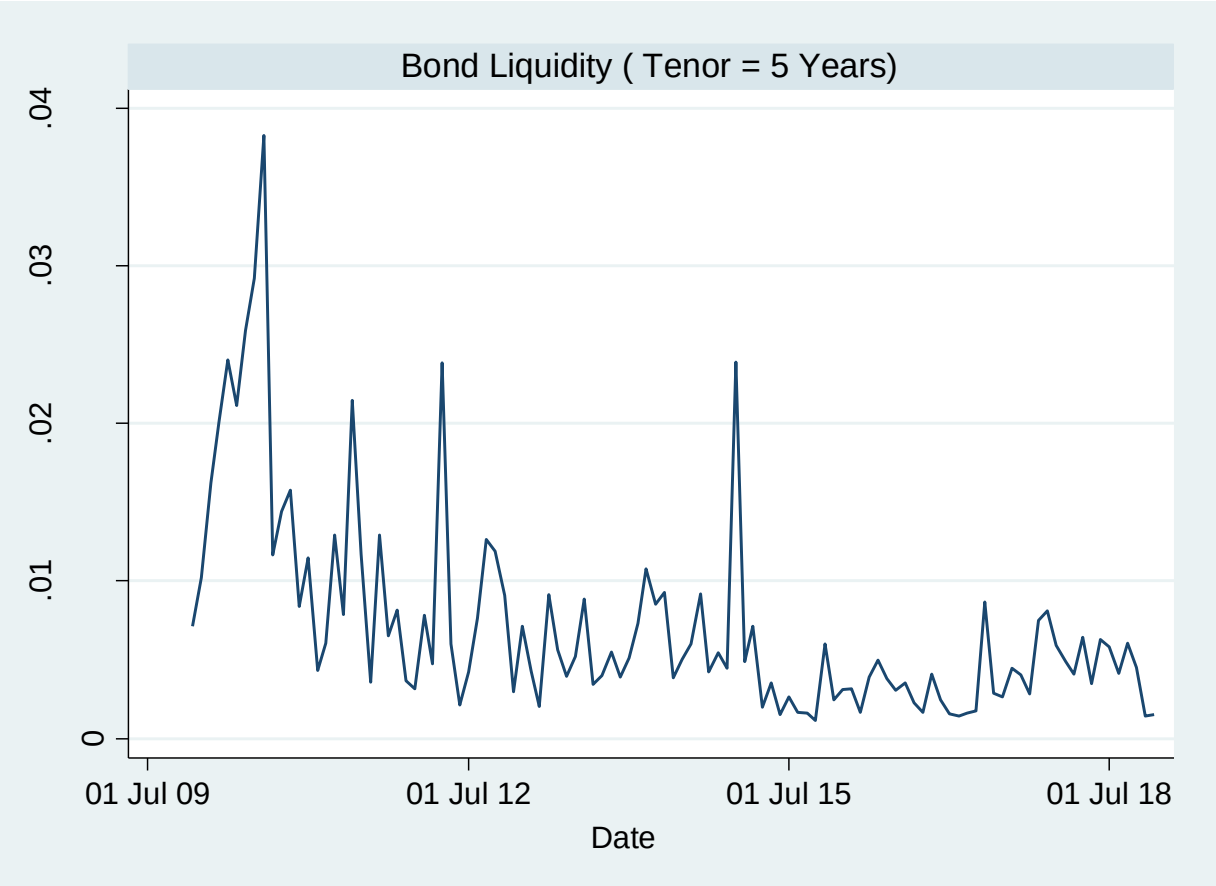


Figure 4. 20: Bond liquidity of the 5-Year Bonds for the period between 2009 and 2018

4.5.3.2 10-Year Bond

Figure 4.21 below shows the graph 10 years bond had irregular patterns all through the ten-year period. From 2009 to 2010 saw descending curve, then from 2010 to 2011 the curve ascended at high rate an indication of more traded and issued bonds. This could be attributed to bond trading automation, which occurred in 2009 hence easing the trading exercise. There was irregular pattern from 2011 to 2018. This is an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. The study used 1798 treasury

bonds traded value observations for the 10-Years government bonds. The Kenya 10 Years Government Bond reached a maximum of 25.6% and a minimum of 0. The figure below shows the turnover rate for the 10-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.6% and the median was 0.4%.

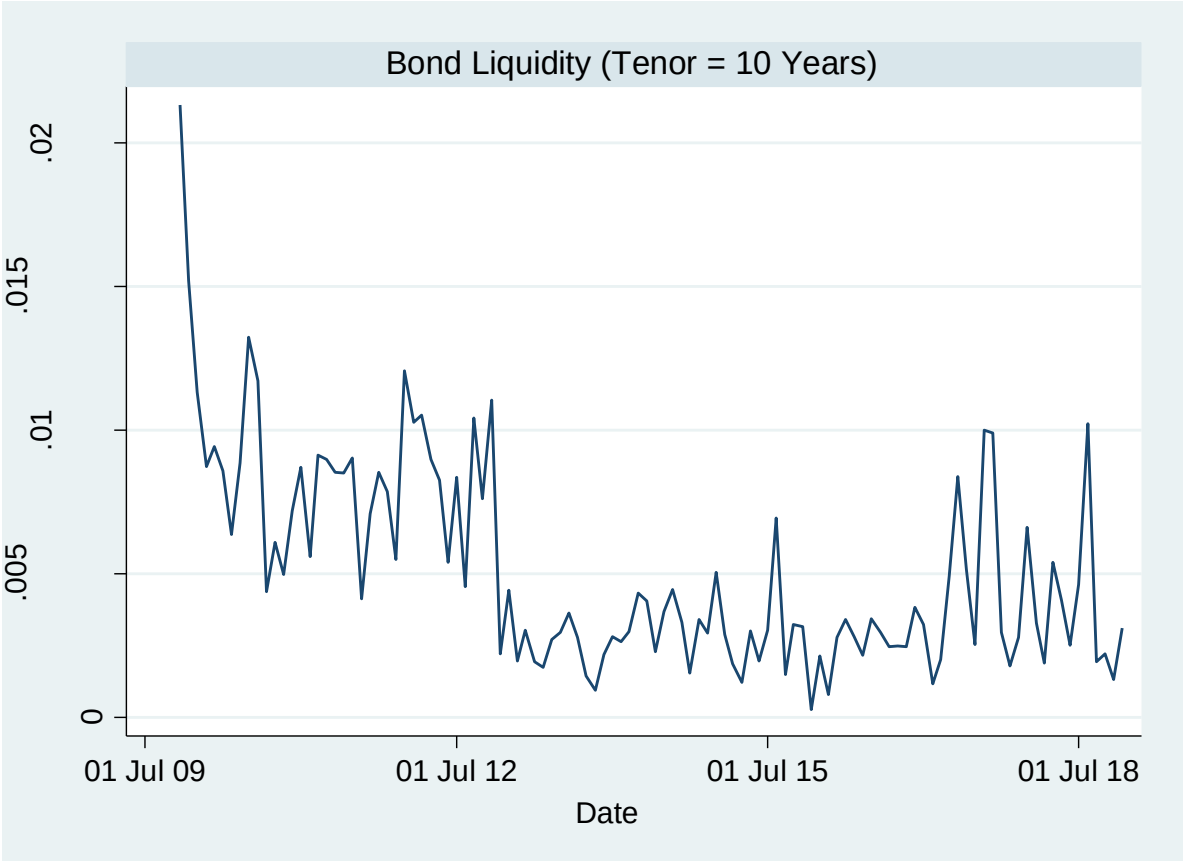


Figure 4. 21: Bond liquidity of the 10-Year Bonds for the period between 2009 and 2018

4.5.3.3 12-Year Bond

Figure 4.22 below shows the graph 12 years bond had irregular patterns all through the ten-year period. From 2009 to 2011 the curve ascended at high rate an indication of more traded and issued bonds. This could be attributed to bond trading automation, which occurred in 2009 hence easing

the trading exercise. There was irregular pattern from 2012 to 2018. During this period the curve descended. This is an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. The study used 1931 treasury bonds traded value observations for the 12-Years government bonds. The Kenya 12 Years Government Bond reached a maximum of 9.5% and a minimum of 0. The figure below shows the turnover rate for the 12-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.3% and the median was 0.2%.

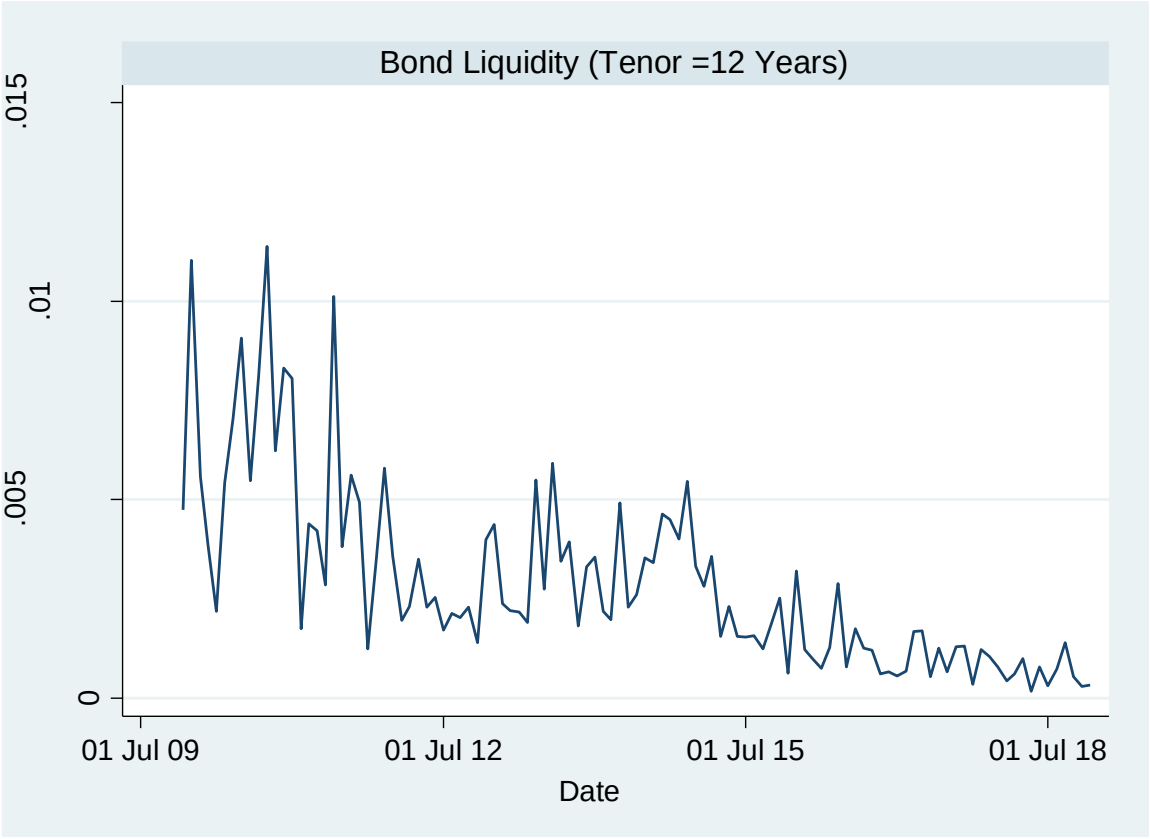


Figure 4. 22: Bond liquidity of the 12-Year Bonds for the period between 2009 and 2018

4.5.3.4 15-Year Bond

Figure 4.23 below shows the graph 15 years bond had irregular patterns all through the ten-year period. From 2009 to 2011 the curve ascended steadily an indication of more traded and issued bonds. This could be attributed to bond trading automation, which occurred in 2009 hence easing the trading exercise. There was irregular pattern from 2011 to 2017, from 2017 to 2018 the curve started ascending at an increasing rate. This is an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. The study used 1777 treasury bonds traded value observations for the 15-Years government bonds. The Kenya 15 Years Government Bond reached a maximum of 9.5% and a minimum of 0. The figure below shows the turnover rate for the 15-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.5% and the median was 0.3%.

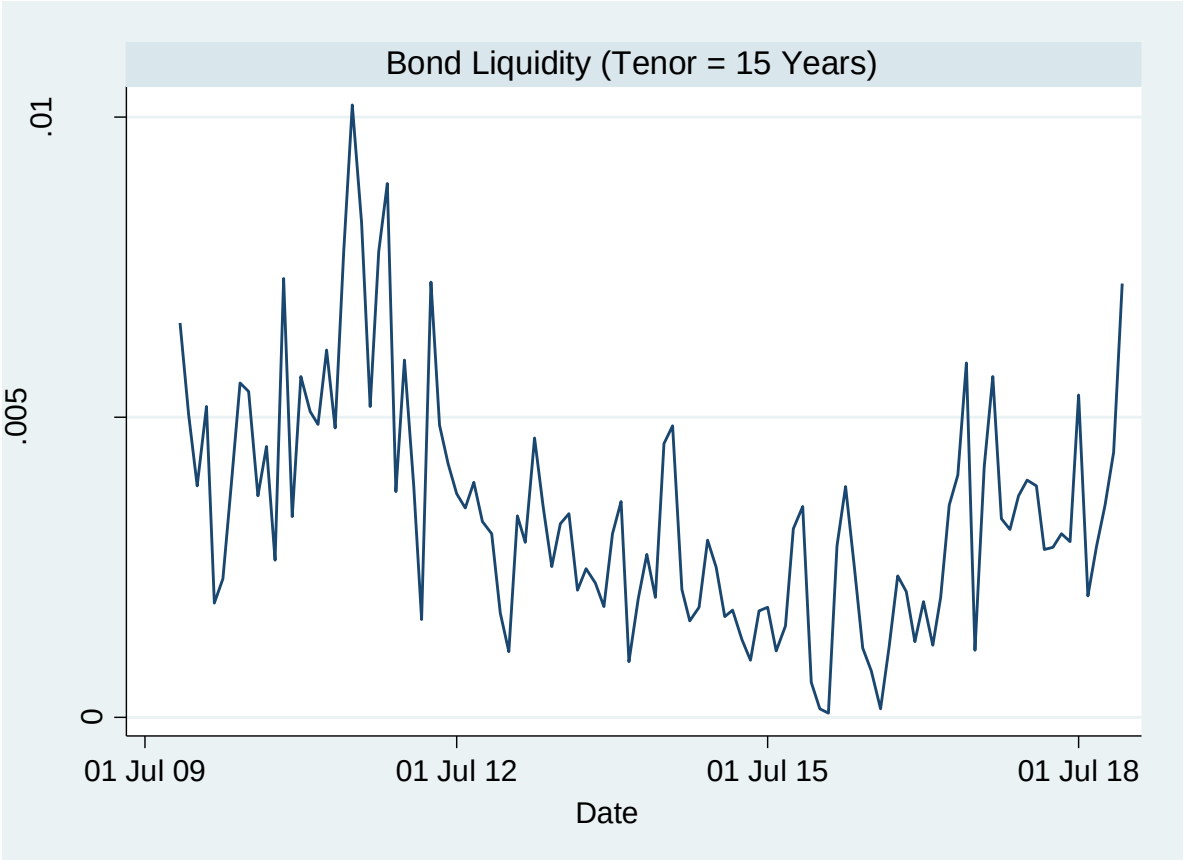


Figure 4. 23: Bond liquidity of the 15-Year Bonds for the period between 2009 and 2018

4.5.3.5 20-Year Bond

Figure 4.24 below shows the graph 20 years bond had irregular patterns all through the ten-year period. From 2009 to 2011 the curve ascended at high rate an indication of more traded and issued bonds. This could be attributed to bond trading automation, which occurred in 2009 hence easing the trading exercise. There was irregular pattern from 2012 to 2018. During this period the curve descended. This was an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. From 2017 to 2018, the curve ascended, a clear indication of increased traded and issued bonds. The study used 1268 treasury bonds traded

value observations for the 20-Years government bonds. The Kenya 20 Years Government Bond reached a maximum of 5.7% and a minimum of 0. The figure below shows the turnover rate for the 20-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.3% and the median was 0.2%.

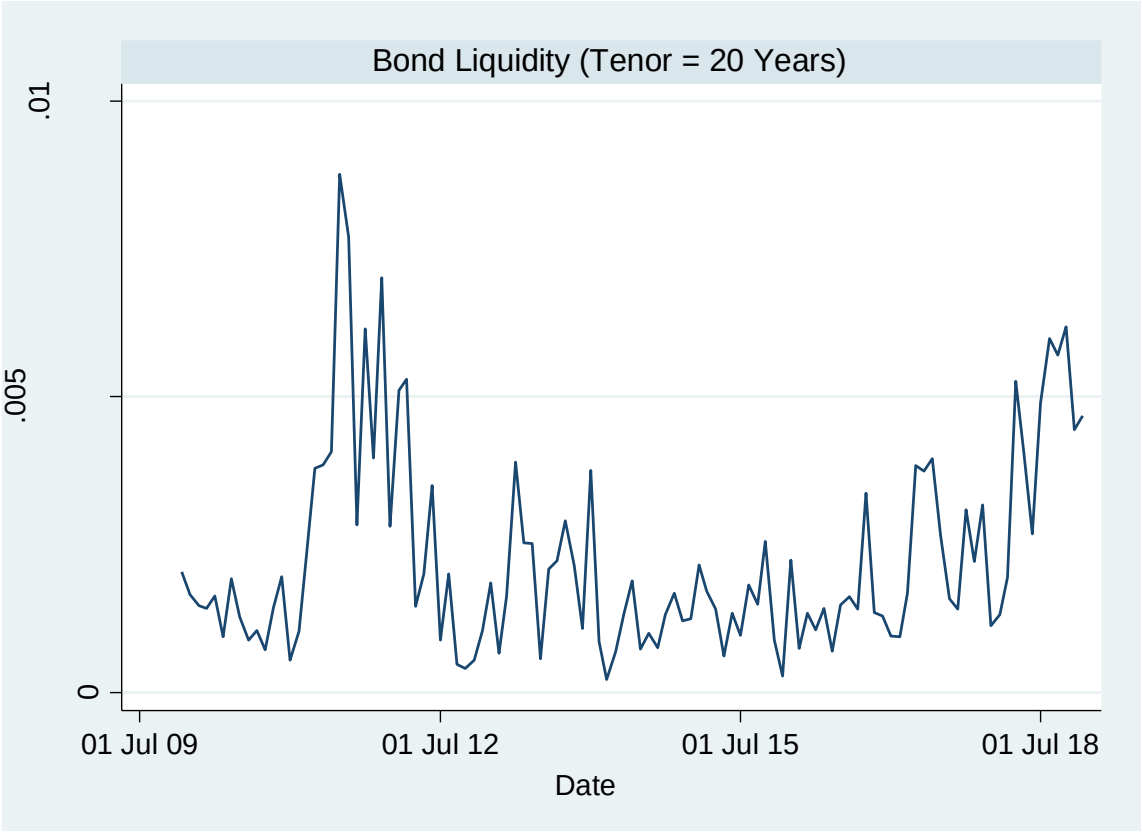


Figure 4. 24: Bond liquidity of the 20-Year Bonds for the period between 2009 and 2018

4.5.3.6 25-Year Bond

Figure 4.25 below shows the graph 25 years bond had irregular patterns all through the ten-year period. From 2010 to 2011 the curve ascended at high rate an indication of more traded and issued bonds. This could be attributed to bond trading automation, which occurred in 2009 hence easing

the trading exercise. There was irregular pattern from 2012 to 2018. During this period the curve descended. This is an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. The study used 263 treasury bonds traded value observations for the 25-Years government bonds. The Kenya 25 Years Government Bond reached a maximum of 4.0% and a minimum of 0. The figure below shows the turnover rate for the 25-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.5% and the median was 0.2%.

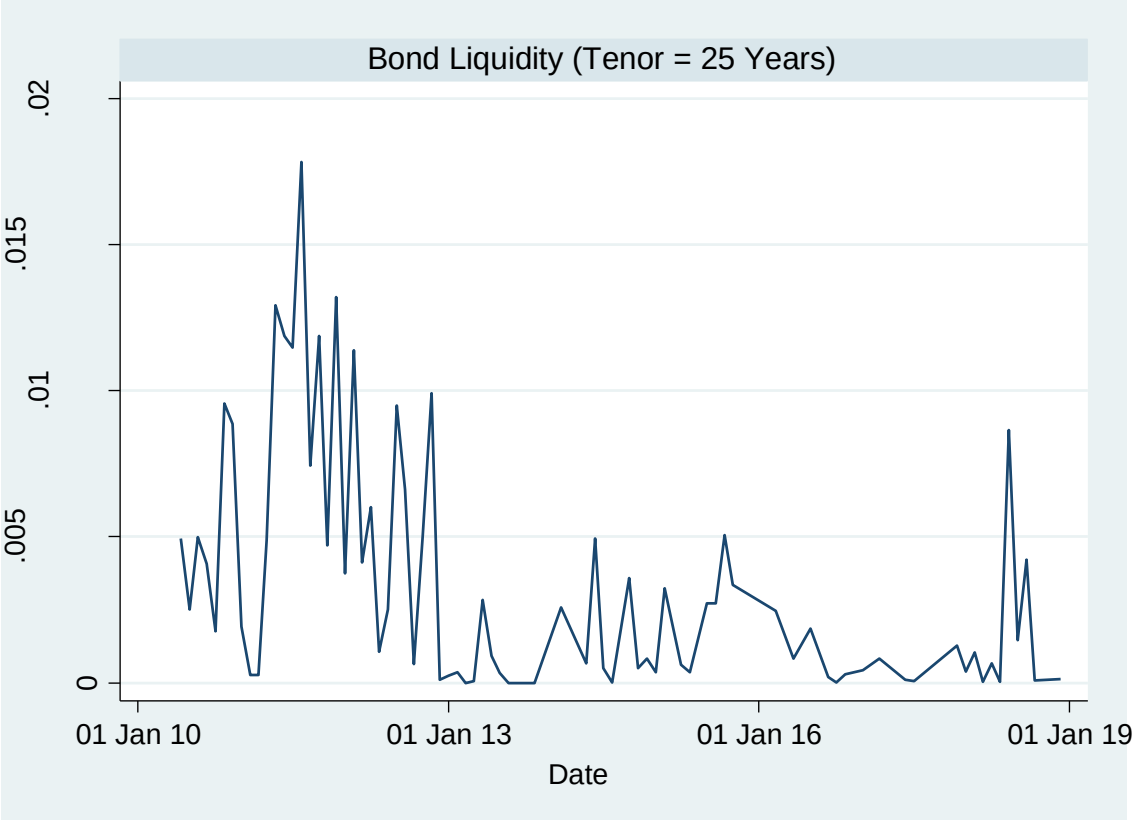


Figure 4. 25: Bond liquidity of the 25-Year Bonds for the period between 2009 and 2018

4.5.3.7 30-Year Bond

Figure 4.26 below shows the graph 30 years bond had irregular patterns all through the ten-year period. There was irregular pattern from 2009 to 2018. This was an indication that the bonds traded and issued were not steady over the study period. This could be attributed to the forces of the market. The study used 557 treasury bonds traded value observations for the 30-Years government bonds. The Kenya 30 Years Government Bond reached a maximum of 2.1% and a minimum of 0. The figure below shows the turnover rate for the 30-year bonds for the period between January 2009 and December 2018. The average turnover rate was 0.1% and the median was 0.

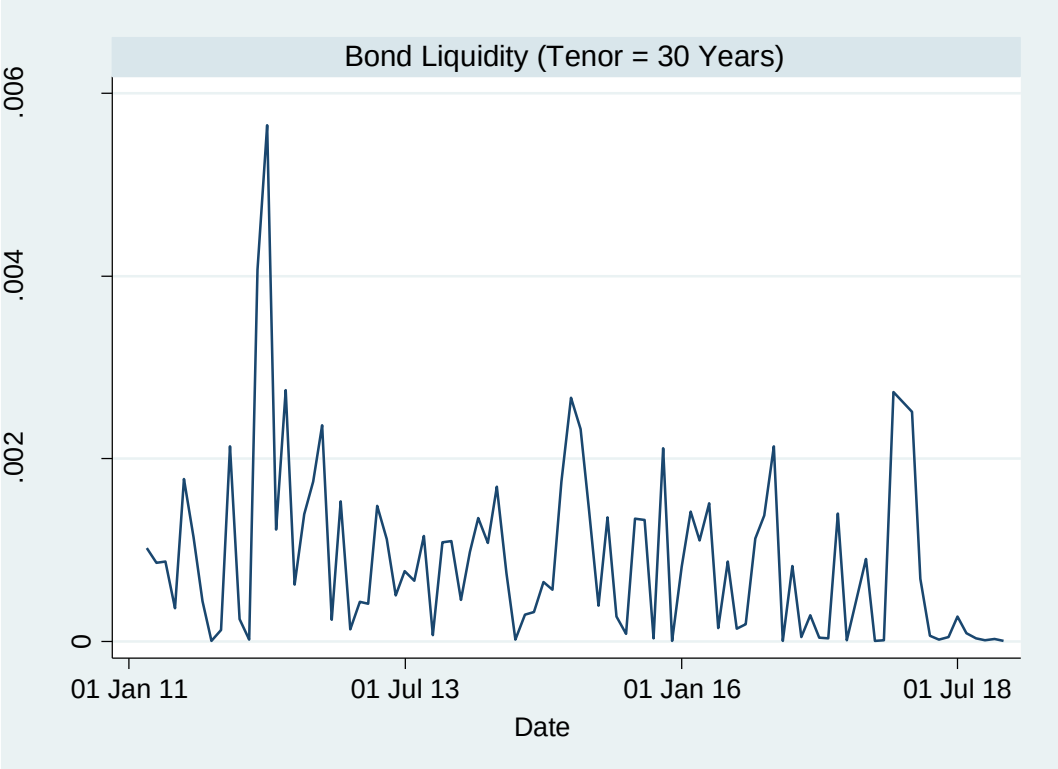


Figure 4. 26: Bond liquidity of the 30-Year Bonds for the period between 2009 and 2018

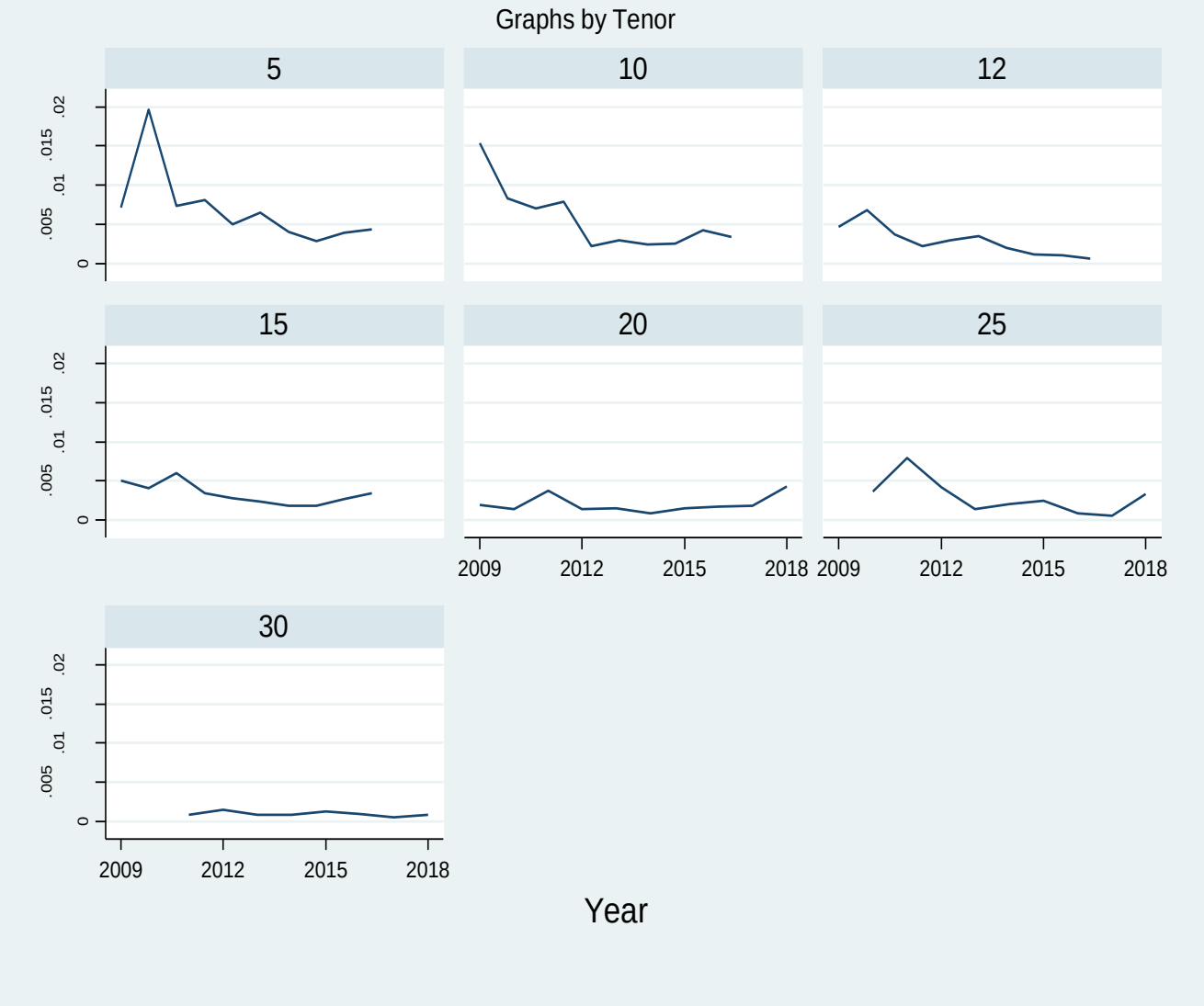


Figure 4. 27: Graphs By Tenor-Bond Liquidity

4.5.4 Order Flow

In order to capture the behavior of order flow over the study period the order imbalance was calculated. Order imbalance was the traded volume or the face value that was the quantity traded and matched price of buy and sell (Lyons & Evans 2001; Lee & Ready, 1991; Chordia, Roll & Subrahmanyam, 2001; Hasbrouck & Seppi, 2001). Daily, Weekly and Monthly average spread

was be computed for each bond tenure and then equally weighted across different bonds tenures for each month. The graphs of 5, 10, 12, 15, 20, 25 and 30-year Kenyan treasury bonds issued between 2009 and 2018 shown below.

4.5.4.1 5-Year Bond

Figure 4.28 below shows the graph 5 years bond had irregular patterns all through the ten-year period. There was irregular pattern from 2009 to 2018. This is an indication that the face value of the traded bonds were not steady over the study period. This could be attributed to the forces of the market and macro-economic factors such as inflation, interest rates, forex exchange, government borrowing. The study used 1668 treasury bonds traded value observations for the 5-Years government bonds. The Kenya 5 Years Government Bond reached a maximum of 10% and a minimum of 0.05. The figure below shows the bond face value for the 5-year bonds for the period between January 2009 and December 2018. The average order imbalance was 113.51 and the median was 91.37.

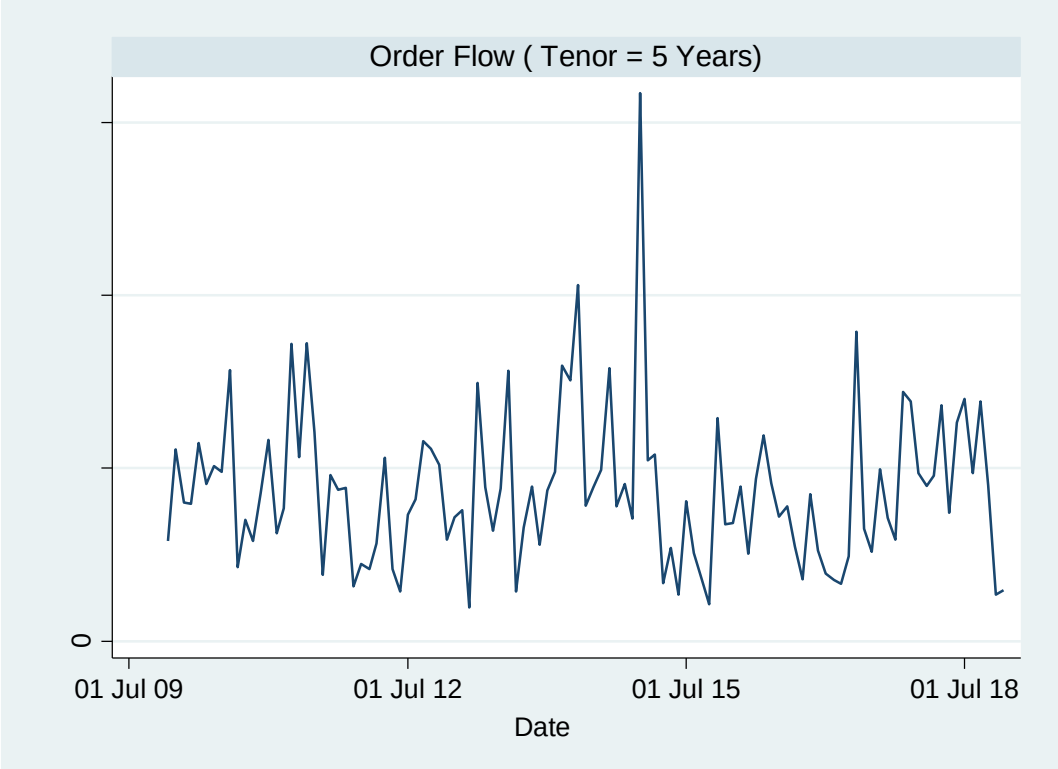


Figure 4. 28: Order Flow of the 5-Year Bonds for the period between 2009 and 2018

4.5.4.2 10-Year Bond

Figure 4.29 below shows the graph 10 years bond had irregular patterns all through the ten-year period. There was irregular pattern from 2009 to 2018. This was an indication that the face value of the traded bonds were not steady over the study period. This could be attributed to the forces of the market and macro-economic factors such as inflation, interest rates, forex exchange, government borrowing. The study used 1798 treasury bonds traded value observations for the 10-Years government bonds. The Kenya 10 Years Government Bond reached a maximum of 10% and a minimum of 0.05. The figure below shows the bond face value for the 10-year bonds for the period between January 2009 and December 2018. The average order imbalance was 101.33 and the median was 90.40.

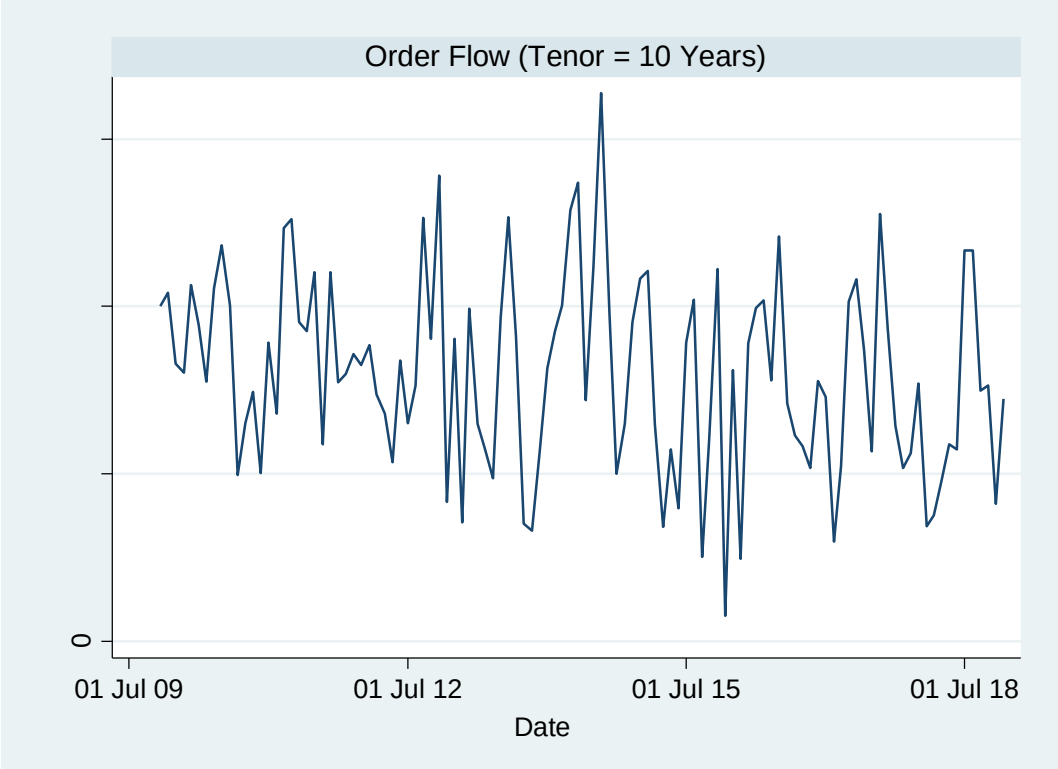


Figure 4. 29: Order Flow of the 10-Year Bonds for the period between 2009 and 2018

4.5.4.3 15-Year Bond

Figure 4.30 below shows the graph 10 years bond had irregular patterns all through the ten-year period. There was irregular pattern from 2009 to 2018. This was an indication that the face value of the traded bonds were not steady over the study period. This could be attributed to the forces of the market and macro-economic factors such as inflation, interest rates, forex exchange, government borrowing. In 2014 and 2016 the curve ascends at high rate a clear indication that the market was busy over this period. The study used 1777 treasury bonds traded value observations for the 15-Years government bonds. The Kenya 15 Years Government Bond reached a maximum of 8% and a minimum of 0.05. The figure below shows the bond face value for the 15-year bonds

for the period between January 2009 and December 2018. The average order imbalance was 94.75 and the median was 78.78.

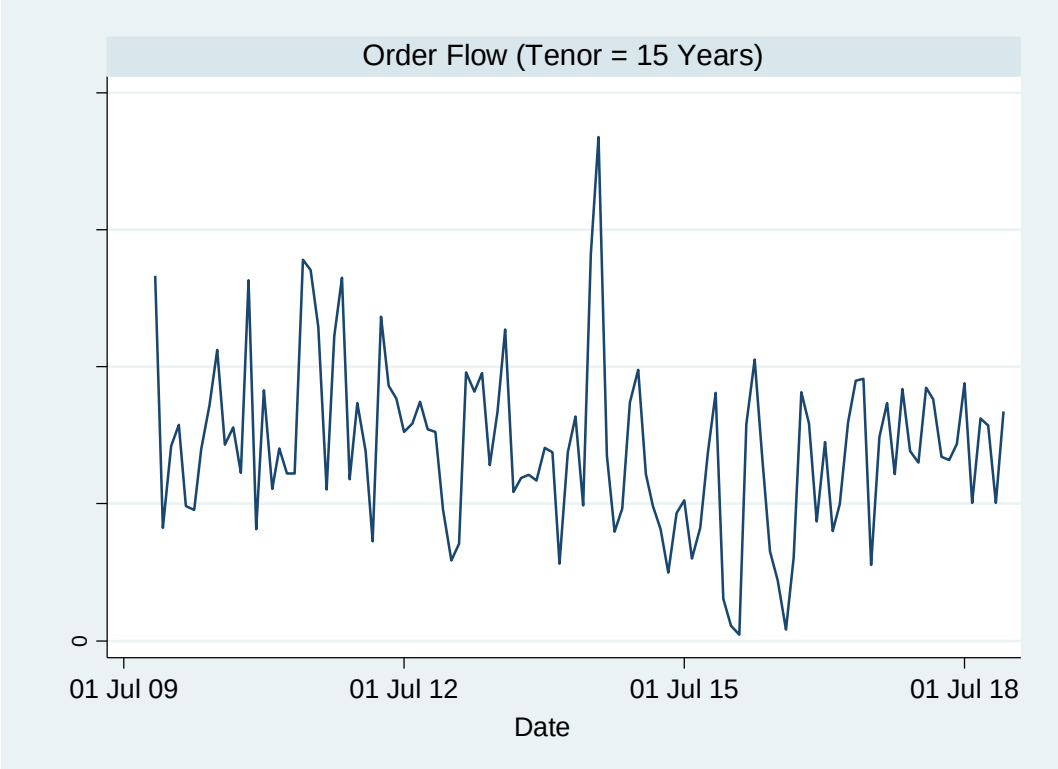


Figure 4. 30: Order Flow of the 15-Year Bonds for the period between 2009 and 2018

4.5.4.4 20-Year Bond

Figure 4.31 below shows the graph 20 years bond had irregular patterns all through the ten-year period. There was irregular pattern from 2009 to 2018. This was an indication that the face value of the traded bonds were not steady over the study period. This could be attributed to the forces of the market and macro-economic factors such as inflation, interest rates, forex exchange, government borrowing. In 2011, 2014 and 2017 the curve ascended at high rate a clear indication

that the market was busy over this period. The study used 1268 treasury bonds traded value observations for the 20-Years government bonds. The Kenya 20 Years Government Bond reached a maximum of 6% and a minimum of 0.05. The figure below shows the bond face value for the 20-year bonds for the period between January 2009 and December 2018. The average order imbalance was 82.71 and the median was 66.67.

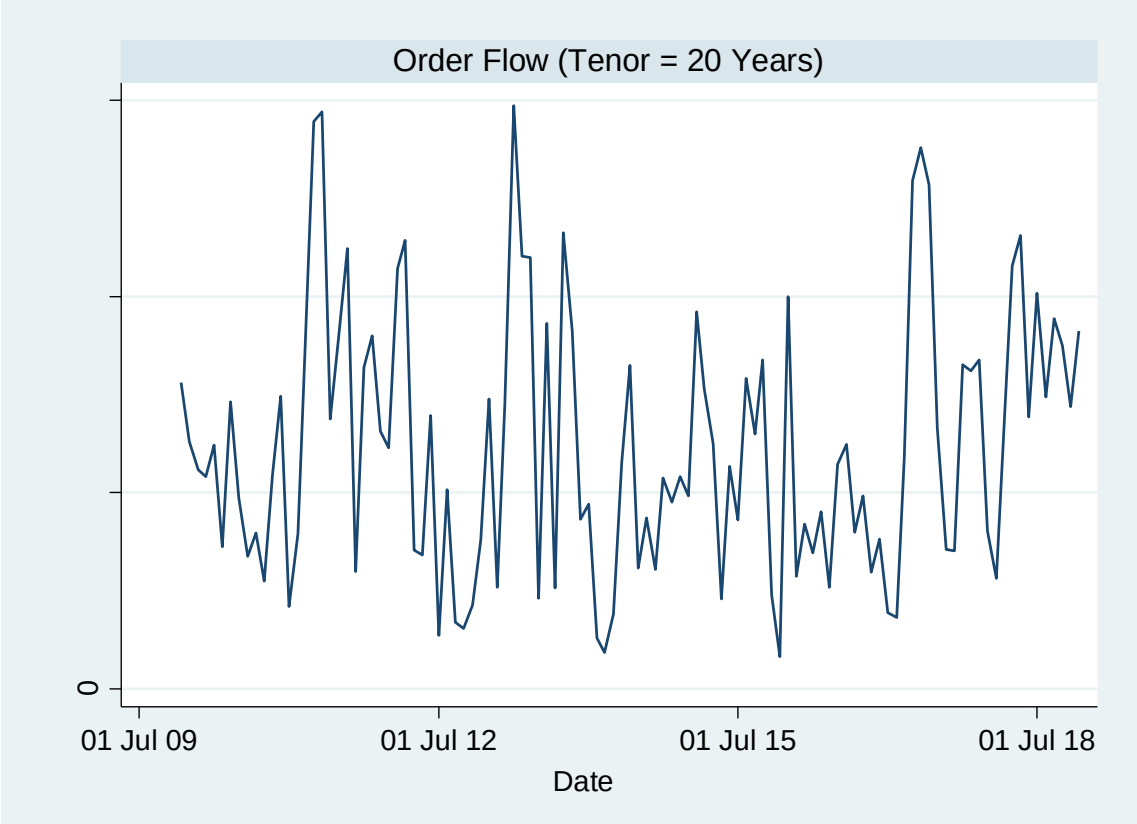


Figure 4. 31: Order Flow of the 20-Year Bonds for the period between 2009 and 2018

4.5.4.5 25-Year Bond

Figure 4.32 below shows the graph 25 years bond had irregular patterns all through the ten-year period. Between 2010 and 2013, the curve inclines as high rate an indication of more trading.

Thereafter from 2013 to 2018, the curve declines and remains almost flat the whole period. This was an indication that the face value of the traded bonds were not steady over the study period. The study used 263 treasury bonds traded value observations for the 25-Years government bonds. The Kenya 25 Years Government Bond reached a maximum of 8% and a minimum of 0.05. The figure below shows the bond face value for the 25-year bonds for the period between January 2009 and December 2018. The average order imbalance was 98.66 and the median was 50.00.

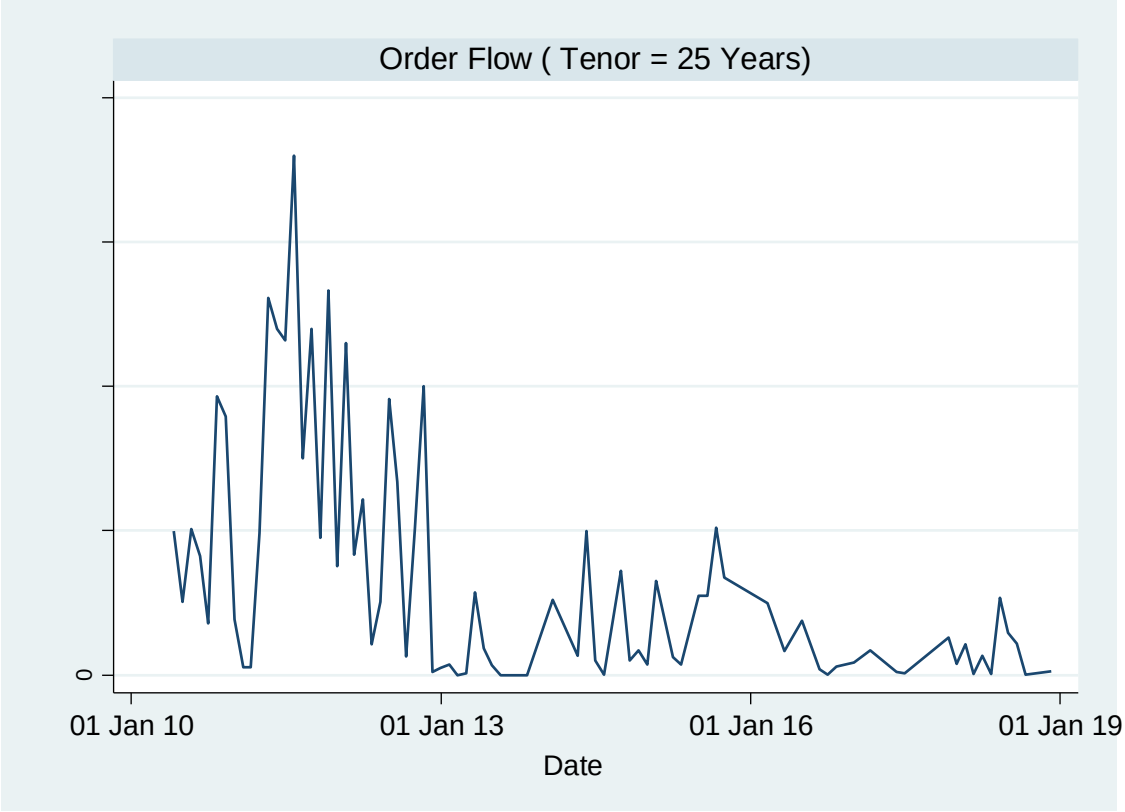


Figure 4. 32: Order Flow of the 25-Year Bonds for the period between 2009 and 2018

4.5.4.6 30-Year Bond

Figure 4.33 below shows the graph 30 years bond had irregular patterns all through the ten-year period. In 2012, 2015 and 2017 it was observed that the curve had long humps in these years an

indication of active trading. The study used 557 treasury bonds traded value observations for the 30-Years government bonds. The Kenya 30 Years Government Bond reached a maximum of 10% and a minimum of 0.05. The figure below shows the bond face value for the 30-year bonds for the period between January 2009 and December 2018. The average order imbalance was 115.51 and the median was 91.37.

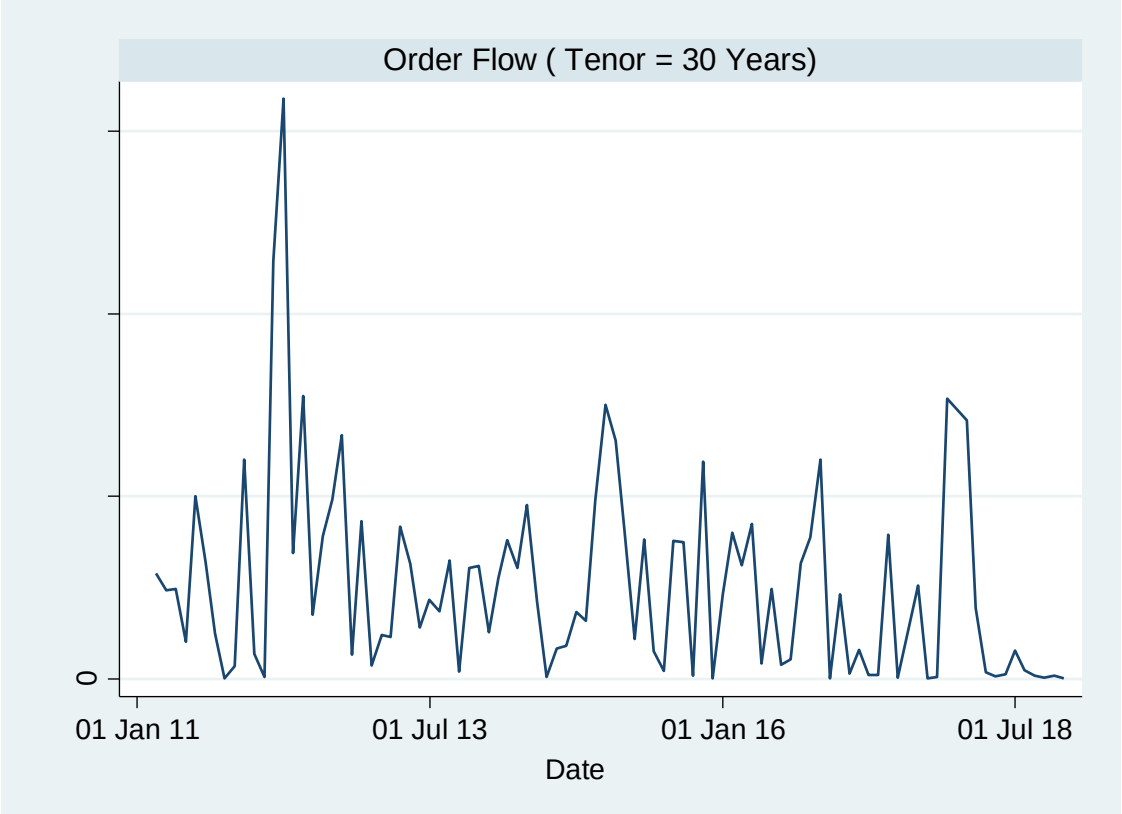


Figure 4. 33: Order Flow of the 30-Year Bonds for the period between 2009 and 2018

4.6 Panel Data Diagnostic tests

Diagnostic tests were performed prior to undertaking inferential statistics to test the hypothesized relationships. The tests were to verify if the panel data meet the basic linear regression requirements. The tests undertaken were multicollinearity test, panel unit root test, normality test, heteroscedasticity test, linearity test and serial correlation test. If any violation of these basic requirements were detected, necessary corrective measures were applied.

4.6.1 Tests of Normality

One of the assumptions for most parametric tests to be reliable is that the data is approximately normally distributed (Cooper & Schindler, 2006). Violation of this requirement may lead to inaccurate hypothesis tests due exaggerated test statistics. The two well-known tests of normality, namely, the Kolmogorov–Smirnov test and the Shapiro–Wilk test are most widely used methods to test the normality of the data. The Shapiro–Wilk test is more appropriate method for small sample sizes (<50 samples) although it can also be handling on larger sample size while Kolmogorov–Smirnov test is used for $n \geq 50$. For this reason, Kolmogorov–Smirnov test was used for assessing normality. If the p-value is smaller than the significance level of 0.05 the null hypothesis is rejected. In table 4.11 tests of normality for Bond Liquidity, Information Efficiency, Bond Yields and Order Flow indicated highly significant values ($p<0.05$), an indication that the data does not fit a normal distribution.

Table 4. 11: Tests of Normality

Variables	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Bond Liquidity	.273	9262	.000
Information Efficiency	.264	9262	.000
Bond Yields	.119	9262	.000
Order Flow	.171	9262	.000

Source: Research Data 2022

However, for the data which did not fit the normal distribution called for further test and analysis on normality.

4.6.1.1.Non Normality Tests

Data set were modelled to show a normal distribution as per the linear regression standards. Histograms and Shapiro-Wilk and Q-Q plots used to correct the anomalies. Normality existed where p was greater than 0.05 but did not exits where p was less than 0.05, meaning the data contained extreme values (outliers).

4.6.1.2. Outliers

The figures shown the presence of outliers. The presence of outliers did not affect the general outlook of the analysis and therefore the outliers were excluded from the data. The outliers excluded and detected by STATA, a statistical software adopted during the data analysis and thus

normality applied. Kolmogorov-Smirnov and Shapiro- Wilk are very sensitive to outliers and that could have been the possible explanation of the significant generated results.

4.6.1.3. Data Transformation

To address non-normality for study variables, data transformed using an appropriate function, forcing it to fit normal distribution. Table 4.12 presents the results of data transformation.

Table 4. 12: Data Transformation

Variable	**Data Transformation**
Bond Liquidity	Log transformation
Information Efficiency	Log transformation
Bond Yields	Log transformation
Order Flow	Log transformation

Source: Research Data (2022)

4.6.1.4 Central Limit Theorem

Since, for this thesis, the goal was to use parametric tests, it was assumed that the central limit theorem applied. Central limit theorem states that no matter what the distribution of the population is, the shape of the sampling distribution will approach normality as the sample size (N) increases. Therefore, as the sample size in this study is somehow large (N = 9262), asymptotic normality is accepted, although the power of the model is greatly diminished (Wooldridge, 2010).

4.6.2. Autocorrelation Test

In linear panel data models, serial correlation, also known as autocorrelation, causes the regression coefficient estimates to be consistent but inefficient and may result in an underestimating of the standard errors, rendering hypothesis testing invalid (Wooldridge, 2010). In this study, the Wooldridge test for autocorrelation in panel data was used in order to detect the presence of this phenomenon. Violation of this assumption was addressed by using the Newey-West estimator according to individual hypothesis.

A significant test statistic indicated the presence of serial correlation. Based on the results of Wooldridge test below we accepted the null hypothesis and concluded that there is no problem of autocorrelation.

Table 4. 13: Wooldridge test for autocorrelation

Test statistic	Prob > F
4.627	0.0750

Null Hypothesis: There is no serial correlation

4.6.3. Heteroscedasticity test

In linear regression models, heteroscedasticity refers to situations where the variance of the residuals is unequal over a range of measured values (Albright, Zape, & Winston, 2011). Heteroscedasticity is a problem because ordinary least squares (OLS) regression assumes that all residuals are drawn from a population that has a constant variance (homoscedasticity). In this study, Breusch Pagan test was used to test for heteroskedasticity in the regression models. This

test assumes that the error terms are normally distributed. It tests whether the variance of the errors from a regression is dependent on the values of the independent variables.

Table 4. 14: Breusch-Pagan test

chi2(1)	p-value
690.91	0.0000

The null hypothesis is homoskedasticity (or constant variance).

P-value <0.05 which was statistically significant and therefore we reject the null hypothesis and accept the alternative hypothesis. Therefore, the dataset has heteroskedastic variances. To correct this violation during model estimation, we used the option 'robust' to obtain heteroskedasticity-robust standard errors. "Robust" standard errors is a technique to obtain unbiased standard errors of OLS coefficients under heteroscedasticity. Remember, the presence of heteroscedasticity violates the Gauss Markov assumptions that are necessary to render OLS the best linear unbiased estimator.

4.6.4. Multicollinearity Test.

Multicollinearity occurs when independent variables are highly correlated. This leads to problem of understanding which independent variable contributes to the variance explained in the independent variable, as well as technical issues in calculating a multiple regression model. To test the assumption of multicollinearity, VIF and tolerance indices were used. A value of VIF >10 and tolerance scores below 0.2 indicate multicollinearity is present and the assumption is violated

(Albright, Zape & Winston, 2011). Table 4.15 below shows the outcome of the test for multicollinearity. The values of VIF are less than 10 an indication the problem of multicollinearity is not present. Similarly, tolerance values are more than 0.2. Therefore regression analysis could be carried out.

Table 4. 15: Results of Multicollinearity Test (Mean VIF 1.43)

Variable	VIF	Tolerance
Order Flow	1.65	0.605371
Bond Liquidity	1.64	0.608659
Information Efficiency	1.01	0.990905

Source: Researcher Data (2021)

4.6.5. Stationarity Tests

To determine the stationarity of the data, Augmented Dickey–Fuller unit root test was used because it works well with an unbalanced panel data (Cooper & Schindler, 2006). The test was evaluated against their associated p-values at the conventional 5 percent Statistical level of significance. The null hypothesis of this test is that all panels contain a unit root and the alternative hypothesis is at least one panel is stationary.

As shown in the table below, results of the inverse normal Z statistic strongly reject the null hypothesis that all the panels contain unit roots. We conclude that the data is stationary for Bond Yields, Order Flow, Information Efficiency and Bond Liquidity study variables at level. The p-values are less than 0.05.

Table 4. 16: Panel Unit Root Test Results

Variable	Inverse normal Z statistic	p-value
Bond Yields	-18.1221	0.0000
Order Flow	-19.1863	0.0000
Information Efficiency	-20.6353	0.0000
Bond Liquidity	-18.9634	0.0000

Source: Research Data (2022)

4.6.6. Linearity Test

Linearity test aims to determine whether the relationship between the dependent variable and the independent variables is linear or not. The ANOVA test of linearity was used to determine the linearity of the relationships between the dependent and independent variables. The test calculates both the linear and nonlinear components of two variables. Nonlinearity was considered significant if the calculated F-value for the nonlinear components was less than 0.05.

Table 4.17 below shows tests for the linear, nonlinear, and combined relationship between the dependent variable (Bond Yields) and Order Flow, Bond Liquidity and Information Efficiency. The linearity test had a significant value between Bond Yields and Order Flow ($p<0.05$), an indication that there was linear relationship between the dependent variable (Bond Yields) and Order Flow (moderating variable). The test for deviation from linearity had a non-significant value ($p>0.05$).

The linearity test between Bond Yields (dependent variable) and Bond Liquidity (independent variable) had a significant value ($p<0.05$), an indication that the two variables had a linear relationship. The test for deviation from linearity had a significant value also which meant that there was a nonlinear relationship in addition to the linear component.

Table 4. 17: Test of Linearity (Dependent Variable: Bond Yields)

			Sum of Squares	df	Mean Square	F	Sig.
Bond Yields * Order Flow	Between Groups	(Combined)	26204.824	4213	6.220	1.048	.054
		Linearity	1405.928	1	1405.928	236.989	.000
		Deviation from Linearity	24798.896	4212	5.888	.992	.601
	Within Groups		29947.069	5048	5.932		
	Total		56151.893	9261			
Bond Yields * Bond Liquidity	Between Groups	(Combined)	22907.156	1686	13.587	3.096	.000
		Linearity	5530.483	1	5530.483	1260.152	.000
		Deviation from Linearity	17376.673	1685	10.313	2.350	.000
	Within Groups		33244.737	7575	4.389		
	Total		56151.893	9261			
Bond Yields * Information Efficiency	Between Groups	(Combined)	51197.877	8138	6.291	1.426	.000
		Linearity	3555.432	1	3555.432	805.962	.000
		Deviation from Linearity	47642.445	8137	5.855	1.327	.000
	Within Groups		4954.016	1123	4.411		
	Total		56151.893	9261			

Source: Researcher Data (2022)

The linearity test between Bond Yields (dependent variable) and Information Efficiency (moderating variable) had a significant value ($p<0.05$), an indication that the two variables had a linear relationship. The test for deviation from linearity had a significant value also which meant that there was a nonlinear relationship in addition to the linear component.

4.7 Correlation Analysis

Correlation analysis was used to quantify the association between the dependent variable, independent variable and the Moderating variables. Pearson Product Moment correlation is a bivariate analysis technique that measures the strength of association between two variables and the direction of the relationship. In correlation analysis, Correlation coefficients are used to measure the strength of the linear relationship between two variables. A correlation coefficient greater than zero indicates a positive relationship while a value less than zero signifies a negative relationship. A value of zero indicates no relationship between the two variables being compared. In terms of the strength of relationship, the value of the correlation coefficient varies between +1 and -1.

4.7.1 Pearson Product Moment correlation coefficient

Table 4.18 below was used for the interpretation of the strength of the bivariate relationships using Pearson Product Moment correlation coefficient (Cohen 1988).

Table 4. 18: Interpretation of the strength for the Pearson Correlation Coefficient

Size of Correlation	Interpretation
.90 to 1.00 (−.90 to −1.00)	Very high positive (negative) correlation
.70 to .90 (−.70 to −.90)	High positive (negative) correlation
.50 to .70 (−.50 to −.70)	Moderate positive (negative) correlation
.30 to .50 (−.30 to −.50)	Low positive (negative) correlation
.00 to .30 (.00 to −.30)	Very low positive (Negative) Correlation

Source: Research (2021)

4.7.1.1 Bivariate Correlation between Bond Yields, Information Efficiency, Order Flow and Bond Liquidity

Table 4.19 below provides summary of pairwise coefficient of Correlations between Bond Yields, Information Efficiency, Order Flow and Bond Liquidity. Results of this study indicated that there was a very low positive correlation between Bond Yields of treasury bonds in Kenya and Information efficiency (moderating variable) which was statistically significant (r = .256, p<0.01). This implied that increased information efficiency was associated with better bond yields of treasury bonds in Kenya. The results of this study also found a low negative correlation between Bond Yields and Bond Liquidity (r = -.328, p<0.01) which was statistically significant. This was an indication that Bond Liquidity had a significant impact on Bond Yields of treasury bonds in Kenya.

Table 4. 19: Pearson Product-Moment Correlation between Bond Yields, Information Efficiency, Bond Liquidity and Order Flow

Variables	Bond Yields	Information Efficiency	Bond Liquidity	Order Flow
Bond Yields	1	.256**	-.328**	-.229**
Information Efficiency		1	-.061**	-.124**
Bond Liquidity			1	.564**
Order Flow				1

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research Data (2022)

Similarly, the relationship between Bond Yields and Order Flow was negative and statistically significant (r = -.229, p<0.01). This was an indication that order flow had significant impact on Bond Yields of treasury bonds in Kenya.

In addition there was a very low negative correlation between information efficiency of treasury bonds in Kenya and bond liquidity (independent variable) which was statistically significant (r = -.061, p<0.01). This was an indication that treasury bonds with high information efficiency tend to have less bond liquidity.

The relationship between information efficiency and order flow was negative, low and statistically significant (r = -.124, p<0.01). Furthermore, the relationship between bond liquidity and order

flow was positive and statistically significant (r = .564, p<0.01). This implies that the growth of order flow is associated with increased bond liquidity.

4.8 Analysis of Statistical Models for Testing Hypothesis

The data analyzed as per the hypothesis of the study, this was conducting diagnostic test on panel data and correcting important areas to remedy violations of the cardinal ordinary least square requirements.

This study sought to determine the effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. The panel data was unbalanced and it covered 7 treasury bonds over 10 year's period.

4.8.1 Panel Data Regression Analysis

There are several estimation methods in panel data analysis. The most frequently used panel data models are fixed effects model and random effects model and pooled OLS model (Saragih, Raya, & Hendrawan, 2021; Li & Leung, 2021). The pooled OLS model that does not use panel information. Sometimes pooled OLS model would give inconsistent estimates when inappropriately used or when appropriate model to be used was either FEM or REM (Li & Leung, 2021). REM is preferred to FEM since it gives best linear unbiased estimates (Hunter, & Schmidt, 1990), unlike FEM that results to inconsistent estimates (Griffiths, Hill, & Lim, 2012).

4.8.1.1 Hausman Specification test

Hausman specification test was used to check the suitably of fixed or random effect for the study dataset (Saragih, Raya, & Hendrawan, 2021). This involves estimating both models in particular order, starting with Fixed Effects Model (FEM) against the alternative hypothesis. Random Effects Model (REM) is appropriate at 5% confidence level. Based on the results of Huasman test the null hypothesis is accepted or rejected. The null hypothesis (H_O) is that the preferred model is random effects vs. the alternative the fixed effects (Saragih, Raya, & Hendrawan, 2021). It tests whether the unique errors (u_i) are correlated with the regressors, the null hypothesis is they are not

.

Table 4. 20: Hausman Test – RE or FE model

P-value	**Preferred Model**
p>0.05	REM
P<0.05	FEM

Source: Researcher (2022)

H_O: The appropriate model is the RE

H_1: The appropriate model is the FE

4.8.1.2 Breusch-Pagan Lagrange multiplier (LM)

The Breusch-Pagan Lagrange multiplier test was used to select between a random effects regression and a simple OLS regression. The null hypothesis in the LM test was that variances

across entities was zero, that is, there was no significant difference across units (i.e. no panel effect). Depending on the significance of the LM test, if result:

Table 4. 21: LM Test

P-value	**The Most Appropriate Model**
p>0.05	OLS
P<0.05	REM

Source: Researcher (2022)

H0: Select Simple OLS Regression (p> 0.05)

H1: Select REM (p <0.05)

4.9. Statistical Approaches for Choosing the Most Appropriate Model for Testing each Hypothesis.

This area focused on the approaches used in choosing he most appropriate models for testing the hypothesis under study from among the estimation models used in the panel data analysis.

4.9.1 Relationship between Bond Liquidity and Bond Yields of Treasury bonds in Kenya

The first objective of the study was to determine the effect of bond liquidity on bond yields of treasury bonds in Kenya. The following hypothesized relationship was tested;

H_{01}: There is no significant effect of bond liquidity on bond yields of treasury bonds in Kenya.

4. 9.1.1 Diagnostic Tests

The diagnostic tests undertaken in this section were done to select the most appropriate model to be used in each hypothesis if this study.

4.9.1.1.1 Hausman Specification Test

To decide between fixed or random effects, hausman specification test was used where the null hypothesis was the preferred model was random effects vs. the alternative the fixed effects (Green, 2008). Table 4.22 below shows the results of Hausman test. If the p values are greater than 0.05, we accept the $H_{0,}$ meaning that the appropriate model is the RE (Li & Leung 2021). If the $p<0.05$, we accept the $H_{1,}$ implying that the most Appropriate model is the FE (Laureti, Costantiello, & Leogrande, 2022). Since p-value<0.05, Fixed effects model will be used.

Table 4. 22: Hausman Test to Choose Fixed or Random Effect

Chi-square statistic	P-Value
9.42	0.0021

Source: Research Data (2022)

Null Hypothesis: The appropriate model is Random effects.

Alternative Hypothesis: The appropriate model is fixed effects.

From the results from table 4.22 indicated that p less than 0.05. For this reason, we rejected the null hypothesis and, therefore the fixed effect model was chosen to be the most appropriate.

4.9.2 Relationship between Bond Liquidity, Order Flow and Bond Yields of treasury Bonds in Kenya

The second objective of the study was to investigate the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Panel regression analysis was used to test the hypothesized relationship. The flowing hypothesis was tested.

H_{02}: There is no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

4.9.2.1 Regression Models

The moderating effect Regression model of bond yields (dependent variable): Bond liquidity independent variable and order flow the moderator. The table below presents the moderating effect of order flow on Bond liquidity and bond yields.

Table 4. 23: Moderating effect estimation models - Dependent Variable: Bond Yields, Independent Variable: Bond Liquidity and Order flow (moderator)

Model	Bond Liquidity (Predictor/IV)	Order Flow (Moderator)	Interaction Term
Model 2a	BL	OF	-
Model 2b	BL	OF	BL*OF

Source: Research Data (2022)

The moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and Kenny (1986). Baron and Kenny (1986) discussed the steps for testing moderating effect as follows.

Step1: In the Baron and Kenny (1986) approach for testing moderation, the independent variable is presumed to cause the dependent variable. As shown in table 4.23, Bond liquidity (independent variable) is a significant predictor of Bond yields (dependent variable)

Step2: Estimate the relationship between dependent variable, moderator and independent variable (model 2a) using panel regression analysis as guided by Hausman test. The model should be statistically significant.

Step 3: An interaction term is computed by multiplying centered independent variable and centered moderator. Centering is achieved by subtracting mean from a variable. Estimate the relationship between dependent variable, independent variable, the moderator and the interaction term (model 2b) to determine and check whether the moderator variable alters the strength of the causal relationship.

4.9.2.1.1 Moderation Analysis Estimation Models

Table 4.24 presents the moderating effect of order flow.

Table 4. 24: Moderating effect estimation models - Dependent Variable: Bond Yields, Independent Variable: Bond Liquidity and order flow (moderator)

Model	Bond Liquidity (Predictor/IV)	Order Flow (Moderator)	Interaction Term
Model 2a	BL	OF	-
Model 2b	BL	OF	BL*OF

Source: Research Data (2022)

Where

BL is Bond liquidity measured by turnover rate

OF is order flow measured by traded volume

4.9.2.2 Dignostic Test

The related presumption of this statistical analyses were tested. In this section only the Hausman specification test was tested beacause other diagnostic test had been performed.

4.9.2.2.1 Hausman Specification Test

To decide between fixed or random effects, hausman test was used where the null hypothesis is that the preferred model is random effects vs. the alternative the fixed effects (Green, 2008). Table 4.24 below shows the results of Hausman test. Since p-value<0.05, Fixed effects model was

preferred (model 2a). Hausman test howevers indicated that in step 2 of moderation analysis (model 2b), Random effects model was preferred (p>0.05) as shown in Table 4.25 below.

Table 4. 25: Hausman Test to Choose Fixed or Random Effect

Model	Chi-square statistic	P-Value	Preferred Model
Model 2a	13.27	0.0013	FEM
Model 2b	7.53	0.0568	REM

Source: Research Data (2022)

Null Hypothesis: The appropriate model is Random effects.

Alternative Hypothesis: The appropriate model is fixed

4.9.3 Relationship between Information Efficiency, Bond Liquidity and Bond Yields of Treasury Bonds in Kenya

The third objective of the study was to investigate the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Panel regression analysis was used to test the hypothesized relationship. The flowing hypothesis was tested.

H_{03}: There is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

The moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and

Kenny (1986). Baron and Kenny (1986) discussed the steps for testing moderating effect as follows.

Step 1: In the Baron and Kenny (1986) approach for testing moderation, the independent variable is presumed to cause the dependent variable. As shown in table 4.23, Bond liquidity (independent variable) is a significant predictor of Bond yields (dependent variable)

Step 2 (Model 3a): Estimate the relationship between dependent variable (Bond Yields), moderator (Information Efficiency) and independent variable (Bond Liquidity) using panel regression analysis as guided by Hausman specification test. The model should be statistically significant.

Step 3 (Model 3b): An interaction term is computed by multiplying centered independent variable and centered moderator. Centering is achieved by subtracting mean from a variable. Estimate the relationship between dependent variable, independent variable, the moderator and the interaction term (model 3b) to determine and check whether the moderator variable alters the strength of the causal relationship.

4.9.3.1 Moderation Analysis Estimation Models

Table 4. 26: **Moderating effect estimation models - Dependent Variable: Bond Yields, Independent Variable: Bond Liquidity and Information Efficiency (moderator)**

Model	Bond Liquidity (Predictor/IV)	Information Efficiency (Moderator)	Interaction Term

Model 2a	BL	IE	-
Model 2b	BL	IE	BL*IE

Source: Research Data (2022)

Where

BL is Bond liquidity measured by turnover rate

IE is Information Efficiency measured by price dispersion

4.9.3.1.1 Diagnosttic Test

The related presumption of this statistical analyses were tested. In this section only the Hausman specification test was tested beacause other diagnostic test had been performed.

4.9.3.1.1.1 Hauman Specification Test

To decide between fixed or random effects, hausman test was used where the null hypothesis is that the preferred model is random effects vs. the alternative the fixed effects (Green, 2008). Table 4.27 below shows the results of Hausman test. Since p-value<0.05, Fixed effects model was preferred as shown in Table 4.29 below.

Table 4. 27: Hausman Test to Choose Fixed or Random Effect

Model	Chi-square statistic	P-Value	Preferred Model
Model 3a	8.92	0.0116	FEM
Model 3b	19.48	0.0002	FEM

Source: Research Data (2022)

Null Hypothesis: The appropriate model is Random effects.

Alternative Hypothesis: The appropriate model is Fixed effects..

4.9.4. The joint effect of Bond Liquidity, Order Flow and Information Efficiency on bond yields of treasury bonds in Kenya.

Lastly, the study sought to explore the joint effect of bond liquidity, order flow and information efficiency on the bond yields of treasury bonds in Kenya. To investigate the joint effect, the following null hypothesis (H_{04}) was tested.

H_{04}: There is no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.

4.9.4.1 Diagnostic Test

The related presumption of this statistical analyses were tested. In this section only the Hausman specification test was tested because other diagnostic test had been performed.

4.9.4.1.1 Hausman Specification Test

To decide between fixed or random effects, hausman specification test was used where the null hypothesis was that the preferred model was random effects vs. the alternative the fixed effects (Green, 2008). Table 4.28 below shows the results of Hausman test. Since p-value<0.05, Fixed effects model will be used.

Table 4. 28: Hausman Specification Test to Choose Fixed or Random Effect

Chi-square statistic	P-Value
11.95	0.0075

Source: Research Data (2022)

Null Hypothesis: The appropriate model is Random effects.

Alternative Hypothesis: The appropriate model is Fixed effects.

4.10. Chapter Summary

This chapter presented descriptive statistics and trend analysis for the study variables with an effort to interpret the findings. The general objective of this study was to determine the relationship among the bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. This chapter organized as per the four hypothesis of the study.

Descriptive statistics summarized and organized characteristics of the study variables namely, bond liquidity, order flow, information efficiency and the bond yields. The counts, means, median, minimum, maximum, standard deviations, standard errors, skewness and Kurtosis for the dependent variable, independent variable and moderating variables were reported in this section.

Bond liquidity was operationalized using turnover rate while bond yields was measured by yield to maturity. Information efficiency and Order flow operationalized using the price dispersion and the traded volume respectively. Bond Liquidity had a minimum of zero, maximum of .26, mean of .005 and standard deviation of .0085. Bond liquidity positively distributed with skewness of 6.96 (standard error 0.25). The Kurtosis had a value of 113.9 with a standard error of 0.51. Indicated excess kurtosis (leptokurtic distribution).

The minimum and maximum values of bond yields were 2.05 and 76.13 respectively with a mean of 11.56 and standard deviation of 2.46. The bond yields positively distributed with skewness of 2.05 indicating that data the right tail was long relative to the left tail. The kurtosis was above the value of three (67.76) with standard error of 0.51, implying the excess kurtosis (leptokurtic distribution).

Information efficiency had a minimum and maximum of -108.38 and 90.30 respectively (mean -.098, standard deviation 7.49). Information efficiency negatively distributed with skewness of -1.07 indicating data skewed to the left. By skewed left, it meant that the left tail was long relative to the right tail. The study indicator had a kurtosis of that was above the value of three (49.54 with a standard error of 0.51) implying the excess kurtosis (leptokurtic distribution).

The maximum traded volume was an indicator for order flow was 1,000,000,000 with a minimum of 50,000, mean of 91,630,690 and a standard deviation of 96,320,681. Traded volume positively distributed with skewness of 2.30 (standard error 0.25). The positive skewness indicated a long right tail distribution. The results also indicated the traded volume had kurtosis that was above the value of 3, that was, 10.07 with standard error of 0.51, indicating a high-peaked leptokurtic distribution.

Diagnostic tests were performed prior to undertaking inferential statistics to test the hypothesized relationships. The tests were to verify if the panel data meet the basic linear regression requirements. The tests undertaken were multicollinearity test, panel unit root test, normality test, heteroscedasticity test, linearity test and serial correlation test. If of any violation of these basic requirements was detected, necessary corrective measures applied. Haussmann specification test was used to check the suitably of fixed or random effect for the study. This involved estimating both models in particular order, starting with Fixed Effects Model (FEM) against the alternative hypothesis, Random Effects Model (REM) was appropriate at 5% confidence level. The Breusch-Pagan Lagrange multiplier test also used to select between a random effects regression and a

simple OLS regression. The null hypothesis in the LM test was that variances across entities was zero, that is, there was no significant difference across units (i.e. no panel effect).

CHAPTER FIVE: HYPOTHESIS TESTING AND INTERPRETATION OF FINDINGS

5.1. Introduction

After conducting panel data diagnostic tests and taking necessarily remedial actions to correct any violation of the cardinal OLS requirement identified, hypothesis tests were carried out. The aim of this study was to determine relationship between Information efficiency, bond liquidity, order flow and bond yields of treasury bonds in Kenya. Panel data regression analysis was used to test the hypothesized relationships. This study focused on seven CBK treasury bonds with tenors of 5, 10, 12, 15, 20, 25 and 30 years for the period between 2008 and December 2018. The panel dataset was unbalanced.

5.2 Hypothesis Testing

The study sought to determine the effect of bond liquidity on bond yields; the moderating effects of order flow and information efficiency on the relationship between bond liquidity and bond yields of treasury bonds and the joint effect of bond liquidity, order flow and information efficiency on the bond yields of treasury bond. Simple regression, multiple regression, ordinary least square methods and fixed effect model conducted. A level of significance of a=0.05, b=0.1, a confidence level was conducted at 5% and 10%.

5. 2.1 Effect of Bond Liquidity on Bond Yields of Treasury bonds in Kenya

The first objective of the study was to determine the effect of bond liquidity on bond yields of treasury bonds in Kenya. The Breusch-Pagan Lagrange multiplier (LM) test was used to select

between a random effects regression and a simple OLS regression. The null hypothesis in the LM test was that variances across entities was zero, that is, there was no significant difference across units (i.e. no panel effect). Results of hausman test indicated that a fixed effects model was appropriate. The objective informed the first hypothesis, which stated that there was no significant effect of bond liquidity on the bonds, yields of treasury bonds in Kenya.

5.2.1.1. Hypothesis 1 (H_{01}): There is significant Effect of Bond Liquidity on the Bond Yields of Treasury Bonds in Kenya.

The fist hypothesis was to examine the relationship between the bond liquidity and the bond yields of treasury bonds in Kenya. The indicators for bond liquidity were turnover rate while the bond yields were operationalized by using the yield to maturity (YTM). Table 5.1 shows the fixed effect model analysis results undertaken to test the effect of bond liquidity on the bond yields of treasury bonds in Kenya. Similar studies adopted the same model to analyze variables (Christensen, Fischer & Shultz 2019; Weda, Namusonge & Oloko 2014; Fleming 2001; Beber, Brandt, Kavejecz 2009; Goyenko, Subrahmanyam & Ukhov 2008; and Nyongesa 2012).

Table 5. 1: Fixed Effects model, Dependent variable:Bond Yields, predictor: Bond Liquidity

YTM	Coef.	Std. Err.	t	P>t
TR	-41.82***	1.44	-28.96	0.0000
_cons	27.73***	0.73	38.02	0.0000
Model Summary				
R-squared	0.083			
F(1,9254)	838.9			
Prob > F	0.0000			
Observations	9,262			
Number of Bond_ID	7			

*** p<0.01, ** p<0.05, * p<0.1

Source: Research Data (2022)

Where

YTM is Bond Yieds measured by Yield to maturity

TR is Bond liquidity measured by Turnover Rate

From the results tabled above, F-test statistic was statistically significant ($p<0.05$), which means that the overall model was statistically significant, $F(1, 9254) = 838.9$, $p<0.05$. Based on the results of this study the relationship between bond liquidity and bond yields of treasury bonds in Kenya is negative and statistically significant ($\beta= -41.82$, $p<0.01$). This means that for every unit increase in bond liquidity, there is a 41.82 unit decrease in bond yields of treasury bonds in Kenya. The t-

test for bond liquidity (TR) was -28.96, and it was statistically significant, meaning that the regression coefficient for bond liquidity was significantly different from zero.

R-squared (R^2) is 0.083 which suggests that bond liquidity accounted for 8.3% of the variance in bond yields (YTM) of treasury bonds in Kenya. Hypothesis one (H1) examined the relationship between bond yields (dependent variable) and bond liquidity of treasury bonds in Kenya by suggesting that There is no significant effect of bond liquidity on bond yields of treasury bonds in Kenya.

Results of this study indicated that bond liquidity (β= -41.82, $p<0.01$) was a significant predictor of bond yields. Bond liquidity accounted for 8.3% of the variance in bond yields of treasury bonds in Kenya. The H_0 was rejected and it was concluded that the bond liquidity affected the bond yields of treasury yields of treasury bonds in Kenya. The prediction equation $BY_{it} = \beta 0 + \beta 1\ BL_{it} + \varepsilon_{it}$ Where BY_{it} = Bond Yields, BL_{it} = Bond Liqudity and εit =Error term, the regression equation can be rewritten as output equation $BY_{it} = 27.73 - 41.82BL_{it} + \varepsilon_{it.}$

5.2.2 Bond Liquidity, Order Flow and Bond Yields of treasury Bonds in Kenya

The second objective of the study was to investigate the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Panel regression analysis was used to test the hypothesized relationship. The objective resulted to the second hypothesis, which stated that there was no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

5.2.2.1 Hypothesis 2 (H_{02}): There is no Significant Moderating Effect of Order Flow on the Relationship between Bond Liquidity and Bond Yields of Treasury Bonds in Kenya.

The moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and Kenny (1986). Baron and Kenny (1986) as in chapter four.

5.2.2.2 The moderating effect of Order flow on the relation between the bond liquidity and bond yields.

The analysis in first step indicated Fixed effects model was preferred since the results of Hausman test indicated p-value<0.05,. Hausman test howevers indicated that in step 2 of moderation analysis (model 2b), Random effects model was preferred (p>0.05). In step 1 (Model 2a) of Moderation analysis, Fixed-effects model regression analysis was used to estimate the relationship between Bond Yields, Bond liquidity and Order Flow. Results of this study showed that Bond liquidity (β= -39.502, p<0.01) is a significant predictor of Bond Yields as shown in table 5.2 below. Similarly, Order Flow (β= -0.006, p<0.05) is a significant predictor of Bond yields. Based on the results of this study, F-test statistic was statistically significant (p<0.05), which means that the overall model was statistically significant, F (2, 9253) = 422.63, p<0.05. R-squared (R^2) was 0.084, which suggested that jointly, Bond liquidity and order flow accounted for 8.4% of the variance in Bond Yields (dependent variable).

Table 5. 2: Fixed–Effects Regression Results, Dependent Variable: Bond Yields, Predictors: Bond Liquidity and Order Flow

BY	Coef.	Std. Err.	t	P>t
BL	-39.502***	1.730	-22.84	0.0000
OF	-0.006**	0.002	-2.43	0.015
_cons	26.622***	0.861	30.93	0.0000
Model Summary				
R-squared	0.084			
F(2,9253)	422.63			
Prob > F	0.0000			
Observations	9,262			
Number of Bond_ID	7			

*** p<0.01, ** p<0.05, * p<0.1

Source: Research Data (2022)

Where;

BY is Bond Yields (depedent Variable) Measured by Yield to Maturity (YTM)

BL is Bond liquidity (independent variable) measured by turnover rate

OF is order flow (Moderator) measured by traded volume

In step 2 (Model 2b) of Moderation analysis, Random-effects GLS regression analysis was used to estimate the relationship between Bond Yields, Bond liquidity, Order Flow and interaction term (BL*OF). Results of this study showed that Bond liquidity (β= -99.85, p<0.01) is a significant

predictor of Bond Yields as shown in table 5.3 below. Similarly, Order Flow (β= -0.026, p<0.01) is a significant predictor or Bond yields. The Interaction term (BL*OF) was also statistically significant (β= 5.56, p<0.01). The results from the Wald Chi-Square test indicated that model 2a was statistically significant (Prob > chi2 =0.0000). R-squared (R^2) was 0.149 which suggested that jointly, Bond liquidity, order flow and the interaction term (BL*OF) accounted for 14.9% of the variance in Bond Yields (dependent variable).

Table 5. 3: Random–Effects Regression Results, Dependent Variable: Bond Yields, Predictors: Bond Liquidity, Order Flow and Interaction term (BL*OF)

BY	Coef.	Std. Err.	z	P>z
BL	-99.85***	2.817	-35.45	0.000
OF	0.026***	0.003	9.6	0.000
BL*OF	5.56***	0.209	26.57	0.000
_cons	56.69***	1.405	40.35	0.000
Model Summary				
R-squared	0.149			
Wald chi2(3)	1621			
Prob > chi2	0.0000			
Observations	9262			
Number of Bond_ID	7			

*** p<0.01, ** p<0.05, * p<0.1

Source: Research Data (2022)

Where;

BL is Bond liquidity measured by turnover rate

OF is order flow measured by traded volume

BL*OF is interaction term computed by multiplying centred indepedent varianble (Bond Liquidity and Centred moderator (order Flow)

Hypothesis two (H_{02}) sought to determine the effect of order flow on the relationship between bond Liquidity and Bond yields (dependent variable) by suggesting that there was no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Results of this study showed that the interaction term (BL*OF) was statistically significant ($p<0.05$). Furthermore, model 2a and Model 2b were all statistically significant and therefore order flow has a moderating effect on the relationship between bond liquidity and Bond yields of treasury bonds in Kenya. The null hypothesis was (H_{02}), therefore rejected.

The model regression equations are as follows:

Model 2a: $BY_{it} = \beta_0 + \beta_1 BL_{it} + \beta_2 OF_{it} + \varepsilon_{it}$

The regression equation can be re-written as follows:

$BY_{it} = 26.622 - 39.502 BL_{it} - 0.006 OF_{it} + \varepsilon_{it}$

The model regression equations are as follows:

Model 2b: $BY_{it} = \beta_0 + \beta_1 BL_{it} + \beta_2 OF_{it} + \beta_3 BL*OF_{it} + \varepsilon_{it}$

The regression equation can be re-written as follows:

Output equation: $BY_{it} = 56.69 - 99.85BL_{it} + 0.026OF_{it} + 56.69BL*OF_{it} + \varepsilon_{it}$

5.2.3: Relationship among the Bond liquidity, Information Efficiency and Bond Yields of Treasury Bonds in Kenya.

The third objective of the study was to investigate the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Panel regression analysis was used to test the hypothesized relationship. The moderating variable information efficiency was operationalized by examining price dispersion of Kenyan treasury bonds. The flowing hypothesis was tested.

H_{03}: There is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

The moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and Kenny (1986). Baron and Kenny (1986) discussed the 3 steps for testing moderating effect as discussed in chapter four.

Table 5. 4: Moderating effect estimation models - Dependent Variable: Bond Yields, Independent Variable: Bond Liquidity and Information Efficiency (moderator)

Model	**Bond Liquidity (Predictor/IV)**	**Information Efficiency (Moderator)**	**Interaction Term**
Model 2a	BL	IE	-
Model 2b	BL	IE	BL*IE

Source Data (2022)

Where

BL is Bond liquidity measured by turnover rate

IE is Information Efficiency measured by price dispersion

5.2.3.1 The Moderating Effect of Information efficiency between the Bonds Liquidity and Bonds Yields.

The moderating effect of information efficiency on the relation between bond liquidity and bonds yields of treasury bonds in Kenya was calculated using the Baron and Kenny (1986). After analysis the fixed effects model was preferred. In step 1 (Model 3a) of Moderation analysis, Fixed-effects model regression analysis was used to estimate the relationship between Bond Yields (BY), Bond liquidity (BL) and Information Efficiency (IE). Results of this study showed that Bond liquidity (β= -39.47, $p<0.01$) is a significant predictor of Bond Yields (BY) as shown in table 5.5 below.

Similarly, Information Efficiency (β= 0.017, p<0.01) is a significant predictor or Bond yields. Based on the results of this study, F-test statistic was statistically significant (p<0.05), which means that the overall model was statistically significant, F (2, 9253) = 791.55, p<0.05. R-squared (R^2) was 0.146, which suggested that jointly, Bond liquidity and Information efficiency accounted for 14.6% of the variance in Bond Yields (dependent variable).

Table 5. 5: Fixed–Effects Regression Results, Dependent Variable: Bond Yields, Predictors: Bond Liquidity and Information Efficiency

BY	Coef.	Std. Err.	t	P>t
BL	-39.47***	1.396	-28.27	0.000
IE	0.017***	0.001	26.12	0.000
_cons	22.88***	0.728	31.42	0.000
Model Summary				
R-squared	0.146			
F(2,9253)	791.55			
Prob > F	0.0000			
Observations	9262			
Number of Bond_ID	7			

*** p<0.01, ** p<0.05, * p<0.1

Source: Research Data (2022)

Where;

BY is Bond Yields (depedent Variable) Measured by Yield to Maturity (YTM)

BL is Bond liquidity (independent variable) measured by turnover rate

IE is Information Efficiency (Moderator) measured by price dispersion

In step 2 (Model 3b) of Moderation analysis, Fixed-effects model regression analysis was used to estimate the relationship between Bond Yields (BY), Bond liquidity (BL), Information Efficiency (IE) and interaction term (BL*IE). Results of this study showed that Bond liquidity (β= -39.21, $p<0.01$) was a significant predictor of Bond Yields (BY) as shown in table 5.6 below. Similarly, Information Efficiency (β= 0.02, $p<0.01$) was a significant predictor of Bond yields. Based on the results of this study, F-test statistic was statistically significant ($p<0.05$), which means that the overall model was statistically significant, $F(3, 9252) = 532.08$, $p<0.05$. R-squared (R^2) was 0.147, which suggested that jointly, Bond liquidity, Information efficiency and interaction term (BL*IE) accounted for 14.7% of the variance in Bond Yields (dependent variable).

Table 5. 6: Fixed–Effects Regression Results, Dependent Variable: Bond Yields, Predictors: Bond Liquidity, Information Efficiency and Interaction term (BL*IE)

BY	Coef.	Std. Err.	t	P>t
BL	-39.21***	1.40	-28.05	0.000
IE	0.02***	0.0006	25.94	0.000
BL*IE	0.31***	0.09	3.37	0.001
_cons	22.77***	0.73	31.26	0.000

Model Summary	
R-squared	0.147
F(3,9252)	532.08
Prob > F	0.0000
Observations	9262
Number of Bond ID	7

*** p<0.01, ** p<0.05, * p<0.1

Source: Research Data (2022)

Where

BL is Bond liquidity measured by turnover rate

IE is Information Efficiency measured by price dispersion

BL*IE is interaction term computed by multiplying centred indepedent variable (Bond Liquidity) and Centred moderator (Informatin Efficiency)

Hypothesis H_{03} sought to determine the effect of information efficiency on the relationship between bond Liquidity and Bond yields (dependent variable) by suggesting that there is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Results of this study showed that the interaction term (BL*IE) was statistically significant ($p<0.05$). Furthermore, model 3a and Model 3b were all statistically significant and therefore information efficiency had a moderating effect on the

relationship between bond liquidity and Bond yields of treasury bonds in Kenya. The null hypothesis was H_3 therefore rejected.

The model regression equations are as follows:

Model 3a: $BY_{it} = \beta_0 + \beta_1 BL_{it} + \beta_2 IE_{it} + \varepsilon_{it}$

The regression equation can be re-written as follows:

$BY_{it} = 22.88 - 39.47 BL_{it} + 0.017 IE_{it} + \varepsilon_{it}$

The model regression equations are as follows:

Model 3b: $BY_{it} = \beta_0 + \beta_1 BL_{it} + \beta_2 IE_{it} + \beta_3 BL*IE_{it} + \varepsilon_{it}$

The regression equation can be re-written as follows:

Output equation: $BY_{it} = 22.77 - 39.21 BL_{it} + 0.02 IE_{it} + 0.31 BL*IE_{it} + \varepsilon_{it}$

5.2.4 The Joint Effect of Bond Liquidity, Order Flow and information Efficiency on the bond yields of treasury bonds in Kenya.

Lastly, The study sought to explore the joint effect of bond liquidity, order flow and information efficiency on the bond yields of treasury bonds in Kenya. To investigate the joint effect, the following null hypothesis (H_{04}) was tested.

5.2.4.1 Hypothesis 4 (H_{04}): There is no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.

The study examined the joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. Results of hausman test indicated that a fixed effects model was appropriate (table 4.32). The results of Fixed-effects (within) regression are shown in table 5.7 below.

Table 5. 7: Fixed Effects model, Dependent variable:Bond Yields, predictors: Bond Liquidity, order flow and information efficiency

BY	Coef.	Std. Err.	t	P>t
BL	-39.88***	1.670	-23.88	0.0000
IE	0.017***	0.001	26	0.0000
OF	0.001	0.002	0.44	0.658
_cons	23.06***	0.842	27.38	0.0000
Model Summary				
R-squared	0.146			
F(3,9252)	527.72			
Prob > F	0.0000			
Observations	9262			
Number of Bond_ID	7			

*** p<0.01, ** p<0.05, * p<0.1

Source: Research Data (2022).

Where

BY is Bond Yied measured by Yield to maturity (YTM)

BL is Bond liquidity measured by turnover rate

IE is Information Efficiency measured by price dispersion

OF is order flow measured by traded volume

F-test statistic was statistically significant ($p<0.05$), which means that the overall model was statistically significant, $F (3, 9252) = 527.72$, $p<0.05$. Based on the results of this study the relationship between bond liquidity (BL) and bond yields (BY) of treasury bonds in Kenya was negative and statistically significant ($\beta= -39.88$, $p<0.01$). This means that for every unit increase in bond liquidity, there was a 39.88 unit decrease in bond yields of treasury bonds in Kenya. The t-test for bond liquidity (BL) was -23.88, and it was statistically significant, meaning that the regression coefficient for bond liquidity was significantly different from zero. Similarly, Information Efficiency was also a significant predictor of Bond yeilds ($\beta= 0.017$, $p<0.01$). This means that for every unit increase in information efficiency there was a 0.017 unit increase in bond yields of treasury bonds in Kenya. The t-test for Information efficiency (IE) was 26, and it was statistically significant, meaning that the regression coefficient for bond liquidity was significantly different from zero. Order flow was not a significant predictor of Bond Yields ($\beta= 0.001$, $p>0.05$). R-squared (R^2) is 0.146 which suggested that bond liquidity, information efficiency and order flow jointly accounted for 14.6% of the variance in bond yields (BY) of treasury bonds in Kenya.

Hypothesis four (H_{04}) examined the joint effect of bond liquidity, order flow and information efficiency on the bond yields of treasury bonds in Kenya by suggesting that there was no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. Results of this study indicated that F-test statistic was statistically significant ($p<0.05$) which means that the overall model was statistically significant, $F(3, 9252) = 527.72$, $p<0.05$. Bond liquidity ($\beta= -39.88$, $p<0.01$) and Information Efficiency ($\beta= 0.017$, $p<0.01$) are significant predictors of bond yields.

Bond liquidity, order flow and information efficiency jointly accounted for 14.6% of the variance in bond yields of treasury bonds in Kenya. The null hypothesis was therefore rejected.

The model regression equations are as follows:

$$BY_{it} = \beta_0 + \beta_1 BL_{it} + \beta_2 IE_{it} + \beta_3 OF_{it} + \varepsilon_{it}$$

Where:

BY=Bond yields, β_0=Y intercept, BL=Bond Liquidity, IE=Information Efficiency, OF=Order flow, β_1, β_2, and β_3= coefficients, ε=error term, i=individual bonds, t=time series.

The regression equation can be re-written as follows:

$$BY_{it} = 23.06 - 39.88 BL_{it} + 0.017 IE_{it} + \varepsilon_{it}$$

5.3: Discussion of the Results of Hypotheses Testing

The four objective were driven from the findings of the literature, which eventually gave rise to the four hypothesis of the study. The findings from the study clearly indicated that bonds liquidity negatively affected the bond yields of treasury bonds in Kenya. This is in line with the theoretical foundation by Liquidity Preference theory by Keynes (1936). Fixed effects model and ordinary least square regression model were used to test the four hypothesis of the study at confidence level of 5% significance (a=0.05). All the four null hypotheses of the study were rejected. Statistical knowledge, theoretical and empirical literature were used to interpret the data findings. Conclusions were drawn after comparing the data findings and the existing body of knowledge.

The first hypothesis H_{01} results established that bond liquidity had a significant influence on the bond yields of Kenyan treasury bonds. The findings established that bond liquidity was a significant predictor of bond liquidity of treasury bonds in Kenya. The relationship between bond liquidity and bond yields was negative and statistically significant. That bond liquidity accounted for 8.3% of the variance in Treasury bond yields. These findings were consisted with those of Goyenko, Subrahmanyam and Ukhov (2016) and Lartey and Li1 (2018) but contradicted those of Codogno, Favero and Missale (2003) and Favero, Pagano and Thadden (2007). The reasons for contradiction could be the context under which the studies were carried and methodologies adopted to study the hypothesis.

The findings concur with the liquidity preference theory as postulated by Keynes (1936), which argue that traders prefer liquid and high interest rates on long-term bonds as compared to short-term securities that are illiquid. This theory anticipates a negative relationship between the bond

liquidity and the yields of treasury bonds. The findings of this study confirm the position of the liquidity preference theory Keynes (1936). The findings established the relationship between bond liquidity and bond yields of treasury bonds in Kenya was negative and statistically significant (β= -41.82, $p<0.01$). Further, liquidity was a crucial element in bond market growth that influences bond yields as argued by (Vayanos, Dimitri & Jiang, 2012). In addition, (Christensen & Gillan, 2016) posit that traders demand high premiums for assets, which are illiquid. For such bonds government lose a lot of money as bond service costs.

Based on results of the second hypothesis that sought to establish whether order flow moderated the link between the bond liquidity and the bond yields of treasury bonds in Kenya. The hypothesis subjected to hierarchical regression analysis. Traded volume was used as an indicator for the order flow the moderator variable. The findings established that moderation existed, and that the influence of order flow on the relationship between the bond liquidity and bond yields was significant. Thus the null hypothesis was rejected, the alternate hypothesis accepted. Bond liquidity and order flow jointly accounted for 14.9% of variance in bond yields compared to 8.3% bond liquidity variance of yields of treasury bonds. This means that order flow strengthened the bond liquidity thus causing a higher variance in yields of treasury bonds. Bond liquidity and order flow were statistically significant predictors of yields of treasury bonds. These findings were consisted with those of Brandt and Kavajecz (2004) that found out that imbalance of order flow were responsible for daily changes of yield curve especially when liquidity was low. However, the study findings are in in consisted with those of Fleming and Nguyen (2018) which used vector auto regression (VAR) as a methodology in the study analysis. Contradiction of the study finding may be because of the methodology used. This study used the linear regression models.

The study findings support the Market Microstructure Theory founded by O' Hara (1995) which posits that microstructure as a process and results of trading securities under specific and explicit laid down laws. As predicted by O'Hara (1995), order flow is a microstructure element in the securities markets that influenced the relationship between bond liquidity and the Treasury bond yields. Rusell and Engle (2010), argues that market microstructure primarily deals with securities market structure and trading rules, spreads, costs of transaction, quotes and intraday trading behavior. O' Hara (1995) suggests that that order flow influences both bond liquidity and yields in comparison to market regulation. This theory aided in explaining the role of yields in relation to other variables including bond liquidity, order flow and information efficiency.

The third objective aimed to establish whether information efficiency moderated the connection between the bond liquidity and the bond yields Kenyan Treasury bonds. Price dispersion was used to measure the information efficiency. Hypotheses was formulated to test the moderation of the information efficiency. The finding established that the information efficiency had a significant effect on the relationship between the bond liquidity and bond yields hence rejecting the null hypothesis and accepting the alternative hypothesis. The information efficiency had positive relationship with the bond yields which was significant predictor. Jointly bond liquidity and the information efficiency accounted for 14.7% of variance of bond yields, compared to 8.3% bonds liquidity variance in bond yields. This means that the introduction of information efficiency as a moderator changed the strength of the relationships, thus information efficiency was a significant predicator of Treasury bond yields. These findings were consisted with the findings of Bai, Fleming and Horan (2013) who found out that certain announcements had significant effects on relation between liquidity and yields, even when such yields measured at a daily level. Contrary

Thupayagale (2015) found out that the market was informational inefficient, illiquidity and had structural shortage of bonds. These papers used the nonlinear models, which might yield different results from linear models. This study adopted a linear regression models to analyze the variables that could be possible cause of different research findings.

The study supports Efficient Markets Hypothesis (EMH) Fama (1965), which posits that markets are efficient when security prices entirely capture current market information about the value of the institution, and traders cannot make abnormal profits by using available information irrespective of their technical and fundamental know how. This theory provided the much needed support of the linkage between the bond liquidity and the bond yields. It was evident as predicted by Fama (1965), that information efficiency significantly accounted for the changes in Treasury bond yields. Fama (1965), argues that informational efficiency is when all available details are captured by asset prices. Malkiel (1973), tested information efficiency using the random walk analysis and found out that movements of assets prices were unpredictable. While, supporting these theorist, Thotho, (2017) argued that efficiency market theory is rich of informational efficiency thus it predicts a relationship between bond liquidity and bond yields during release of news.

The last objective aimed to establish the joint effect of bond liquidity, order flow an information efficiency on the bond yields of treasury bonds in Kenya. Regression analysis was conducted in line with the formulated hypothesis H_{04}. Bond liquidity measured using the turnover rate, traded volumes was an indicator for order flow while the information efficiency used the price dispersion as an indicator. The results were significant and rejected the null hypothesis hence accepting the

alternate hypothesis. Hence, the joint effect of bond liquidity, order flow and information efficiency on bond yields was greater than the individual effect of the bond liquidity on bond yields of treasury bonds in Kenya. The joint effect of the bond liquidity, order flow and information efficiency accounted for 14.6% of the variance of bond yields. This is higher compared to 8.3% variance caused by bond liquidity on yields of treasury. Though it is slightly lower as compared to the joint variance of bond liquidity and information efficiency at 14.7% as well as slightly lower as compared to the joint variance of bond liquidity and order flow at 14.9%. The findings of this study were consisted with those of Fleming and Remolona (1999). However, this study contradicted the finding of Girardi and Impenna (2013), who analyzed the Italian sovereign bonds market. Price discovery, order flow and the role of information in the secondary markets for Treasury bonds was the key focus. Using state space model, they found out that Liquidity was not necessary for formations of yields and only order flow mattered. The findings of the joint effect also point out that order flow was not a significant predictor of Bond Yields ($\beta = 0.001$, $p > 0.05$). This shows that order flow had significance influence as an individual element but it lost its influence with interaction with other market microstructure elements. This finding contradicted that of Brandt and Kavajecz (2004) who found out that order flow was responsible for daily changes of yield curve. Limited to Italy and therefore its finding could be different as result of contextual difference.

The study support the Efficient Markets Hypothesis Fama (1965). The expectations theory by Hicks (1939), and Lutz (1940) which submit that the mapping of the yield curve depicts the future expectations on interest rate and Market Microstructure Theory founded by O' Hara (1995), which posits that microstructure as a process and results of trading securities under specific and

5.4 Chapter Summary

The milestones achieved on findings of empirical and theoretical literature are discussed in this section. The four objective under this study gave rise to four hypothesis of the study. The Fixed effect model and Ordinary Lest Square regression methods were used to test the hypothesis of the study. The findings were analyzed, compared and contrasted with the existing empirical and theoretical literature. Formulation of null hypotheses was informed by the theoretical and empirical literature review.

Objective number one was to establish the effect of bond liquidity on the bond yields of treasury bonds in Kenya. The first null hypothesis was formulated to ascertain the effect of bond liquidity on bond yields. It stated that there is no significant effect of bond liquidity on bond yields of treasury bonds in Kenya. The fixed effect model analysis was undertaken to test the effect of bond liquidity on the bond yields of treasury bonds in Kenya. Based on the results of this study the relationship between bond liquidity and bond yields of treasury bonds in Kenya is negative and statistically significant. This means that for every unit increase in bond liquidity, there is unit decrease in bond yields of treasury bonds in Kenya. Results of this study indicated that bond liquidity was a significant predictor of bond yields. Hence, the null hypothesis rejected. Thus objective one was proved by this study

The study finding were consisted with those of Goyenko, Subrahmanyam and Ukhov (2016) and Lartey and Li1 (2018). However, they were contrary to some other studies which had differing views on bond liquidity and yields Codogno, Favero and Missale (2003), Weda, Namusonge, and Oloko (2014) and Favero, Pagano and Thadden (2007). The findings concurred with Liquidity

preference theory as postulated by Keynes (1936), that traders prefer liquid and high interest rates on long-term bonds as compared to short-term securities that are illiquid. Howells and Bain (2002), posit that long term interest rates of bonds are derived from average interest rates on short-term bond that traders predict to take place over long term bonds' term to maturity bearing in mind that the liquidity premium that is accompanied by the supply and demand of that particular bond.

The second objective of the study was to determine the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. To ascertain the moderating effect of order flow on the relation between the bond liquidity and bond yields of treasury bonds in Kenya, the second hypothesis was formulated. It stated that there is no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

Fixed effects model and Random-effects generalized least squares (GLS) regression analysis was used to estimate the relationship between Bond Yields, Bond liquidity, Order Flow and interaction term (BL*OF). The moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and Kenny (1986). Traded volume was an indicator for the order flow, which acted as the moderator in the hypothesized equation. Results of this study showed that bond liquidity and order Flow were significant predictor for bond yields. Based on the results of this study, F-test statistic was statistically significant which means that the overall model was statistically significant. Results of this study showed that the interaction term (BL*OF) was statistically significant ($p<0.05$) and therefore order flow has a moderating effect on the relationship between bond liquidity and Bond

yields of treasury bonds in Kenya. The null hypothesis was (H_{02}), therefore rejected. Therefore, the study validated the second objective. The findings are in agreement with those of Brandt and Kavajecz (2004), Fleming, and Nguyen (2018). The findings support Market Microstructure Theory founded by O' Hara (1995). Rusell and Engle (2010), argues that market microstructure primarily deals with securities market structure and trading rules, spreads, costs of transaction, quotes and intraday trading behavior.

The third objective was to assess the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. To assist in investigating the effect of information efficiency on the linkage between the bond liquidity and bond yields of treasury bonds the third hypothesis was formulated. It stated that there is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.

This hypothesis was tested using the fixed effect model and the moderating effect was calculated using the method advanced by Baron and Kennny (1986). The price dispersion was used to measure the information efficiency. The Results of this study showed the overall model was statistically significant. Therefore, information efficiency had a moderating effect on the relationship between bond liquidity and Bond yields of treasury bonds in Kenya. Hence, the null hypothesis was H_3 therefore rejected. The results were interpreted as conclusive since there was sufficient evidence from the study to make conclusion on the hypothesis. Objective three thus proved by this study.

These findings are consisted with those of Bai, Fleming and Horan (2013) though contradicted the findings of Thupayagale (2015). The paper used the nonlinear models, which might yield different results from linear models. This study adopted linear regression models to analyze the variables, studies by Goyenko, Subrahmanyam & Ukhov 2016; Favero, Pagano & Thadden 2007; Nwiado & Deekor 2013 and Thotho (2017) used nonlinear models.

The study supports the study by Fama (1965), on the Efficient Markets Hypothesis (EMH). Malkiel (1973), tested information efficiency using the random walk analysis and found out that movements of assets prices were unpredictable. Further, the study findings are in agreement with critics of market efficiency, since it is not in position to explain why there is variation in market efficiency (Lo, 2004; Brealey, Myers & Allen, 2005). EMH assumes that securities are never overpriced or underpriced since the market has perfect information about the market trend which is available to every investor which always not the case.

Lastly, the fourth objective determined the joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. Based on this objective the forth hypothesis was formulated which stated that there was no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. Results of hausman test indicated that a fixed effects model was appropriate tool to test the hypothesis. Based on the results of this study the relationship between bond liquidity (BL) and bond yields (BY) of treasury bonds in Kenya is negative and statistically significant.

Hypothesis four (H_{04}) examined the joint effect of bond liquidity, order flow and information efficiency on the bond yields of treasury bonds in Kenya by suggesting that there is no significant

joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. Results of this study indicated that F-test statistic was statistically significant which means that the overall model was statistically significant and significant predictors of bond yields. Bond liquidity, order flow and information efficiency jointly accounted for the variance in bond yields of treasury bonds in Kenya. The null hypothesis was $H_{04,}$ therefore rejected. The fourth objective was confirmed by this study. Table 5.12 below summaries the hypothesis tested and the resultant models of significance used.

Table 5. 8: Summary of Research objectives, hypothesis, Analysis Methods, Model Estimation, Results and interpretation

Objective	Hypothesis	Analytical Method	Model Estimation	Results	Interpretation
To establish the effect of bond liquidity on bond yields of treasury bonds in Kenya.	There is no significant effect of bond liquidity on bond yields of treasury bonds in Kenya.	$BY_{it} = \beta 0 + \beta 1\ BL_{it} + \varepsilon_{it}$ Regress BY on BL Where: β0=Population Y intercept/ Regression constant, β1=Population slope coefficient, BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity	Fixed Effects Model	The null hypothesis was rejected (Not supported)	The relationship between bond liquidity and bond yields of treasury bonds in Kenya is negative and statistically significant (β= -41.82, $p<0.01$). F-test statistic was statistically significant ($p<0.05$), which means that the overall model was statistically significant, $F(1, 9254) = 838.9$, $p<0.05$. R-squared (R^2) is 0.083 which suggests that bond

		where *i* = bond and time= *t* and ε_{it} is the error term			liquidity accounts for 8.3% of the variance in bond yields (YTM) of treasury bonds in Kenya.
To determine the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.	There is no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.	**The Baron and Kenny (1986) approach for testing Moderation:** Panel Regression Analysis Models: Model 1: $BY_{it} = \beta0 + \beta1\ BL_{it} + \varepsilon_{it}$ Model 2: $BY_{it} = \beta0 + \beta1BL_{it} + \beta2OF_{it} + \varepsilon_{it}$ Model 3: : $BY_{it} = \beta0 + \beta1BL_{it} + \beta2OF_{it} + \beta3(BL*OF)_{it} + \varepsilon_{it}$	Fixed Effects Model and Random-effects GLS regression analysis	The null hypothesis was rejected (Not supported	Results of this study showed that Bond liquidity ($\beta = -39.502$, $p<0.01$) is a significant predictor of Bond Yields. Similarly, Order Flow ($\beta = -0.006$, $p<0.05$) is a significant predictor or Bond yields. F-test statistic was statistically significant ($p<0.05$), which means that the overall model was

		Where BY_{it}=Bond Yield where *i* = bond and time= *t,* BL_{it}=Bond Liquidity where *i* = bond and time= *t,* OL=Order Flow where *i = bond* and time= *t,* β0, β1, β2 and β3 = Regression coefficients and ε_{it} is the error term			statistically significant, F (2, 9253) = 422.63, p<0.05. R-squared (R^2) was 0.084, which suggests that jointly, Bond liquidity and order flow account for 8.4% of the variance in Bond Yields (dependent variable). The Interaction term (BL*OF) was also statistically significant (β= 5.56, p<0.01). Bond liquidity, order flow and the interaction term (BL*OF) account for 14.9% of the variance in Bond Yields (dependent variable).

To assess the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya.	There is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields treasury bonds in Kenya.	**The Baron and Kenny (1986) approach for testing Moderation:** Panel Regression Analysis Models: Model 1: $BY_{it}= \beta0 +\beta1BL_{it} + \varepsilon_{it}$ Model 2: $BY_{it}= \beta0+\beta1BL_{it}+\beta2IE_{it} + \varepsilon_{it}$ Model 3: : $BY_{it}=\beta0+\beta1BL_{it} + \beta2IE_{it} + \beta3(BL*IE)_{it} + \varepsilon_{it}$ Where BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity where *i* = bond and time=	Fixed Effects Model	The null hypothesis was rejected (Not supported	Results of this study showed that Bond liquidity ($\beta= -39.47$, $p<0.01$) is a significant predictor of Bond Yields (BY). Similarly, Information Efficiency ($\beta= 0.017$, $p<0.01$) is a significant predictor or Bond yields. F-test statistic was statistically significant ($p<0.05$), which means that the overall model was statistically significant, $F (2, 9253) = 791.55$, $p<0.05$. R-squared (R^2) was 0.146, which suggests that jointly,

		t, IE_{it}=Information Efficiency where *i* = bond and time= *t*, β0, β1, β2 and β3 = Regression coefficients and ε_{it} is the error term			Bond liquidity and Information efficiency account for 14.6% of the variance in Bond Yields (dependent variable).
To determine the joint effect of bond liquidity, order flow and information efficiency on bond yields.	There is no significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.	BY_{it}= β0 +β1 BL_{it}+ β2OF_{it} +β3 IE_{it} +ε_{it} Where BY_{it}=Bond Yield where *i* = bond and time= *t*, BL_{it}=Bond Liquidity where *i* = bond and time= *t*, IE_{it}=Information Efficiency where *i* = bond and time= *t*, OF_{it}=Order flow where *i* = bond and time= *t*,β0, β1, β2 and β3	Fixed Effects Model	The null hypothesis was rejected (Not supported	F-test statistic was statistically significant ($p<0.05$), which means that the overall model was statistically significant, $F(3, 9252) = 527.72$, $p<0.05$. Based on the results of this study the relationship between bond liquidity (BL) and bond yields (BY) of treasury bonds in Kenya is negative and statistically

		= Regression coefficients and ε_{it} is the error term			significant (β= -39.88, p<0.01). Similarly, Information Efficiency is also a significant predictor of Bond yeilds (β= 0.017, p<0.01). F-test statistic was statistically significant (p<0.05) which means that the overall model was statistically significant, F (3, 9252) = 527.72, p<0.05. Bond liquidity (β= -39.88, p<0.01) and Information Efficiency (β= 0.017, p<0.01) are significant predictors of bond yields.

					R-squared (R^2) is 0.146 which suggests that bond liquidity, information efficiency and order flow jointly account for 14.6% of the variance in bond yields (BY) of treasury bonds in Kenya.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Chapter five-covered hypothesis testing, interpretation of the analysis and discussion of the results. Summary of research findings, conclusions of the study and recommendations for further studies will be discussed in this chapter. Special attention drawn to the objectives of the study from which the four hypothesis were driven. It summarizes the synopsis of the study, conceptualization of the study variables, points out the population of the study and the methods of data collection. It encapsulates the results of the descriptive of the study variables. This chapter points out the relationships of the four variables and its findings after data analysis and hypothesis testing. Recommendations appurtenant to the study findings highlighted. The contribution of this study findings in regards to knowledge management, theory contribution, policy and management practice formed the final bit of this chapter. Finally, the limitations of the study, mitigation measures undertaken to ensure authentic results were provided. Recommendation for further studies related to the limitation of the study formed the last section of this chapter.

6.2 Summary of findings

The general objective of this study was to determine the relationship among the bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. To achieve this objective independent, moderating and dependent variables were used. The independent variable was the Bond Liquidity, measured using the turnover rate. The moderating variables were the Order Flow and Information Efficiency. Traded volume was an indicator used to measure the order

flow, while information efficiency was measured by price dispersion of treasury bonds in Kenya. The dependent variable was Bond Yields, measured by yield to maturity (YTM).

Formulation of null hypotheses was from the gaps identified by theoretical and empirical literature review. The hypothesis were in line with the four objective of the study. The identified gaps after literature review in chapter one and two were summarized in table 2.1. The gaps included the conceptual gaps, contextual gaps and methodological gaps.

Review of theoretical and empirical literature identified conceptual gaps. Different scholars attempted to explain factors that drive yields of treasury bonds and they failed to reach to a consensus. Researchers ascertained that bond liquidity influenced the bond yields while others found that liquidity had insignificant impact on yields. Other studies were of the view that bond yields enhanced liquidity and not the vice versa. Hence, understanding the dynamics of bond liquidity and bond yields was paramount to most economists and ultimately interesting to comprehend how and why, the elements influencing bond yields vary over time. There was a need to introduce the order flow and information efficiency as moderators to test their effect on the relationship between the bond liquidity and yields.

Empirical evidences from different studies on relationship between the bond liquidity and yields generated mixed results hence resulting to contextual gaps. Studies conducted in Africa had differing views on the relationship between bond liquidity and bond yields. There were inadequate studies in Kenya regarding the Bond Liquidity and Bond Yields of treasury bonds in Kenya. Most studies were from developed counties such as United stated of America, Italy and Europe. The findings on moderating effect of Order Flow and Information Efficiency supported the Efficient

Markets Theory by Fama (1965). The findings on the joint effect of bond liquidity, Order Flow and Information Efficiency on Bond Yields of treasury bonds revealed lack of adequate empirical studies. Most studies focused of two major variables that is the Bond Liquidity and the Bond Yields.

There were notable differences in the methodology adopted by studies on the bond liquidity and bond yields. Some studies assumed nonlinear relationship among the variables such as vector auto regression, the state space model and generalized autogressive conditional heteroskedasticity (GARCH). This study adopted the linear regression analysis. Fixed effects Model was used to test hypothesis of the study. The study reviewed that the Bonds Liquidity, Order Flow and Information Efficiency affected the Bond Yields. The results of the hypothesis summarized in chapter five, table 5.1.

The first objective of the study was to establish the effect of bond liquidity on bond yields of treasury bonds in Kenya. The null hypothesis formulated stated that there was no significant effect of bond liquidity on bond yields of treasury bonds in Kenya. The indicators for bond liquidity were turnover rate while the bond yields were operationalized by using the yield to maturity (YTM).The fixed effect model was used to analysis the hypothesis. Results of this study indicated that bond liquidity was a significant predictor of bond yields. The findings established that bond liquidity was a significant predictor of bond yields of treasury bonds in Kenya. The relationship between bond liquidity and bond yields was negative and statistically significant. That bond liquidity accounted for 8.3% of the variance in Treasury bond yields. Bond liquidity accounted for the variance in bond yields of treasury bonds in Kenya. The H_0 was rejected and it was concluded that

the bond liquidity affected the bond yields of treasury yields of treasury bonds in Kenya. The findings concur with the liquidity preference theory as postulated by Keynes (1936), which argue that traders prefer liquid and high interest rates on long-term bonds as compared to short-term securities that are illiquid. This theory anticipates a negative relationship between the bond liquidity and the yields of treasury bonds. The findings of this study confirm the position of the liquidity preference theory Keynes (1936). The findings established the relationship between bond liquidity and bond yields of treasury bonds in Kenya was negative and statistically significant.

The second objective was to determine the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. The resultant null hypothesis stated that there is no significant moderating effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Panel regression analysis was used to test the hypothesized relationship. Bond liquidity and order flow jointly accounted for 14.9% of variance in bond yields compared to 8.3% bond liquidity variance of yields of treasury bonds. This means that order flow strengthened the bond liquidity thus causing a higher variance in yields of treasury bonds. Results of this study showed that the interaction term (BL*OF) was statistically significant and therefore order flow had a moderating effect on the relationship between bond liquidity and Bond yields of treasury bonds in Kenya. The null hypothesis was (H_{02}), therefore rejected and alternative hypothesis accepted. As predicted by O'Hara (1995), order flow is a microstructure element in the securities markets that influenced the relationship between bond liquidity and the Treasury bond yields.

The third objective was to assess the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. The moderating variable was the information efficiency, which was measured using price dispersion. Hypothesis formulated as resultant of this objective stated that there is no significant moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. The moderating effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya was computed using the method proposed by Baron and Kenny (1986). Moderation analysis used fixed-effects model regression analysis to estimate the relationship between Bond Yields (BY), Bond liquidity (BL) and Information Efficiency (IE). The information efficiency had positive relationship with the bond yields which was significant predictor. Jointly bond liquidity and the information efficiency accounted for 14.7% of variance of bond yields, compared to 8.3% bonds liquidity variance in bond yields. This meant that the introduction of information efficiency as a moderator changed the strength of the relationships, thus information efficiency was a significant predicator of Treasury bond yields. Results of this study showed that the interaction term (BL*IE) was statistically significant and therefore information efficiency had a moderating effect on the relationship between bond liquidity and Bond yields of treasury bonds in Kenya. The null hypothesis was H_3 therefore rejected. Efficiency markets hypothesis provided the much needed support of the linkage between the bond liquidity and the bond yields. It was evident as predicted by Fama (1965), that information efficiency significantly accounted for the changes in Treasury bond yields.

The final objective was to determine the joint effect of bond liquidity, order flow and information efficiency on bond yields. Hypothesis formulated stated that there was no significant joint effect

of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. Results of this study indicated that F-test statistic was statistically significant which meant that the overall model was statistically significant.

The findings revealed an interesting outcome of the study variables. Based on the results of this study the relationship between bond liquidity and bond yields of treasury bonds in Kenya was negative and statistically significant. This meant that for every unit increase in bond liquidity, there was a unit decrease in bond yields of treasury bonds in Kenya. The t-test for bond liquidity was statistically significant, meaning that the regression coefficient for bond liquidity was significantly different from zero. The joint effect of the bond liquidity, order flow and information efficiency accounted for 14.6% of the variance of bond yields. This was higher compared to 8.3% variance caused by bond liquidity on yields of treasury. Though it was slightly lower as compared to the joint variance of bond liquidity and information efficiency at 14.7% as well as slightly lower as compared to the joint variance of bond liquidity and order flow at 14.9%. The findings also established that the joint effect pointed out that order flow was not a significant predictor of Bond Yields. This shown that order flow had significance influence as an individual microstructure element but it lost its influence with interaction with other market microstructure elements.

6.3 Conclusions

The first objective of the study was to establish the effect of bond liquidity on bond yields of treasury bonds in Kenya. Based on the results of this study the relationship between bond liquidity and bond yields of treasury bonds in Kenya shown negative correlation which was and statistically

significant. This means that for every unit increase in bond liquidity would lead to unit decrease in bond yields of treasury bonds in Kenya.

The second objective of the study was to determine the effect of order flow on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Similarly, the relationship between Bond Yields and Order Flow was negative and statistically significant. This was an indication that order flow had a significant impact on Bond Yields of treasury bonds in Kenya. The study established that there was a causal relationship between the Bond liquidity and the Bonds Yields of treasury bonds in Kenya. This meant that traded volume of Kenyan Treasury bond had impact on the Bond Yields. Therefore, a well-organized securities market which facilitates smooth trading od securities would influence the yields of traders.

The third objective was to assess the effect of information efficiency on the relationship between bond liquidity and bond yields of treasury bonds in Kenya. Correlation analysis of the Pairwise coefficient between Bond Yields, Information Efficiency, Order Flow and Bond Liquidity was conducted. Results of this study indicated that there is a very low positive correlation between Bond Yields of treasury bonds in Kenya and Information efficiency, which was statistically significant. This implies that increased information efficiency is associated with better bond yields of treasury bonds in Kenya. The results rejected the null hypothesis meaning that the information efficient had moderating effect on the relationship between the Bond Liquidity and Bond Yields of treasury bonds.

The fourth objective was to determine the joint effect of bond liquidity, order flow and information efficiency on bond yields. The relationship between information efficiency and order flow is

negative, low and statistically significant. Furthermore, the relationship between bond liquidity and order flow was positive and statistically significant. This implies that the growth of order flow was associated with increased bond liquidity. F-test statistic was statistically significant which meant that the overall model was statistically significant. Bond liquidity, order flow and information efficiency jointly account for 14.6% of the variance in bond yields of treasury bonds in Kenya. Hence, the null hypothesis was H_{04} rejected and concluded that there was significant joint effect of bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya.

6.4 Contribution to New Knowledge.

This study contributed to the existing knowledge in academia and provided insights into the Treasury bond market. It assessed adequacy of the existing literature, theory and identified gaps that could serve as guide to future research. The study adopted fixed effects models (FEM) to operationalize and test research hypothesis. Identification of relationship among variables will help securities exchanges and traders make decisions on how to build on the interactions between bond yields and market microstructure elements and provides better understanding of the behavior of yields in bonds markets. The bond liquidity had a negative relationship with bonds yields of treasury bonds. The introduction of the moderators that is the order flow and information efficiency had interesting outcomes. The joint analysis established that order flow was statistically insignificant predictor of bond yields. Though the order flow and information efficiency as standalone positively influenced the Treasury bond yields and were statistically significant. It was also established that the moderators had caused big variance in treasury yields as compared to

individual independent and moderator variables. Theoretically, this study reaffirmed the role of information efficiency in securities hence supporting the Efficient Markets Hypothesis by Fama (1965). This study also supported the Liquidity preference theory as postulated by Keynes (1936) that argue that traders prefer liquid and high interest rates on long-term bonds as compared to short-term securities that are illiquid and relationship between liquidity and yields are inverse.

Secondly, this study was crucial to policy makers concerned with financial development in Kenya. It provided arguments on the operations at the securities exchange and soundness of secondary bonds market that could be used to design optimal regulatory framework. Evidence educed demonstrated relationship between the bond liquidity and bond yields in market. Introduction of moderating variables on the relationship between the bond liquidity and bond yields unraveled differences among the existing empirical evidences. This study indicated that the overall model was statistically significant and that Bond liquidity and Information Efficiency were significant predictors of bond yields. Some empirical evidences under this study had differing findings and seemed to be no consensus on the relationship among bond liquidity, order flow, information efficiency and yields in treasury bonds. Some observed that bond liquidity is correlated to yields, while other studies cited no relationship among the variables.

Thirdly, academicians, management, practitioners and government policymakers were the major beneficiaries of this study. The study findings helped to balance divergent interests of investors and firms thus enhancing investor sentiment and integrity of the bonds market. It identified the bonds that acted as the price leaders at the different parts of the yield curve and determined factors driving yields over time. Descriptive statistics including counts, mean, median, minimum level,

maximum level and standard deviations means for 7 Central Bank of Kenya treasury bonds with tenors of 5, 10, 12, 15, 20, 25 and 30 years for a period of 10 years, between January 2009 and December 2018 were analyzed conclusively in this study. This information is vital for the practitioners and managers of the securities for it helps to make informed investment decisions.

6.5 Recommendations

We recommend the central bank of Kenya to engage the Nairobi Securities exchanges and design good policies that could increase trading of treasury bonds at the secondary market. Public education on available opportunities at the securities exchange as far as available securities are concerned. Treasury bonds investments being safer investments, more emphasizes should be laid on the how Nairobi securities exchange should ensure efficiency in trading securities.

Kenyans are not aware of the investment opportunities at NSE. We therefore recommend civil education initiated to sensitize the Kenyan populace on operations at NSE and excellent opportunities with treasury bonds trading. Trading bonds is an expensive exercise since one required to have at least Ksh50, 000 to purchase bonds. This locks out most of low-income earners; we therefore recommend the minimum amount to be reviewed to reasonable figures.

Contrary to Liquidity preference theory as postulated by Keynes (1936). Investors seem to prefer short-term Treasury bond as opposed to the long-term treasury bonds. Evidence from the analysis done shows that short tenor bonds far outperformed long tenor bonds as analyzed using descriptive statistics. It is important that more emphasizes are laid on long-term investments which gives more rewards. The government should find ways to make Treasury bond with longer tenors more attractive.

To deepen the Treasury bond market and promote financial inclusion, we recommend policy shift and improvement of understanding of the available government bond products and improved customer care practices that would increase trader's subscription. This could revive the performance of the debt instrument.

6.6 Limitations of the study

This study focused only on treasury bonds, sidelining the other securities in the Nairobi securities markets. This might not give conclusive status of the Nairobi Securities exchange. It also means the findings were not reflective of general activities at Nairobi Securities exchange. The study only focused on seven treasury bonds, which had tenors of 5 years and above and were actively traded ignoring bonds with tenors below 5 years. This study focused on Kenyan treasury bonds, meaning it did not cover bonds in other jurisdictions hence creating contextual gaps.

Retrieval of the data from the Nairobi Securities Exchange and the Central bank of Kenya was tedious and resource invoking. Hence, the availability of the data to other stakeholders is not readily available. Inadequate number of studies conducted in Kenya also limited the empirical literature of this study. Bond yields could be influenced many other factors, however this study used the bond liquidity has its main contributor. This could have limited the study findings and as well limited the scope of the study. The tome period of this study was restricted to 10 years, just a year after the bonds automation at Nairobi Securities Exchange. This period was limiting and a broader period would have generated more details on securities trading.

6.7 Suggestions for Further Research

The general objective of this study was to determine the relationship among the bond liquidity, order flow and information efficiency on bond yields of treasury bonds in Kenya. The role of Order Flow and Information Efficiency as moderators in this equation were the main contributions in this study. This study only focused on few microstructure elements yet there are many other variables. Future studies need to include other variables such as inflation, interest rates as a moderator. Probably this would generator different results.

Bond Liquidity, Order Flow, Information Efficient and Bond Liquidity are micro variables of securities markets; however, macro variables such as inflation, Interest rates, government regulations, foreign exchange, automation and public debt can as well contribute to the growth of securities markets. Hence, it is important to carry out research on this area. This study only focused on domestic bonds, however the study suggest that studies could be carried out on Eurobonds, corporate bonds and equity markets

This study used bond liquidity as the independent variable and Bond Yields as the dependent variable of the study. A further research can be conducted to established whether the revere relationship of the variables hold water. The findings for this study are useful in Kenyan context. We suggest further studies conducted in Africa to confirm or refute the findings of this study.

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APPENDICES

APPENDIX I: TREASURY BONDS

Treasury Bonds

1. **5 year bond**
2. **10-year bond**
3. **12-year bond**
4. **15-year bond**
5. **20-year bond**
6. **25-year bond**
7. **30-year bond**

Source: CBK Website

APPENDIX II: SECONDARY DATA CHECK LIST

SECTION A: BOND LIQUIDITY CHECK LIST;

Independent Variable	Measure (KSH)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bond liquidity	Number of Bonds Traded										
	Number of Bonds Issued										
	Turnover Rate										

SECTION B: ORDER FLOW CHECK LIST

Moderating Variable	Measure (KSH)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Order Imbalance	Number of Bonds Traded										
	Price of the Bond										
	Traded Volume										

SECTION C: INFORMATION EFFICENCY CHECKLIST

Moderating Variable	Measure (KSH)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Information Efficiency	Opening Price										
	Closing price										
	Price Dispersion										

SECTION D: BOND YIELDS CHECKLIST

Dependent Variable	Measure	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Bond Yield	Face Value										
	Present value										
	Time Period										
	Yield to Maturity (YTM)										

APPENDIX III: SECONDARY DATA CAPTURE FORM-EXTRACT OF DAILY DATA

Tenor	Date	Coupon_avg	Facevalue_traded_avg	Issued_Quantity_avg	Turnover_rate_avg	Settlement_Amount_avg	Daily_Opening_Price_a
30	2-Mar-2011	12.00	55,000,000	28,144,700,000	0.00195	53,449,080	98
30	3-Mar-2011	12.00	17,500,000	28,144,700,000	0.00062	17,268,695	98
30	17-Mar-2011	12.00	15,000,000	28,144,700,000	0.00053	14,064,765	93
30	22-Mar-2011	12.00	100,000	28,144,700,000	0.00000	93,926	93
30	29-Mar-2011	12.00	67,500,000	28,144,700,000	0.00240	59,773,388	87
30	30-Mar-2011	12.00	10,000,000	28,144,700,000	0.00036	8,945,930	88
30	31-Mar-2011	12.00	24,571,429	28,144,700,000	0.00087	23,642,667	95
30	1-Apr-2011	12.00	33,066,667	28,144,700,000	0.00117	30,495,171	93
30	4-Apr-2011	12.00	104,050,000	28,144,700,000	0.00370	95,495,404	93
30	7-Apr-2011	12.00	19,508,621	28,144,700,000	0.00069	18,008,983	90
30	8-Apr-2011	12.00	7,709,821	28,144,700,000	0.00027	7,111,603	90
30	11-Apr-2011	12.00	22,277,778	28,144,700,000	0.00079	20,601,466	91
30	12-Apr-2011	12.00	33,716,667	28,144,700,000	0.00120	31,213,714	91
30	13-Apr-2011	12.00	150,000,000	28,144,700,000	0.00533	143,818,800	93
30	14-Apr-2011	12.00	30,375,000	28,144,700,000	0.00108	28,199,791	91

30	15-Apr-2011	12.00	1,350,000	28,144,700,000	0.00005	1,260,509	91
30	18-Apr-2011	12.00	50,000,000	28,144,700,000	0.00178	46,343,400	91
30	19-Apr-2011	12.00	30,846,154	28,144,700,000	0.00110	28,618,193	90
30	20-Apr-2011	12.00	50,000,000	28,144,700,000	0.00178	46,410,160	91
30	21-Apr-2011	12.00	261,500,000	28,144,700,000	0.00929	245,592,921	91
30	26-Apr-2011	12.00	820,000	28,144,700,000	0.00003	767,780	91
30	27-Apr-2011	12.00	20,000,000	28,144,700,000	0.00071	18,871,660	92
30	29-Apr-2011	12.00	100,000	28,144,700,000	0.00000	91,919	89
30	3-May-2011	12.00	500,000	28,144,700,000	0.00002	472,064	92
30	5-May-2011	12.00	550,000	28,144,700,000	0.00002	508,759	90
30	9-May-2011	12.00	1,350,000	28,144,700,000	0.00005	1,283,495	92
30	11-May-2011	12.00	662,500	28,144,700,000	0.00002	618,223	90
30	13-May-2011	12.00	50,000	28,144,700,000	0.00000	45,508	89
30	17-May-2011	12.00	14,444,444	28,144,700,000	0.00051	13,706,251	91
30	18-May-2011	12.00	1,466,667	28,144,700,000	0.00005	1,363,908	90

30	19-May-2011	12.00	100,000,000	28,144,700,000	0.00355	92,692,800	90
30	20-May-2011	12.00	76,125,000	28,144,700,000	0.00270	72,270,569	90
30	25-May-2011	12.00	5,000,000	28,144,700,000	0.00018	4,593,490	89
30	26-May-2011	12.00	5,000,000	28,144,700,000	0.00018	4,946,555	96
30	8-Jun-2011	12.00	50,000	28,144,700,000	0.00000	46,067	89
30	10-Jun-2011	12.00	100,000	28,144,700,000	0.00000	95,806	92
30	15-Jun-2011	12.00	23,400,000	28,144,700,000	0.00083	20,933,033	86
30	28-Jun-2011	12.00	1,000,000	28,144,700,000	0.00004	852,624	81
30	11-Jul-2011	12.00	50,000	28,144,700,000	0.00000	47,748	91
30	26-Jul-2011	12.00	50,000	28,144,700,000	0.00000	47,496	90
30	28-Jul-2011	12.00	100,000,000	28,144,700,000	0.00355	95,493,100	90
30	29-Jul-2011	12.00	100,000,000	28,144,700,000	0.00355	95,661,300	90
30	2-Aug-2011	12.00	220,300,000	28,144,700,000	0.00783	213,513,659	91
30	5-Aug-2011	12.00	220,300,000	28,144,700,000	0.00783	226,736,946	97
30	8-Aug-2011	12.00	550,000	28,144,700,000	0.00002	508,729	87
30	17-Aug-2011	12.00	50,000,000	28,144,700,000	0.00178	40,427,650	75

30	19-Aug-2011	12.00	7,142,857	28,144,700,000	0.00025	5,951,343	77
30	29-Aug-2011	12.00	300,000	28,144,700,000	0.00001	235,571	78
30	1-Sep-2011	12.00	100,000	28,144,700,000	0.00000	89,381	89
30	5-Sep-2011	12.00	50,000	28,144,700,000	0.00000	50,000	100
30	6-Sep-2011	12.00	100,000	28,144,700,000	0.00000	74,926	74
30	7-Sep-2011	12.00	1,000,000	28,144,700,000	0.00004	1,000,070	99
30	8-Sep-2011	12.00	10,608,333	28,144,700,000	0.00038	7,826,606	73
30	9-Sep-2011	12.00	50,000	28,144,700,000	0.00000	41,774	83
30	14-Sep-2011	12.00	36,350,000	28,144,700,000	0.00129	26,876,390	73
30	15-Sep-2011	12.00	325,000	28,144,700,000	0.00001	259,240	77
30	16-Sep-2011	12.00	150,000	28,144,700,000	0.00001	112,616	74
30	19-Sep-2011	12.00	850,000	28,144,700,000	0.00003	684,837	88
30	21-Sep-2011	12.00	100,000	28,144,700,000	0.00000	93,395	92
30	22-Sep-2011	12.00	87,083,333	28,144,700,000	0.00309	78,836,972	92
30	23-Sep-2011	12.00	700,000	28,144,700,000	0.00002	589,743	86
30	3-Oct-2011	12.00	50,000	28,144,700,000	0.00000	34,028	66
30	6-Oct-2011	12.00	270,000	28,144,700,000	0.00001	256,764	93
30	7-Oct-2011	12.00	216,667	28,144,700,000	0.00001	204,751	93
30	12-Oct-2011	12.00	100,000	28,144,700,000	0.00000	93,384	91

30	27-Oct-2011	12.00	100,000	28,144,700,000	0.00000	88,048	85
30	28-Oct-2011	12.00	300,000	28,144,700,000	0.00001	264,145	85
30	1-Nov-2011	12.00	350,000	28,144,700,000	0.00001	330,981	92
30	3-Nov-2011	12.00	20,000,000	28,144,700,000	0.00071	17,992,340	89
30	15-Nov-2011	12.00	500,000	28,144,700,000	0.00002	388,789	75
30	22-Nov-2011	12.00	125,000	28,144,700,000	0.00000	97,527	75
30	25-Nov-2011	12.00	50,000	28,144,700,000	0.00000	34,925	66
30	1-Dec-2011	12.00	100,000,000	28,144,700,000	0.00355	91,215,900	88
30	2-Dec-2011	12.00	100,000,000	28,144,700,000	0.00355	91,440,700	88
30	8-Dec-2011	12.00	20,000,000	28,144,700,000	0.00071	17,751,540	85
30	9-Dec-2011	12.00	20,000,000	28,144,700,000	0.00071	17,751,540	85
30	9-Jan-2012	12.00	350,000	28,144,700,000	0.00001	263,123	70
30	12-Jan-2012	12.00	35,000,000	28,144,700,000	0.00124	25,635,540	68
30	13-Jan-2012	12.00	35,000,000	28,144,700,000	0.00124	27,114,010	72
30	19-Jan-2012	12.00	200,000	28,144,700,000	0.00001	190,949	90
30	20-Jan-2012	12.00	1,220,000	28,144,700,000	0.00004	1,167,239	91

30	24-Jan-2012	12.00	200,000	28,144,700,000	0.00001	143,523	66
30	25-Jan-2012	12.00	1,500,000	28,144,700,000	0.00005	1,123,905	70
30	31-Jan-2012	12.00	10,000,000	28,144,700,000	0.00036	9,199,910	86
30	3-Feb-2012	12.00	200,000	28,144,700,000	0.00001	160,934	75
30	10-Feb-2012	12.00	250,000	28,144,700,000	0.00001	201,594	75
30	28-Feb-2012	12.00	1,000,000	28,144,700,000	0.00004	691,072	69
30	2-Mar-2012	12.00	600,000,000	28,144,700,000	0.02132	555,811,200	92
30	7-Mar-2012	12.00	100,000,000	28,144,700,000	0.00355	89,460,800	89
30	13-Mar-2012	12.00	10,200,000	28,144,700,000	0.00036	8,493,037	76
30	14-Mar-2012	12.00	600,000,000	28,144,700,000	0.02132	560,820,000	92
30	15-Mar-2012	12.00	10,700,000	28,144,700,000	0.00038	9,183,592	78
30	19-Mar-2012	12.00	50,000	28,144,700,000	0.00000	35,759	70
30	26-Mar-2012	12.00	200,000	28,144,700,000	0.00001	143,549	70
30	28-Mar-2012	12.00	8,000,000	28,144,700,000	0.00028	6,967,595	87
30	29-Mar-2012	12.00	15,000,000	28,144,700,000	0.00053	13,520,640	89
30	11-Apr-2012	12.00	1,200,000	28,144,700,000	0.00004	964,856	78

30	12-Apr-2012	12.00	350,000,000	28,144,700,000	0.01244	328,855,800	92
30	13-Apr-2012	12.00	100,000	28,144,700,000	0.00000	76,767	75
30	17-Apr-2012	12.00	233,350,000	28,144,700,000	0.00829	227,676,576	87
30	18-Apr-2012	12.00	75,000	28,144,700,000	0.00000	57,516	76
30	19-Apr-2012	12.00	250,000,000	28,144,700,000	0.00888	235,466,500	92
30	23-Apr-2012	12.00	166,666,667	28,144,700,000	0.00592	160,538,000	94
30	24-Apr-2012	12.00	100,000,000	28,144,700,000	0.00355	93,282,300	91
30	2-May-2012	12.00	27,850,000	28,144,700,000	0.00099	25,820,438	89
30	3-May-2012	12.00	166,800,000	28,144,700,000	0.00593	155,621,695	89
30	4-May-2012	12.00	5,336,735	28,144,700,000	0.00019	5,052,650	92
30	7-May-2012	12.00	550,000	28,144,700,000	0.00002	521,263	92
30	10-May-2012	12.00	2,033,333	28,144,700,000	0.00007	1,901,609	91
30	11-May-2012	12.00	1,633,333	28,144,700,000	0.00006	1,538,832	91
30	14-May-2012	12.00	10,000,000	28,144,700,000	0.00036	9,448,490	91
30	15-May-2012	12.00	2,000,000	28,144,700,000	0.00007	1,770,534	85

30	16-May-2012	12.00	200,000,000	28,144,700,000	0.00711	191,899,900	93
30	17-May-2012	12.00	250,125,000	28,144,700,000	0.00889	234,440,921	91
30	18-May-2012	12.00	53,333,333	28,144,700,000	0.00189	51,483,497	93
30	21-May-2012	12.00	375,000	28,144,700,000	0.00001	354,776	91
30	22-May-2012	12.00	17,033,333	28,144,700,000	0.00061	16,641,596	92
30	23-May-2012	12.00	700,000	28,144,700,000	0.00002	636,924	87
30	24-May-2012	12.00	200,000	28,144,700,000	0.00001	177,581	85
30	25-May-2012	12.00	167,016,667	28,144,700,000	0.00593	160,302,482	88
30	28-May-2012	12.00	700,000	28,144,700,000	0.00002	630,620	88
30	29-May-2012	12.00	500,000	28,144,700,000	0.00002	474,367	91
30	30-May-2012	12.00	100,000,000	28,144,700,000	0.00355	96,964,000	93
30	31-May-2012	12.00	167,000,000	28,144,700,000	0.00593	160,761,744	92
30	4-Jun-2012	12.00	50,000	28,144,700,000	0.00000	47,503	91
30	6-Jun-2012	12.00	2,000,000	28,144,700,000	0.00007	1,848,616	89
30	8-Jun-2012	12.00	500,000,000	28,144,700,000	0.01777	483,900,500	85
30	12-Jun-2012	12.00	12,166,667	28,144,700,000	0.00043	10,884,395	87

30	15-Jun-2012	12.00	100,000,000	28,144,700,000	0.00355	97,994,900	94
30	18-Jun-2012	12.00	550,000	28,144,700,000	0.00002	516,531	88
30	19-Jun-2012	12.00	10,000,000	28,144,700,000	0.00036	9,840,370	94
30	22-Jun-2012	12.00	333,333	28,144,700,000	0.00001	318,568	91
30	25-Jun-2012	12.00	5,000,000	28,144,700,000	0.00018	4,651,495	89
30	28-Jun-2012	12.00	500,000,000	28,144,700,000	0.01777	500,694,000	96
30	29-Jun-2012	12.00	500,000,000	28,144,700,000	0.01777	490,609,500	94
30	2-Jul-2012	12.00	100,000	28,144,700,000	0.00000	96,529	92
30	10-Jul-2012	12.00	400,000	28,144,700,000	0.00001	338,908	80
30	12-Jul-2012	12.00	2,000,000	28,144,700,000	0.00007	1,914,080	91
30	13-Jul-2012	12.00	4,160,000	28,144,700,000	0.00015	4,153,115	94
30	16-Jul-2012	12.00	29,700,000	28,144,700,000	0.00106	29,711,524	95
30	17-Jul-2012	12.00	53,500,000	28,144,700,000	0.00190	50,872,570	94
30	18-Jul-2012	12.00	2,200,000	28,144,700,000	0.00008	2,178,345	94
30	19-Jul-2012	12.00	300,000,000	28,144,700,000	0.01066	287,375,700	91
30	20-Jul-2012	12.00	5,263,158	28,144,700,000	0.00019	5,115,763	92

30	24-Jul-2012	12.00	5,882,353	28,144,700,000	0.00021	5,646,706	91
30	25-Jul-2012	12.00	1,950,000	28,144,700,000	0.00007	1,661,392	80
30	27-Jul-2012	12.00	180,050,000	28,144,700,000	0.00640	183,751,278	91
30	31-Jul-2012	12.00	66,700,000	28,144,700,000	0.00237	67,234,457	94
30	3-Aug-2012	12.00	300,000	28,144,700,000	0.00001	281,087	88
30	8-Aug-2012	12.00	102,050,000	28,144,700,000	0.00363	98,479,271	91
30	10-Aug-2012	12.00	51,275,000	28,144,700,000	0.00182	50,548,001	90
30	15-Aug-2012	12.00	12,352,941	28,144,700,000	0.00044	12,118,109	91
30	16-Aug-2012	12.00	50,050,000	28,144,700,000	0.00178	50,913,037	93
30	17-Aug-2012	12.00	233,333,333	28,144,700,000	0.00829	238,646,467	97
30	28-Aug-2012	12.00	70,016,667	28,144,700,000	0.00249	67,910,767	95
30	29-Aug-2012	12.00	73,333,333	28,144,700,000	0.00261	73,380,340	100
30	31-Aug-2012	12.00	10,000,000	28,144,700,000	0.00036	9,264,820	92
30	6-Sep-2012	12.00	104,700,000	28,144,700,000	0.00372	103,042,414	97
30	12-Sep-2012	12.00	200,000,000	28,144,700,000	0.00711	199,432,400	99
30	13-Sep-2012	12.00	600,000	28,144,700,000	0.00002	569,797	94

30	17-Sep-2012	12.00	100,000,000	28,144,700,000	0.00355	97,130,950	96
30	20-Sep-2012	12.00	67,266,667	28,144,700,000	0.00239	65,732,752	95
30	21-Sep-2012	12.00	40,540,000	28,144,700,000	0.00144	41,152,305	94
30	27-Sep-2012	12.00	6,005,556	28,144,700,000	0.00021	6,044,299	86
30	28-Sep-2012	12.00	500,000	28,144,700,000	0.00002	462,584	91
30	4-Oct-2012	12.00	75,000	28,144,700,000	0.00000	65,438	85
30	10-Oct-2012	12.00	100,000,000	28,144,700,000	0.00355	100,938,100	99
30	12-Oct-2012	12.00	14,000,000	28,144,700,000	0.00050	14,207,704	90
30	18-Oct-2012	12.00	200,000	28,144,700,000	0.00001	175,652	85
30	26-Oct-2012	12.00	50,000,000	28,144,700,000	0.00178	48,727,950	95
30	29-Oct-2012	12.00	151,025,000	28,144,700,000	0.00537	154,536,307	101
30	30-Oct-2012	12.00	100,000,000	28,144,700,000	0.00355	106,301,700	104
30	2-Nov-2012	12.00	10,000,000	28,144,700,000	0.00036	8,468,090	82
30	5-Nov-2012	12.00	10,000,000	28,144,700,000	0.00036	10,257,120	100
30	7-Nov-2012	12.00	10,000,000	28,144,700,000	0.00036	10,233,190	99
30	14-Nov-2012	12.00	20,000,000	28,144,700,000	0.00071	17,715,980	85

30	15-Nov-2012	12.00	825,000	28,144,700,000	0.00003	770,877	90
30	16-Nov-2012	12.00	10,000,000	28,144,700,000	0.00036	9,514,980	92
30	19-Nov-2012	12.00	100,000	28,144,700,000	0.00000	93,942	91
30	20-Nov-2012	12.00	50,000	28,144,700,000	0.00000	41,525	80
30	27-Nov-2012	12.00	250,000	28,144,700,000	0.00001	201,823	77
30	3-Dec-2012	12.00	3,000,000	28,144,700,000	0.00011	2,821,029	90
30	4-Dec-2012	12.00	16,733,333	28,144,700,000	0.00059	16,011,706	83
30	7-Dec-2012	12.00	1,000,000	28,144,700,000	0.00004	924,816	89
30	13-Dec-2012	12.00	500,000	28,144,700,000	0.00002	463,405	89
30	17-Dec-2012	12.00	1,000,000	28,144,700,000	0.00004	917,497	88
30	19-Dec-2012	12.00	680,000	28,144,700,000	0.00002	584,431	83
30	27-Dec-2012	12.00	400,000,000	28,144,700,000	0.01421	432,584,800	104
30	9-Jan-2013	12.00	10,250,000	28,144,700,000	0.00036	9,918,622	85
30	11-Jan-2013	12.00	1,175,000	28,144,700,000	0.00004	1,079,771	91
30	17-Jan-2013	12.00	4,500,000	28,144,700,000	0.00016	4,299,192	90
30	25-Jan-2013	12.00	200,000	28,144,700,000	0.00001	194,965	92

30	7-Feb-2013	12.00	133,333	28,144,700,000	0.00000	114,356	80
30	11-Feb-2013	12.00	20,000,000	28,144,700,000	0.00071	19,501,561	90
30	28-Feb-2013	12.00	24,250,000	28,144,700,000	0.00086	25,266,075	104
30	1-Mar-2013	12.00	500,000	28,144,700,000	0.00002	430,828	86
30	7-Mar-2013	12.00	700,000	28,144,700,000	0.00002	700,001	99
30	15-Mar-2013	12.00	28,100,000	28,144,700,000	0.00100	24,888,001	87
30	19-Mar-2013	12.00	28,100,000	28,144,700,000	0.00100	25,348,420	89
30	27-Mar-2013	12.00	100,000	28,144,700,000	0.00000	93,112	92
30	3-Apr-2013	12.00	400,000,000	28,144,700,000	0.01421	431,849,600	106
30	4-Apr-2013	12.00	100,000	28,144,700,000	0.00000	78,986	77
30	10-Apr-2013	12.00	30,050,000	28,144,700,000	0.00107	26,935,607	89
30	12-Apr-2013	12.00	60,000,000	28,144,700,000	0.00213	53,778,600	88
30	15-Apr-2013	12.00	30,500,000	28,144,700,000	0.00108	27,833,104	85
30	23-Apr-2013	12.00	150,000	28,144,700,000	0.00001	142,901	93
30	26-Apr-2013	12.00	212,500	28,144,700,000	0.00001	200,232	92
30	29-Apr-2013	12.00	750,000	28,144,700,000	0.00003	704,122	91

30	30-Apr-2013	12.00	400,000	28,144,700,000	0.00001	375,662	91
30	3-May-2013	12.00	134,100,000	28,144,700,000	0.00476	146,507,233	94
30	7-May-2013	12.00	1,000,000	28,144,700,000	0.00004	901,963	87
30	16-May-2013	12.00	150,000	28,144,700,000	0.00001	135,443	87
30	21-May-2013	12.00	1,125,000	28,144,700,000	0.00004	1,022,528	88
30	22-May-2013	12.00	100,000	28,144,700,000	0.00000	94,983	92
30	23-May-2013	12.00	425,000	28,144,700,000	0.00002	377,679	86
30	24-May-2013	12.00	1,000,000	28,144,700,000	0.00004	940,239	91
30	27-May-2013	12.00	50,000	28,144,700,000	0.00000	45,006	86
30	28-May-2013	12.00	1,000,000	28,144,700,000	0.00004	919,707	89
30	3-Jun-2013	12.00	300,000	28,144,700,000	0.00001	266,597	86
30	14-Jun-2013	12.00	250,000	28,144,700,000	0.00001	249,952	96
30	21-Jun-2013	12.00	8,100,000	28,144,700,000	0.00029	7,415,712	87
30	24-Jun-2013	12.00	1,000,000	28,144,700,000	0.00004	942,817	90
30	27-Jun-2013	12.00	61,000,000	28,144,700,000	0.00217	55,503,595	87
30	4-Jul-2013	12.00	500,000	28,144,700,000	0.00002	470,689	89

30	5-Jul-2013	12.00	7,000,000	28,144,700,000	0.00025	6,122,333	83
30	8-Jul-2013	12.00	6,250,000	28,144,700,000	0.00022	5,777,159	88
30	11-Jul-2013	12.00	40,950,000	28,144,700,000	0.00145	38,814,089	90
30	15-Jul-2013	12.00	150,000	28,144,700,000	0.00001	144,000	91
30	17-Jul-2013	12.00	15,800,000	28,144,700,000	0.00056	14,724,605	88
30	18-Jul-2013	12.00	100,000,000	28,144,700,000	0.00355	95,194,573	90
30	19-Jul-2013	12.00	13,125,000	28,144,700,000	0.00047	12,252,749	88
30	23-Jul-2013	12.00	2,750,000	28,144,700,000	0.00010	2,551,890	87
30	25-Jul-2013	12.00	100,000,000	28,144,700,000	0.00355	95,455,900	90
30	5-Aug-2013	12.00	9,587,037	28,144,700,000	0.00034	8,801,025	86
30	6-Aug-2013	12.00	28,550,000	28,144,700,000	0.00101	26,209,271	86
30	7-Aug-2013	12.00	38,905,556	28,144,700,000	0.00138	36,999,470	85
30	12-Aug-2013	12.00	1,733,333	28,144,700,000	0.00006	1,647,053	87
30	27-Aug-2013	12.00	16,966,667	28,144,700,000	0.00060	14,749,400	86
30	28-Aug-2013	12.00	75,000,000	28,144,700,000	0.00266	66,863,350	89
30	30-Aug-2013	12.00	250,000	28,144,700,000	0.00001	223,307	89

30	3-Sep-2013	12.00	50,000,000	28,144,700,000	0.00178	43,463,400	86
30	4-Sep-2013	12.00	50,000,000	28,144,700,000	0.00178	44,741,650	89
30	9-Sep-2013	12.00	40,333,333	28,144,700,000	0.00143	35,164,988	89
30	10-Sep-2013	12.00	100,000,000	28,144,700,000	0.00355	89,676,200	89
30	11-Sep-2013	12.00	10,100,000	28,144,700,000	0.00036	9,052,253	86
30	16-Sep-2013	12.00	200,000	28,144,700,000	0.00001	183,235	90
30	19-Sep-2013	12.00	40,000,000	28,144,700,000	0.00142	36,429,640	88
30	23-Sep-2013	12.00	200,000	28,144,700,000	0.00001	180,191	89
30	24-Oct-2013	12.00	2,000,000	28,144,700,000	0.00007	1,645,624	80
30	1-Nov-2013	12.00	3,400,000	28,144,700,000	0.00012	2,992,061	86
30	7-Nov-2013	12.00	450,000	28,144,700,000	0.00002	397,776	86
30	11-Nov-2013	12.00	1,650,000	28,144,700,000	0.00006	1,438,097	86
30	12-Nov-2013	12.00	3,000,000	28,144,700,000	0.00011	2,657,760	86
30	14-Nov-2013	12.00	100,000,000	28,144,700,000	0.00355	111,000,000	108
30	15-Nov-2013	12.00	100,000,000	28,144,700,000	0.00355	111,231,800	108
30	21-Nov-2013	12.00	27,272,727	28,144,700,000	0.00097	28,421,018	88

30	22-Nov-2013	12.00	200,000	28,144,700,000	0.00001	183,915	89
30	25-Nov-2013	12.00	100,000,000	28,144,700,000	0.00355	92,381,900	89
30	5-Dec-2013	12.00	15,000,000	28,144,700,000	0.00053	13,634,085	87
30	6-Dec-2013	12.00	150,000,000	28,144,700,000	0.00533	139,759,350	89
30	16-Dec-2013	12.00	95,000,000	28,144,700,000	0.00338	84,095,995	84
30	17-Dec-2013	12.00	2,500,000	28,144,700,000	0.00009	2,251,410	86
30	18-Dec-2013	12.00	47,500,000	28,144,700,000	0.00169	42,992,303	86
30	19-Dec-2013	12.00	95,000,000	28,144,700,000	0.00338	88,490,505	89
30	23-Dec-2013	12.00	30,000,000	28,144,700,000	0.00107	27,364,440	87
30	27-Dec-2013	12.00	1,500,000	28,144,700,000	0.00005	1,337,811	86
30	30-Dec-2013	12.00	125,000	28,144,700,000	0.00000	108,909	84
30	13-Jan-2014	12.00	1,050,000	28,144,700,000	0.00004	956,577	90
30	14-Jan-2014	12.00	500,000	28,144,700,000	0.00002	453,289	86
30	21-Jan-2014	12.00	26,000,000	28,144,700,000	0.00092	23,633,090	86
30	22-Jan-2014	12.00	50,000,000	28,144,700,000	0.00178	47,095,150	89

30	27-Jan-2014	12.00	2,500,000	28,144,700,000	0.00009	2,163,153	81
30	28-Jan-2014	12.00	5,000,000	28,144,700,000	0.00018	4,558,230	86
30	5-Feb-2014	12.00	48,200,000	28,144,700,000	0.00171	45,527,553	87
30	10-Feb-2014	12.00	100,000,000	28,144,700,000	0.00355	115,517,300	109
30	11-Feb-2014	12.00	33,533,333	28,144,700,000	0.00119	38,694,281	92
30	13-Feb-2014	12.00	200,000,000	28,144,700,000	0.00711	231,303,000	109
30	25-Feb-2014	12.00	9,500,000	28,144,700,000	0.00034	8,067,448	84
30	27-Feb-2014	12.00	9,500,000	28,144,700,000	0.00034	8,543,464	89
30	28-Feb-2014	12.00	18,244,828	28,144,700,000	0.00065	16,096,202	88
30	3-Mar-2014	12.00	38,100,000	28,144,700,000	0.00135	34,254,519	88
30	4-Mar-2014	12.00	148,500,000	28,144,700,000	0.00528	134,624,012	90
30	5-Mar-2014	12.00	3,000,000	28,144,700,000	0.00011	2,719,677	90
30	10-Mar-2014	12.00	900,000	28,144,700,000	0.00003	766,329	85
30	12-Mar-2014	12.00	50,000	28,144,700,000	0.00000	43,030	85
30	25-Mar-2014	12.00	500,000	28,144,700,000	0.00002	435,087	86
30	26-Mar-2014	12.00	100,000	28,144,700,000	0.00000	87,017	86

30	1-Apr-2014	12.00	800,000	28,144,700,000	0.00003	650,418	80
30	2-Apr-2014	12.00	150,000	28,144,700,000	0.00001	120,134	78
30	22-Apr-2014	12.00	50,000,000	28,144,700,000	0.00178	46,185,800	90
30	23-Apr-2014	12.00	150,000,000	28,144,700,000	0.00533	141,143,250	92
30	25-Apr-2014	12.00	1,050,000	28,144,700,000	0.00004	1,006,819	90
30	30-Apr-2014	12.00	300,000	28,144,700,000	0.00001	277,516	88
30	12-May-2014	12.00	27,156,250	28,144,700,000	0.00096	25,172,785	90
30	13-May-2014	12.00	7,850,000	28,144,700,000	0.00028	7,275,696	89
30	14-May-2014	12.00	271,500,000	28,144,700,000	0.00965	257,339,103	92
30	15-May-2014	12.00	178,500,000	28,144,700,000	0.00634	169,189,797	92
30	28-May-2014	12.00	100,000,000	28,144,700,000	0.00355	93,257,200	90
30	3-Jun-2014	12.00	100,000,000	28,144,700,000	0.00355	95,243,700	92
30	10-Jun-2014	12.00	500,000	28,144,700,000	0.00002	432,894	83
30	18-Jun-2014	12.00	2,000,000	28,144,700,000	0.00007	1,760,580	84
30	20-Jun-2014	12.00	1,100,000	28,144,700,000	0.00004	968,732	88
30	25-Jun-2014	12.00	2,000,000	28,144,700,000	0.00007	1,800,898	86

30	10-Jul-2014	12.00	1,400,000	28,144,700,000	0.00005	1,268,149	86
30	24-Jul-2014	12.00	100,000	28,144,700,000	0.00000	100,000	95
30	31-Jul-2014	12.00	383,333	28,144,700,000	0.00001	359,873	89
30	7-Aug-2014	12.00	2,600,000	28,144,700,000	0.00009	2,472,868	89
30	8-Aug-2014	12.00	3,025,000	28,144,700,000	0.00011	2,827,981	90
30	11-Aug-2014	12.00	10,000,000	28,144,700,000	0.00036	9,317,020	87
30	12-Aug-2014	12.00	20,000,000	28,144,700,000	0.00071	19,354,700	91
30	13-Aug-2014	12.00	10,000,000	28,144,700,000	0.00036	9,166,410	86
30	14-Aug-2014	12.00	20,000,000	28,144,700,000	0.00071	19,641,280	92
30	4-Sep-2014	12.00	50,000	28,144,700,000	0.00000	43,199	86
30	11-Sep-2014	12.00	466,667	28,144,700,000	0.00002	408,788	86
30	12-Sep-2014	12.00	32,933,333	28,144,700,000	0.00117	28,912,338	87
30	17-Sep-2014	12.00	50,000	28,144,700,000	0.00000	43,425	86
30	22-Sep-2014	12.00	7,500,000	28,144,700,000	0.00027	6,576,443	87
30	24-Sep-2014	12.00	100,000	28,144,700,000	0.00000	87,076	86
30	30-Sep-2014	12.00	100,000	28,144,700,000	0.00000	87,303	86

30	2-Oct-2014	12.00	1,100,000	28,144,700,000	0.00004	960,322	86
30	3-Oct-2014	12.00	68,750,000	28,144,700,000	0.00244	60,337,919	86
30	6-Oct-2014	12.00	100,000,000	28,144,700,000	0.00355	88,724,100	87
30	7-Oct-2014	12.00	50,000,000	28,144,700,000	0.00178	44,832,600	88
30	8-Oct-2014	12.00	50,000,000	28,144,700,000	0.00178	45,328,900	89
30	10-Oct-2014	12.00	10,000,000	28,144,700,000	0.00036	8,759,540	86
30	13-Oct-2014	12.00	12,451,515	28,144,700,000	0.00044	11,238,068	88
30	14-Oct-2014	12.00	10,000,000	28,144,700,000	0.00036	9,085,320	89
30	21-Oct-2014	12.00	1,100,000	28,144,700,000	0.00004	967,497	86
30	22-Oct-2014	12.00	1,100,000	28,144,700,000	0.00004	1,002,260	89
30	29-Oct-2014	12.00	25,000,000	28,144,700,000	0.00089	22,835,925	89
30	30-Oct-2014	12.00	2,225,000	28,144,700,000	0.00008	1,974,835	86
30	31-Oct-2014	12.00	50,000,000	28,144,700,000	0.00178	46,744,950	91
30	4-Nov-2014	12.00	4,750,000	28,144,700,000	0.00017	4,348,179	89
30	5-Nov-2014	12.00	5,000,000	28,144,700,000	0.00018	4,577,025	89
30	6-Nov-2014	12.00	100,000,000	28,144,700,000	0.00355	93,889,700	91
30	11-Nov-2014	12.00	10,000,000	28,144,700,000	0.00036	9,128,140	88

30	19-Nov-2014	12.00	1,500,000	28,144,700,000	0.00005	1,441,499	93
30	24-Nov-2014	12.00	20,000,000	28,144,700,000	0.00071	17,601,780	85
30	25-Nov-2014	12.00	24,250,000	28,144,700,000	0.00086	22,690,827	90
30	26-Nov-2014	12.00	76,166,667	28,144,700,000	0.00271	71,396,233	90
30	28-Nov-2014	12.00	450,000	28,144,700,000	0.00002	406,943	87
30	1-Dec-2014	12.00	1,000,000	28,144,700,000	0.00004	911,564	87
30	4-Dec-2014	12.00	118,575,000	28,144,700,000	0.00421	110,033,561	89
30	5-Dec-2014	12.00	200,000,000	28,144,700,000	0.00711	189,828,600	91
30	17-Dec-2014	12.00	575,000	28,144,700,000	0.00002	524,868	82
30	18-Dec-2014	12.00	1,000,000	28,144,700,000	0.00004	910,972	87
30	19-Dec-2014	12.00	2,050,000	28,144,700,000	0.00007	1,954,599	91
30	22-Dec-2014	12.00	100,000	28,144,700,000	0.00000	80,000	76
30	21-Jan-2015	12.00	150,000,000	28,144,700,000	0.00533	143,172,750	90
30	22-Jan-2015	12.00	150,000,000	28,144,700,000	0.00533	144,730,950	91
30	26-Jan-2015	12.00	125,000	28,144,700,000	0.00000	114,107	86
30	6-Feb-2015	12.00	683,333	28,144,700,000	0.00002	638,622	86

30	12-Feb-2015	12.00	5,000,000	28,144,700,000	0.00018	4,558,065	85
30	13-Feb-2015	12.00	5,000,000	28,144,700,000	0.00018	4,811,410	90
30	24-Feb-2015	12.00	550,000	28,144,700,000	0.00002	473,934	86
30	25-Feb-2015	12.00	215,000,000	28,144,700,000	0.00764	190,670,385	88
30	26-Feb-2015	12.00	163,333,333	28,144,700,000	0.00580	148,880,578	89
30	5-Mar-2015	12.00	3,000,000	28,144,700,000	0.00011	2,590,863	86
30	6-Mar-2015	12.00	1,166,667	28,144,700,000	0.00004	1,052,704	89
30	9-Mar-2015	12.00	50,000,000	28,144,700,000	0.00178	45,017,200	89
30	10-Mar-2015	12.00	100,000,000	28,144,700,000	0.00355	91,467,250	90
30	2-Apr-2015	12.00	100,000	28,144,700,000	0.00000	87,363	86
30	9-Apr-2015	12.00	1,000,000	28,144,700,000	0.00004	888,158	87
30	14-Apr-2015	12.00	15,000,000	28,144,700,000	0.00053	13,680,240	89
30	30-Apr-2015	12.00	27,750,000	28,144,700,000	0.00099	25,809,831	90
30	8-May-2015	12.00	13,600,000	28,144,700,000	0.00048	12,570,450	88
30	25-May-2015	12.00	111,600,000	28,144,700,000	0.00397	104,752,894	90
30	4-Jun-2015	12.00	21,000,000	28,144,700,000	0.00075	19,490,940	89

30	19-Jun-2015	12.00	250,000	28,144,700,000	0.00001	204,200	77
30	26-Jun-2015	12.00	1,500,000	28,144,700,000	0.00005	1,100,915	69
30	1-Jul-2015	12.00	1,500,000	28,144,700,000	0.00005	1,269,959	80
30	2-Jul-2015	12.00	1,700,000	28,144,700,000	0.00006	1,536,278	86
30	9-Jul-2015	12.00	1,000,000	28,144,700,000	0.00004	885,375	84
30	20-Jul-2015	12.00	1,500,000	28,144,700,000	0.00005	1,279,584	80
30	21-Jul-2015	12.00	1,500,000	28,144,700,000	0.00005	1,392,864	87
30	22-Jul-2015	12.00	6,400,000	28,144,700,000	0.00023	5,807,533	85
30	3-Aug-2015	12.00	19,665,789	28,144,700,000	0.00070	17,984,522	86
30	4-Aug-2015	12.00	200,000,000	28,144,700,000	0.00711	185,136,325	87
30	5-Aug-2015	12.00	47,300,000	28,144,700,000	0.00168	43,688,692	86
30	6-Aug-2015	12.00	73,650,000	28,144,700,000	0.00262	68,970,942	88
30	11-Aug-2015	12.00	50,000	28,144,700,000	0.00000	40,541	75
30	3-Sep-2015	12.00	850,000	28,144,700,000	0.00003	686,977	80
30	14-Sep-2015	12.00	35,000,000	28,144,700,000	0.00124	29,773,205	84
30	15-Sep-2015	12.00	24,000,000	28,144,700,000	0.00085	20,735,652	84
30	16-Sep-2015	12.00	75,000	28,144,700,000	0.00000	57,893	77

30	21-Sep-2015	12.00	53,333,333	28,144,700,000	0.00189	44,877,600	83
30	22-Sep-2015	12.00	20,000,000	28,144,700,000	0.00071	16,829,120	83
30	23-Sep-2015	12.00	100,500,000	28,144,700,000	0.00357	86,377,567	85
30	24-Sep-2015	12.00	100,000,000	28,144,700,000	0.00355	86,566,500	85
30	28-Sep-2015	12.00	100,000	28,144,700,000	0.00000	62,894	61
30	29-Sep-2015	12.00	200,000	28,144,700,000	0.00001	168,810	83
30	1-Oct-2015	12.00	1,000,000	28,144,700,000	0.00004	905,443	89
30	7-Oct-2015	12.00	800,000	28,144,700,000	0.00003	655,361	80
30	12-Oct-2015	12.00	150,000	28,144,700,000	0.00001	121,211	78
30	13-Oct-2015	12.00	1,000,000	28,144,700,000	0.00004	821,157	80
30	14-Oct-2015	12.00	100,000	28,144,700,000	0.00000	81,855	80
30	15-Oct-2015	12.00	2,350,000	28,144,700,000	0.00008	2,063,697	86
30	21-Oct-2015	12.00	100,000	28,144,700,000	0.00000	76,684	74
30	22-Oct-2015	12.00	4,700,000	28,144,700,000	0.00017	4,031,566	83
30	27-Oct-2015	12.00	100,000	28,144,700,000	0.00000	86,000	83
30	11-Nov-2015	12.00	80,000,000	28,144,700,000	0.00284	72,215,440	87

30	12-Nov-2015	12.00	39,400,000	28,144,700,000	0.00140	35,566,104	87
30	13-Nov-2015	12.00	237,600,000	28,144,700,000	0.00844	223,007,796	91
30	25-Nov-2015	12.00	100,000	28,144,700,000	0.00000	80,273	77
30	27-Nov-2015	12.00	400,000	28,144,700,000	0.00001	374,753	90
30	22-Dec-2015	12.00	200,000	28,144,700,000	0.00001	244,416	118
30	8-Jan-2016	12.00	200,000	28,144,700,000	0.00001	245,532	118
30	20-Jan-2016	12.00	100,000,000	28,144,700,000	0.00355	88,689,300	83
30	22-Jan-2016	12.00	17,500,000	28,144,700,000	0.00062	16,596,720	89
30	25-Jan-2016	12.00	30,000,000	28,144,700,000	0.00107	28,451,550	89
30	29-Jan-2016	12.00	16,666,667	28,144,700,000	0.00059	14,934,233	84
30	2-Feb-2016	12.00	50,000,000	28,144,700,000	0.00178	45,741,250	86
30	3-Feb-2016	12.00	50,000,000	28,144,700,000	0.00178	44,599,450	83
30	4-Feb-2016	12.00	50,000,000	28,144,700,000	0.00178	47,673,450	89
30	11-Feb-2016	12.00	100,000	28,144,700,000	0.00000	86,160	80
30	8-Mar-2016	12.00	34,750,000	28,144,700,000	0.00123	30,332,580	86
30	10-Mar-2016	12.00	69,500,000	28,144,700,000	0.00247	61,438,556	87
30	14-Mar-2016	12.00	19,227,273	28,144,700,000	0.00068	16,432,220	83

30	15-Mar-2016	12.00	100,000,000	28,144,700,000	0.00355	88,438,700	87
30	18-Mar-2016	12.00	350,000	28,144,700,000	0.00001	300,001	84
30	6-Apr-2016	12.00	200,000	28,144,700,000	0.00001	179,999	88
30	13-Apr-2016	12.00	400,000	28,144,700,000	0.00001	349,652	85
30	21-Apr-2016	12.00	166,350,000	28,144,700,000	0.00591	141,714,729	83
30	25-Apr-2016	12.00	100,000,000	28,144,700,000	0.00355	84,204,400	82
30	26-Apr-2016	12.00	1,000,000	28,144,700,000	0.00004	776,051	75
30	27-Apr-2016	12.00	37,900,000	28,144,700,000	0.00135	32,692,763	82
30	28-Apr-2016	12.00	38,233,333	28,144,700,000	0.00136	33,664,716	83
30	29-Apr-2016	12.00	13,700,000	28,144,700,000	0.00049	12,102,676	86
30	3-May-2016	12.00	75,000	28,144,700,000	0.00000	71,215	88
30	23-May-2016	12.00	50,000	28,144,700,000	0.00000	51,478	99
30	30-May-2016	12.00	4,125,000	28,144,700,000	0.00015	3,548,135	82
30	31-May-2016	12.00	16,500,000	28,144,700,000	0.00059	16,403,987	96
30	8-Jun-2016	12.00	25,840,000	28,144,700,000	0.00092	22,214,956	80
30	9-Jun-2016	12.00	64,600,000	28,144,700,000	0.00230	57,965,903	86

30	10-Jun-2016	12.00	100,000	28,144,700,000	0.00000	80,000	76
30	20-Jun-2016	12.00	3,225,000	28,144,700,000	0.00011	2,885,484	83
30	21-Jun-2016	12.00	6,400,000	28,144,700,000	0.00023	6,050,938	90
30	6-Jul-2016	12.00	50,000	28,144,700,000	0.00000	43,000	81
30	15-Jul-2016	12.00	5,000,000	28,144,700,000	0.00018	4,283,995	80
30	18-Jul-2016	12.00	3,000,000	28,144,700,000	0.00011	2,604,964	79
30	20-Jul-2016	12.00	6,000,000	28,144,700,000	0.00021	5,852,346	92
30	21-Jul-2016	12.00	10,000,000	28,144,700,000	0.00036	10,000,000	95
30	29-Jul-2016	12.00	300,000	28,144,700,000	0.00001	270,000	84
30	2-Aug-2016	12.00	1,300,000	28,144,700,000	0.00005	1,116,606	80
30	3-Aug-2016	12.00	1,300,000	28,144,700,000	0.00005	1,274,165	92
30	10-Aug-2016	12.00	200,000	28,144,700,000	0.00001	180,000	84
30	30-Aug-2016	12.00	11,800,000	28,144,700,000	0.00042	9,471,671	80
30	6-Sep-2016	12.00	2,250,000	28,144,700,000	0.00008	1,823,117	80
30	13-Sep-2016	12.00	1,150,000	28,144,700,000	0.00004	1,073,723	92
30	14-Sep-2016	12.00	600,000	28,144,700,000	0.00002	487,713	80

30	16-Sep-2016	12.00	2,166,667	28,144,700,000	0.00008	1,911,469	83
30	19-Sep-2016	12.00	1,100,000	28,144,700,000	0.00004	902,155	81
30	20-Sep-2016	12.00	6,000,000	28,144,700,000	0.00021	5,963,040	98
30	23-Sep-2016	12.00	180,000,000	28,144,700,000	0.00640	149,993,640	82
30	26-Sep-2016	12.00	180,000,000	28,144,700,000	0.00640	157,796,100	86
30	30-Sep-2016	12.00	1,000,000	28,144,700,000	0.00004	767,999	75
30	4-Oct-2016	12.00	25,000,000	28,144,700,000	0.00089	22,057,125	86
30	5-Oct-2016	12.00	60,000,000	28,144,700,000	0.00213	53,324,820	87
30	7-Oct-2016	12.00	79,158,333	28,144,700,000	0.00281	70,711,043	87
30	10-Oct-2016	12.00	15,000,000	28,144,700,000	0.00053	13,340,940	87
30	12-Oct-2016	12.00	3,000,000	28,144,700,000	0.00011	2,656,770	86
30	14-Oct-2016	12.00	100,000	28,144,700,000	0.00000	85,033	83
30	19-Oct-2016	12.00	500,000	28,144,700,000	0.00002	425,819	83
30	25-Oct-2016	12.00	666,667	28,144,700,000	0.00002	588,730	86
30	26-Oct-2016	12.00	2,500,000	28,144,700,000	0.00009	2,513,050	98
30	27-Oct-2016	12.00	50,000,000	28,144,700,000	0.00178	44,797,200	87

30	28-Oct-2016	12.00	75,000,000	28,144,700,000	0.00266	67,829,400	88
30	31-Oct-2016	12.00	50,000,000	28,144,700,000	0.00178	45,173,650	88
30	1-Nov-2016	12.00	50,000,000	28,144,700,000	0.00178	50,293,750	98
30	7-Nov-2016	12.00	65,000,000	28,144,700,000	0.00231	58,471,660	87
30	8-Nov-2016	12.00	65,000,000	28,144,700,000	0.00231	59,306,130	88
30	15-Dec-2016	12.00	100,000	28,144,700,000	0.00000	81,769	77
30	10-Jan-2017	12.00	37,400,000	28,144,700,000	0.00133	33,986,801	86
30	12-Jan-2017	12.00	37,400,000	28,144,700,000	0.00133	34,922,549	88
30	17-Jan-2017	12.00	150,000	28,144,700,000	0.00001	120,000	75
30	19-Jan-2017	12.00	34,400,000	28,144,700,000	0.00122	29,794,425	81
30	30-Jan-2017	12.00	6,400,000	28,144,700,000	0.00023	5,528,550	81
30	1-Feb-2017	12.00	6,600,000	28,144,700,000	0.00023	5,736,133	81
30	2-Feb-2017	12.00	50,000	28,144,700,000	0.00000	43,002	80
30	9-Feb-2017	12.00	1,033,333	28,144,700,000	0.00004	894,745	78
30	21-Feb-2017	12.00	50,000	28,144,700,000	0.00000	47,069	94
30	28-Feb-2017	12.00	50,000	28,144,700,000	0.00000	54,325	108

30	8-Mar-2017	12.00	6,200,000	28,144,700,000	0.00022	5,097,838	81
30	10-Mar-2017	12.00	2,550,000	28,144,700,000	0.00009	2,142,232	83
30	14-Mar-2017	12.00	7,366,667	28,144,700,000	0.00026	6,231,935	84
30	15-Mar-2017	12.00	8,500,000	28,144,700,000	0.00030	7,132,512	83
30	20-Mar-2017	12.00	16,000,000	28,144,700,000	0.00057	13,409,744	82
30	18-Apr-2017	12.00	50,000	28,144,700,000	0.00000	41,234	80
30	25-Apr-2017	12.00	3,000,000	28,144,700,000	0.00011	2,563,044	83
30	28-Apr-2017	12.00	150,000	28,144,700,000	0.00001	126,000	81
30	11-May-2017	12.00	50,000	28,144,700,000	0.00000	60,318	118
30	17-May-2017	12.00	1,500,000	28,144,700,000	0.00005	1,313,906	84
30	12-Jun-2017	12.00	50,000	28,144,700,000	0.00000	42,000	80
30	16-Jun-2017	12.00	800,000	28,144,700,000	0.00003	697,284	83
30	28-Jun-2017	12.00	78,500,000	28,144,700,000	0.00279	71,377,372	86
30	6-Jul-2017	12.00	50,000	28,144,700,000	0.00000	40,000	75
30	27-Jul-2017	12.00	100,000	28,144,700,000	0.00000	88,444	83
30	31-Jul-2017	12.00	1,000,000	28,144,700,000	0.00004	895,357	84

Continuation

Tenor	Date	Daily_Opening_Price_avg	Present_value_avg	YTM_avg	Traded_volume_avg	Daily Closing Price_avg	Price_Dispersion_avg
30	2-Mar-2011	98.23	53,409,535	12.21	55,000,000	98.23	0.0000
30	3-Mar-2011	98.70	17,250,563	12.16	17,500,000	97.10	-1.6055
30	17-Mar-2011	93.17	13,975,755	12.90	15,000,000	93.17	-0.0036
30	22-Mar-2011	93.17	93,168	12.90	100,000	88.92	-4.2456
30	29-Mar-2011	87.19	59,119,563	13.55	67,500,000	87.11	-0.0809
30	30-Mar-2011	88.44	8,843,730	13.60	10,000,000	96.08	7.6442
30	31-Mar-2011	95.76	23,398,243	12.55	24,571,429	95.72	-0.0353
30	1-Apr-2011	93.83	30,146,351	12.82	33,066,667	93.13	-0.6994
30	4-Apr-2011	93.24	94,294,879	12.90	104,050,000	93.58	0.3355
30	7-Apr-2011	90.94	17,753,023	13.22	19,508,621	90.94	0.0000
30	8-Apr-2011	90.91	7,009,839	13.23	7,709,821	90.91	0.0000
30	11-Apr-2011	91.07	20,289,341	13.20	22,277,778	91.14	0.0607
30	12-Apr-2011	91.35	30,736,078	13.16	33,716,667	91.85	0.4947
30	13-Apr-2011	93.57	141,610,050	12.85	150,000,000	91.07	-2.5000
30	14-Apr-2011	91.33	27,757,386	13.16	30,375,000	91.50	0.1706
30	15-Apr-2011	91.76	1,238,701	13.10	1,350,000	91.07	-0.6842
30	18-Apr-2011	91.07	45,535,700	13.20	50,000,000	90.74	-0.3362
30	19-Apr-2011	90.71	28,101,067	13.25	30,846,154	90.84	0.1302
30	20-Apr-2011	91.41	45,569,510	13.15	50,000,000	91.65	0.2421
30	21-Apr-2011	91.83	241,110,027	13.09	261,500,000	91.58	-0.2432
30	26-Apr-2011	91.75	752,371	13.10	820,000	91.89	0.1387
30	27-Apr-2011	92.45	18,489,240	13.00	20,000,000	87.47	-4.9763

30	29-Apr-2011	89.96	89,958	13.38	100,000	92.36	2.4000
30	3-May-2011	92.27	461,349	13.03	500,000	90.39	-1.8781
30	5-May-2011	90.39	497,154	13.30	550,000	92.86	2.4732
30	9-May-2011	92.86	1,253,676	12.94	1,350,000	90.39	-2.4749
30	11-May-2011	90.73	602,279	13.25	662,500	90.57	-0.1648
30	13-May-2011	89.07	44,536	13.50	50,000	90.39	1.3179
30	17-May-2011	91.48	13,330,060	13.14	14,444,444	91.48	0.0000
30	18-May-2011	90.39	1,325,710	13.30	1,466,667	90.28	-0.1113
30	19-May-2011	90.06	90,055,400	13.35	100,000,000	91.06	1.0085
30	20-May-2011	90.73	70,175,991	13.25	76,125,000	90.48	-0.2495
30	25-May-2011	89.07	4,453,380	13.50	5,000,000	96.06	6.9954
30	26-May-2011	96.06	4,803,150	12.50	5,000,000	89.07	-6.9950
30	8-Jun-2011	89.07	44,534	13.50	50,000	92.44	3.3753
30	10-Jun-2011	92.44	92,443	13.00	100,000	89.18	-3.2609
30	15-Jun-2011	86.97	20,107,729	13.83	23,400,000	85.43	-1.5384
30	28-Jun-2011	81.31	813,064	14.80	1,000,000	91.08	9.7711
30	11-Jul-2011	91.08	45,539	13.20	50,000	90.08	-0.9980
30	26-Jul-2011	90.08	45,040	13.35	50,000	90.55	0.4685
30	28-Jul-2011	90.55	90,548,000	13.28	100,000,000	90.68	0.1353
30	29-Jul-2011	90.68	90,683,300	13.26	100,000,000	91.78	1.0933
30	2-Aug-2011	91.78	202,183,850	13.10	220,300,000	97.61	5.8376
30	5-Aug-2011	97.61	215,044,083	12.30	220,300,000	87.19	-10.4257
30	8-Aug-2011	87.19	479,537	13.80	550,000	75.25	-11.9376
30	17-Aug-2011	75.25	37,625,450	16.00	50,000,000	76.47	1.2153
30	19-Aug-2011	77.68	5,548,671	15.50	7,142,857	77.74	0.0602
30	29-Aug-2011	78.52	235,571	16.50	300,000	89.12	10.5932
30	1-Sep-2011	89.12	89,117	13.50	100,000	100.00	10.8830

30	5-Sep-2011	100.00	50,000	12.00	50,000	74.79	-25.2061
30	6-Sep-2011	74.79	74,794	16.10	100,000	99.71	24.9164
30	7-Sep-2011	99.71	997,103	12.04	1,000,000	73.42	-26.2950
30	8-Sep-2011	73.42	7,788,140	16.40	10,608,333	75.02	1.6010
30	9-Sep-2011	83.02	41,511	14.50	50,000	73.41	-9.6107
30	14-Sep-2011	73.41	26,684,644	16.40	36,350,000	75.25	1.8390
30	15-Sep-2011	77.76	257,089	15.50	325,000	77.41	-0.3498
30	16-Sep-2011	74.55	111,825	16.15	150,000	95.74	21.1874
30	19-Sep-2011	88.33	679,625	13.78	850,000	87.79	-0.5442
30	21-Sep-2011	92.47	92,472	13.00	100,000	95.57	3.0950
30	22-Sep-2011	92.82	78,118,819	12.96	87,083,333	92.80	-0.0202
30	23-Sep-2011	86.75	583,796	14.04	700,000	81.02	-5.7343
30	3-Oct-2011	66.84	33,418	18.00	50,000	92.72	25.8848
30	6-Oct-2011	93.66	252,937	12.83	270,000	94.13	0.4714
30	7-Oct-2011	93.49	201,624	12.86	216,667	92.39	-1.1028
30	12-Oct-2011	91.77	91,769	13.10	100,000	85.94	-5.8304
30	27-Oct-2011	85.94	85,938	14.00	100,000	85.94	0.0000
30	28-Oct-2011	85.94	257,815	14.00	300,000	92.46	6.5179
30	1-Nov-2011	92.46	323,597	13.00	350,000	89.04	-3.4176
30	3-Nov-2011	89.04	17,807,720	13.51	20,000,000	75.22	-13.8194
30	15-Nov-2011	75.22	376,096	16.00	500,000	75.22	-0.0002
30	22-Nov-2011	75.22	94,024	16.00	125,000	71.02	-4.2007
30	25-Nov-2011	66.82	33,409	18.00	50,000	88.12	21.2994
30	1-Dec-2011	88.12	88,117,000	13.65	100,000,000	88.31	0.1918
30	2-Dec-2011	88.31	88,308,800	13.62	100,000,000	85.43	-2.8808
30	8-Dec-2011	85.43	17,085,600	14.08	20,000,000	85.43	0.0000
30	9-Dec-2011	85.43	17,085,600	14.08	20,000,000	70.79	-14.6347

30	9-Jan-2012	70.79	247,777	17.00	350,000	69.78	-1.0162
30	12-Jan-2012	68.76	24,066,315	17.50	35,000,000	72.95	4.1912
30	13-Jan-2012	72.95	25,533,235	16.50	35,000,000	90.73	17.7750
30	19-Jan-2012	90.73	181,454	13.25	200,000	90.48	-0.2504
30	20-Jan-2012	91.79	1,110,048	13.10	1,220,000	87.07	-4.7255
30	24-Jan-2012	66.85	133,699	18.00	200,000	70.01	3.1655
30	25-Jan-2012	70.01	1,050,224	17.00	1,500,000	86.89	16.8743
30	31-Jan-2012	86.89	8,688,920	13.85	10,000,000	75.26	-11.6308
30	3-Feb-2012	75.26	150,517	16.00	200,000	75.26	0.0055
30	10-Feb-2012	75.26	188,160	16.00	250,000	69.01	-6.2556
30	28-Feb-2012	69.01	690,083	17.45	1,000,000	92.50	23.4950
30	2-Mar-2012	92.50	555,019,800	13.00	600,000,000	89.13	-3.3722
30	7-Mar-2012	89.13	89,131,100	13.50	100,000,000	83.04	-6.0881
30	13-Mar-2012	76.94	8,445,964	15.75	10,200,000	81.85	4.9168
30	14-Mar-2012	92.88	557,259,600	12.95	600,000,000	85.98	-6.8937
30	15-Mar-2012	78.94	9,129,691	15.38	10,700,000	71.36	-7.5789
30	19-Mar-2012	70.83	35,413	17.00	50,000	70.82	-0.0068
30	26-Mar-2012	70.82	141,637	17.00	200,000	85.97	15.1549
30	28-Mar-2012	87.55	6,893,582	13.75	8,000,000	89.12	1.5712
30	29-Mar-2012	89.12	13,367,340	13.50	15,000,000	78.95	-10.1614
30	11-Apr-2012	78.95	947,450	15.25	1,200,000	92.48	13.5211
30	12-Apr-2012	92.48	323,663,550	13.00	350,000,000	83.86	-8.6125
30	13-Apr-2012	75.25	75,250	16.00	100,000	70.80	-4.4455
30	17-Apr-2012	87.66	224,214,801	14.00	233,350,000	87.66	-0.0009
30	18-Apr-2012	76.91	56,156	15.75	75,000	87.75	10.8351
30	19-Apr-2012	92.47	231,180,750	13.00	250,000,000	93.54	1.0681
30	23-Apr-2012	94.61	157,680,833	12.70	166,666,667	93.55	-1.0575

30	24-Apr-2012	91.44	91,436,100	13.15	100,000,000	89.36	-2.0776
30	2-May-2012	89.83	25,223,640	13.40	27,850,000	89.83	0.0000
30	3-May-2012	89.19	151,992,504	13.50	166,800,000	91.61	2.4216
30	4-May-2012	92.47	4,934,772	13.00	5,336,735	92.47	0.0000
30	7-May-2012	92.47	508,571	13.00	550,000	91.09	-1.3753
30	10-May-2012	91.55	1,852,664	13.13	2,033,333	91.78	0.2275
30	11-May-2012	91.77	1,498,985	13.10	1,633,333	91.80	0.0286
30	14-May-2012	91.95	9,194,640	13.08	10,000,000	85.96	-5.9911
30	15-May-2012	85.96	1,719,106	14.00	2,000,000	93.17	7.2129
30	16-May-2012	93.29	186,691,100	12.88	200,000,000	92.59	-0.6923
30	17-May-2012	91.78	227,844,083	13.10	250,125,000	92.47	0.6874
30	18-May-2012	93.71	50,059,337	12.83	53,333,333	93.48	-0.2307
30	21-May-2012	91.77	344,152	13.18	375,000	92.57	0.7982
30	22-May-2012	92.84	16,164,288	12.95	17,033,333	90.88	-1.9558
30	23-May-2012	87.53	617,407	13.75	700,000	85.96	-1.5721
30	24-May-2012	85.96	171,910	14.00	200,000	86.73	0.7728
30	25-May-2012	88.82	155,292,329	13.56	167,016,667	89.00	0.1857
30	28-May-2012	88.06	616,405	13.80	700,000	91.77	3.7165
30	29-May-2012	91.77	458,872	13.10	500,000	93.88	2.1057
30	30-May-2012	93.88	93,880,100	12.80	100,000,000	93.17	-0.7117
30	31-May-2012	92.24	155,586,581	13.03	167,000,000	91.77	-0.4645
30	4-Jun-2012	91.77	45,887	13.10	50,000	89.10	-2.6738
30	6-Jun-2012	89.10	1,782,022	13.50	2,000,000	85.96	-3.1441
30	8-Jun-2012	85.96	429,785,000	12.87	500,000,000	85.96	0.0006
30	12-Jun-2012	87.90	10,459,242	13.70	12,166,667	90.71	2.8144
30	15-Jun-2012	94.40	94,401,500	12.73	100,000,000	92.12	-2.2794
30	18-Jun-2012	88.48	496,659	13.63	550,000	88.99	0.5113

30	19-Jun-2012	94.68	9,467,840	12.69	10,000,000	94.39	-0.2899
30	22-Jun-2012	91.78	305,931	13.10	333,333	90.89	-0.8908
30	25-Jun-2012	89.11	4,455,340	13.50	5,000,000	96.08	6.9771
30	28-Jun-2012	96.08	480,419,500	12.50	500,000,000	94.07	-2.0169
30	29-Jun-2012	94.07	470,335,000	12.78	500,000,000	92.47	-1.5928
30	2-Jul-2012	92.47	92,474	13.00	100,000	80.28	-12.1978
30	10-Jul-2012	80.28	321,106	15.00	400,000	91.11	10.8304
30	12-Jul-2012	91.33	1,824,410	13.17	2,000,000	92.77	1.4383
30	13-Jul-2012	94.56	3,965,228	12.71	4,160,000	94.56	0.0002
30	16-Jul-2012	95.42	28,340,750	12.59	29,700,000	92.60	-2.8250
30	17-Jul-2012	94.87	48,385,676	12.70	53,500,000	97.18	2.3134
30	18-Jul-2012	94.40	2,076,807	12.73	2,200,000	91.11	-3.2897
30	19-Jul-2012	91.11	273,331,800	13.20	300,000,000	92.49	1.3746
30	20-Jul-2012	92.49	4,867,642	13.00	5,263,158	92.46	-0.0240
30	24-Jul-2012	91.11	5,359,700	13.20	5,882,353	90.80	-0.3185
30	25-Jul-2012	80.29	1,565,606	15.00	1,950,000	97.08	16.7926
30	27-Jul-2012	91.92	174,788,389	13.11	180,050,000	91.62	-0.2981
30	31-Jul-2012	94.63	63,826,132	12.70	66,700,000	92.26	-2.3676
30	3-Aug-2012	88.49	265,460	13.60	300,000	91.13	2.6406
30	8-Aug-2012	91.13	92,995,512	13.20	102,050,000	87.54	-3.5859
30	10-Aug-2012	90.37	47,775,685	13.33	51,275,000	92.17	1.7968
30	15-Aug-2012	91.30	11,421,724	13.18	12,352,941	91.44	0.1450
30	16-Aug-2012	93.70	48,077,723	13.25	50,050,000	93.94	0.2399
30	17-Aug-2012	97.04	226,767,300	12.38	233,333,333	97.15	0.1113
30	28-Aug-2012	95.40	67,887,661	12.61	70,016,667	95.92	0.5201
30	29-Aug-2012	100.00	73,331,940	12.00	73,333,333	97.50	-2.4939
30	31-Aug-2012	92.52	9,251,630	13.00	10,000,000	98.41	5.8915

30	6-Sep-2012	97.82	102,607,072	12.28	104,700,000	98.02	0.1952
30	12-Sep-2012	99.19	198,377,400	12.10	200,000,000	94.27	-4.9149
30	13-Sep-2012	94.27	565,643	12.75	600,000	96.54	2.2701
30	17-Sep-2012	96.44	96,438,650	12.46	100,000,000	96.70	0.2640
30	20-Sep-2012	95.59	65,200,736	12.57	67,266,667	86.98	-8.6163
30	21-Sep-2012	94.08	40,818,042	13.00	40,540,000	98.69	4.6091
30	27-Sep-2012	86.28	5,985,108	14.21	6,005,556	85.97	-0.3118
30	28-Sep-2012	91.46	457,310	13.15	500,000	85.99	-5.4746
30	4-Oct-2012	85.99	64,490	14.00	75,000	92.74	6.7502
30	10-Oct-2012	99.49	99,487,600	12.06	100,000,000	95.23	-4.2603
30	12-Oct-2012	90.97	12,735,394	12.00	14,000,000	85.98	-4.9875
30	18-Oct-2012	85.98	171,959	14.00	200,000	95.35	9.3664
30	26-Oct-2012	95.35	47,673,000	12.60	50,000,000	98.38	3.0328
30	29-Oct-2012	101.25	151,450,133	11.85	151,025,000	104.13	2.8736
30	30-Oct-2012	104.13	104,125,900	11.50	100,000,000	82.47	-21.6538
30	2-Nov-2012	82.47	8,247,210	14.60	10,000,000	100.36	17.8903
30	5-Nov-2012	100.36	10,036,240	11.95	10,000,000	99.96	-0.4041
30	7-Nov-2012	99.96	9,995,830	12.00	10,000,000	85.98	-13.9828
30	14-Nov-2012	85.98	17,195,100	14.00	20,000,000	90.77	4.7938
30	15-Nov-2012	90.77	748,847	13.25	825,000	91.62	0.8551
30	16-Nov-2012	92.48	9,247,950	13.00	10,000,000	91.79	-0.6865
30	19-Nov-2012	91.11	91,107	13.20	100,000	80.28	-10.8252
30	20-Nov-2012	80.28	40,141	15.00	50,000	77.70	-2.5850
30	27-Nov-2012	77.70	194,241	15.50	250,000	90.77	13.0743
30	3-Dec-2012	90.77	2,723,118	13.25	3,000,000	80.28	-10.4873
30	4-Dec-2012	83.49	15,465,662	14.50	16,733,333	86.43	2.9452
30	7-Dec-2012	89.12	891,190	13.50	1,000,000	89.12	0.0016

30	13-Dec-2012	89.12	445,603	13.50	500,000	88.96	-0.1607
30	17-Dec-2012	88.16	881,563	13.65	1,000,000	84.22	-3.9350
30	19-Dec-2012	83.06	559,798	14.52	680,000	87.82	4.7676
30	27-Dec-2012	104.12	416,496,800	11.50	400,000,000	98.31	-5.8155
30	9-Jan-2013	85.10	9,465,785	14.25	10,250,000	83.43	-1.6786
30	11-Jan-2013	91.85	1,027,429	13.11	1,175,000	92.26	0.4136
30	17-Jan-2013	90.79	4,085,564	13.25	4,500,000	92.50	1.7143
30	25-Jan-2013	92.50	185,009	13.00	200,000	80.33	-12.1771
30	7-Feb-2013	80.33	107,103	15.00	133,333	84.39	4.0639
30	11-Feb-2013	90.35	18,395,487	13.33	20,000,000	94.23	3.8803
30	28-Feb-2013	104.16	25,258,800	11.50	24,250,000	86.03	-18.1264
30	1-Mar-2013	86.03	430,168	14.00	500,000	99.67	13.6369
30	7-Mar-2013	99.67	697,694	12.04	700,000	87.88	-11.7934
30	15-Mar-2013	87.88	24,693,465	13.70	28,100,000	89.48	1.6055
30	19-Mar-2013	89.48	25,144,611	13.45	28,100,000	92.52	3.0360
30	27-Mar-2013	92.52	92,519	13.00	100,000	106.78	14.2570
30	3-Apr-2013	106.78	427,102,400	11.20	400,000,000	77.73	-29.0421
30	4-Apr-2013	77.73	77,734	15.50	100,000	88.18	10.4470
30	10-Apr-2013	89.66	26,499,716	13.43	30,050,000	89.66	0.0000
30	12-Apr-2013	88.18	52,908,300	13.65	60,000,000	89.80	1.6151
30	15-Apr-2013	85.05	27,340,242	14.20	30,500,000	86.93	1.8788
30	23-Apr-2013	93.55	140,330	12.85	150,000	92.15	-1.4033
30	26-Apr-2013	92.15	195,819	13.05	212,500	92.06	-0.0860
30	29-Apr-2013	91.81	688,545	13.10	750,000	91.81	-0.0003
30	30-Apr-2013	91.81	367,223	13.10	400,000	92.15	0.3433
30	3-May-2013	94.61	143,589,232	12.82	134,100,000	93.18	-1.4311
30	7-May-2013	87.86	878,556	13.70	1,000,000	87.86	0.0002

30	16-May-2013	87.86	131,784	13.70	150,000	87.86	-0.0002
30	21-May-2013	88.82	991,275	13.55	1,125,000	90.97	2.1459
30	22-May-2013	92.15	92,147	13.05	100,000	86.00	-6.1498
30	23-May-2013	86.00	365,489	14.00	425,000	88.56	2.5627
30	24-May-2013	91.12	911,228	13.20	1,000,000	86.98	-4.1434
30	27-May-2013	86.98	43,490	13.84	50,000	89.14	2.1561
30	28-May-2013	89.14	891,355	13.50	1,000,000	86.00	-3.1380
30	3-Jun-2013	86.00	257,993	14.00	300,000	96.62	10.6208
30	14-Jun-2013	96.62	241,546	12.43	250,000	87.86	-8.7554
30	21-Jun-2013	87.86	7,116,895	13.70	8,100,000	90.46	2.5946
30	24-Jun-2013	90.46	904,575	13.00	1,000,000	87.86	-2.5998
30	27-Jun-2013	87.86	53,593,197	13.70	61,000,000	89.85	1.9944
30	4-Jul-2013	89.85	449,261	13.39	500,000	83.08	-6.7748
30	5-Jul-2013	83.08	5,815,411	14.50	7,000,000	88.83	5.7507
30	8-Jul-2013	88.23	5,502,748	13.64	6,250,000	88.42	0.1923
30	11-Jul-2013	90.37	37,005,082	13.32	40,950,000	91.35	0.9853
30	15-Jul-2013	91.35	137,028	13.17	150,000	88.51	-2.8394
30	17-Jul-2013	88.51	13,984,959	13.60	15,800,000	88.59	0.0797
30	18-Jul-2013	90.01	90,480,685	13.37	100,000,000	89.51	-0.4980
30	19-Jul-2013	88.76	11,629,873	13.56	13,125,000	88.68	-0.0787
30	23-Jul-2013	87.88	2,416,810	13.70	2,750,000	90.51	2.6268
30	25-Jul-2013	90.51	90,510,800	13.30	100,000,000	86.49	-4.0172
30	5-Aug-2013	86.49	8,292,173	13.93	9,587,037	86.49	0.0000
30	6-Aug-2013	86.49	24,693,923	13.93	28,550,000	87.60	1.1108
30	7-Aug-2013	85.24	34,921,944	14.17	38,905,556	84.82	-0.4208
30	12-Aug-2013	87.30	1,554,459	13.80	1,733,333	87.61	0.3130
30	27-Aug-2013	86.14	14,743,702	13.99	16,966,667	86.35	0.2103

30	28-Aug-2013	89.03	66,813,925	13.53	75,000,000	89.19	0.1606
30	30-Aug-2013	89.19	222,978	13.50	250,000	86.66	-2.5279
30	3-Sep-2013	86.66	43,331,550	13.90	50,000,000	89.19	2.5235
30	4-Sep-2013	89.19	44,593,300	13.50	50,000,000	86.66	-2.5286
30	9-Sep-2013	89.33	34,978,739	13.50	40,333,333	90.17	0.8412
30	10-Sep-2013	89.18	89,181,700	13.50	100,000,000	89.18	0.0000
30	11-Sep-2013	86.87	9,002,737	13.88	10,100,000	90.19	3.3133
30	16-Sep-2013	90.93	181,851	13.27	200,000	86.79	-4.1341
30	19-Sep-2013	88.34	35,335,120	13.63	40,000,000	89.15	0.8162
30	23-Sep-2013	89.17	178,345	13.50	200,000	80.34	-8.8364
30	24-Oct-2013	80.34	1,606,722	15.00	2,000,000	86.02	5.6877
30	1-Nov-2013	86.02	2,924,809	14.00	3,400,000	86.02	-0.0027
30	7-Nov-2013	86.02	387,095	14.00	450,000	86.00	-0.0175
30	11-Nov-2013	86.00	1,419,059	14.00	1,650,000	86.02	0.0170
30	12-Nov-2013	86.02	2,580,618	14.00	3,000,000	108.56	22.5410
30	14-Nov-2013	108.56	108,561,600	11.00	100,000,000	108.56	-0.0001
30	15-Nov-2013	108.56	108,561,500	11.00	100,000,000	108.56	-0.0013
30	21-Nov-2013	88.90	27,641,800	13.59	27,272,727	87.14	-1.7641
30	22-Nov-2013	89.16	178,311	13.50	200,000	89.32	0.1626
30	25-Nov-2013	89.48	89,480,800	13.45	100,000,000	87.56	-1.9166
30	5-Dec-2013	87.56	13,134,630	13.75	15,000,000	87.79	0.2246
30	6-Dec-2013	89.81	134,715,450	13.40	150,000,000	84.83	-4.9805
30	16-Dec-2013	84.83	80,588,310	14.20	95,000,000	86.33	1.5013
30	17-Dec-2013	86.33	2,158,278	13.95	2,500,000	86.95	0.6148
30	18-Dec-2013	86.64	41,207,158	13.90	47,500,000	87.84	1.2054
30	19-Dec-2013	89.36	84,888,865	13.47	95,000,000	87.26	-2.0979
30	23-Dec-2013	87.26	26,177,640	13.80	30,000,000	86.02	-1.2362

30	27-Dec-2013	86.02	1,290,339	14.00	1,500,000	85.85	-0.1708
30	30-Dec-2013	84.05	103,718	14.34	125,000	84.15	0.0953
30	13-Jan-2014	90.70	908,102	13.30	1,050,000	90.70	0.0000
30	14-Jan-2014	86.04	430,212	14.00	500,000	86.05	0.0054
30	21-Jan-2014	86.05	22,372,419	14.00	26,000,000	87.68	1.6318
30	22-Jan-2014	89.31	44,655,600	13.48	50,000,000	81.45	-7.8620
30	27-Jan-2014	81.45	2,036,230	14.80	2,500,000	83.75	2.3028
30	28-Jan-2014	86.05	4,302,735	14.00	5,000,000	89.19	3.1381
30	5-Feb-2014	87.63	42,969,011	13.75	48,200,000	98.02	10.3930
30	10-Feb-2014	109.98	109,978,800	10.85	100,000,000	83.14	-26.8437
30	11-Feb-2014	92.08	36,826,070	13.28	33,533,333	101.03	8.9487
30	13-Feb-2014	109.98	219,962,400	10.85	200,000,000	84.89	-25.0937
30	25-Feb-2014	84.89	8,064,313	14.20	9,500,000	89.87	4.9778
30	27-Feb-2014	89.87	8,537,204	13.40	9,500,000	88.25	-1.6150
30	28-Feb-2014	88.13	16,072,187	13.67	18,244,828	88.04	-0.0958
30	3-Mar-2014	88.17	34,204,430	13.67	38,100,000	88.67	0.5051
30	4-Mar-2014	90.52	134,428,140	13.30	148,500,000	90.52	0.0000
30	5-Mar-2014	90.52	2,715,720	13.30	3,000,000	84.88	-5.6393
30	10-Mar-2014	85.18	764,845	14.15	900,000	85.47	0.2912
30	12-Mar-2014	85.47	42,734	14.10	50,000	86.06	0.5943
30	25-Mar-2014	86.06	430,307	14.00	500,000	86.06	0.0000
30	26-Mar-2014	86.06	86,061	14.00	100,000	80.38	-5.6821
30	1-Apr-2014	80.38	643,034	15.00	800,000	78.80	-1.5756
30	2-Apr-2014	78.80	118,205	15.30	150,000	90.49	11.6889
30	22-Apr-2014	90.49	45,246,250	13.30	50,000,000	91.06	0.5636
30	23-Apr-2014	92.18	138,275,100	13.05	150,000,000	87.28	-4.9047
30	25-Apr-2014	90.78	986,543	13.28	1,050,000	90.17	-0.6159

30	30-Apr-2014	88.60	270,923	13.60	300,000	90.66	2.0554
30	12-May-2014	90.16	24,483,423	13.35	27,156,250	90.16	0.0000
30	13-May-2014	89.67	7,076,391	13.43	7,850,000	90.68	1.0111
30	14-May-2014	92.18	250,268,157	13.05	271,500,000	92.18	0.0000
30	15-May-2014	92.18	164,540,943	13.05	178,500,000	90.16	-2.0215
30	28-May-2014	90.16	90,158,300	13.35	100,000,000	92.11	1.9535
30	3-Jun-2014	92.11	92,111,800	13.06	100,000,000	83.12	-8.9946
30	10-Jun-2014	83.12	415,586	14.50	500,000	84.27	1.1536
30	18-Jun-2014	84.27	1,685,416	14.30	2,000,000	88.01	3.7392
30	20-Jun-2014	88.01	968,110	13.67	1,100,000	86.06	-1.9541
30	25-Jun-2014	86.06	1,721,118	14.00	2,000,000	86.07	0.0097
30	10-Jul-2014	86.07	1,204,918	14.00	1,400,000	95.02	8.9568
30	24-Jul-2014	95.02	95,022	12.65	100,000	89.20	-5.8237
30	31-Jul-2014	89.20	341,928	13.50	383,333	89.38	0.1793
30	7-Aug-2014	89.74	2,333,154	13.42	2,600,000	95.02	5.2857
30	8-Aug-2014	90.43	2,662,230	13.33	3,025,000	88.58	-1.8477
30	11-Aug-2014	87.63	8,763,170	13.75	10,000,000	91.20	3.5704
30	12-Aug-2014	91.20	18,240,420	13.20	20,000,000	86.69	-4.5160
30	13-Aug-2014	86.69	8,668,610	13.90	10,000,000	92.57	5.8829
30	14-Aug-2014	92.57	18,513,800	13.00	20,000,000	86.10	-6.4669
30	4-Sep-2014	86.10	43,051	14.00	50,000	86.71	0.6100
30	11-Sep-2014	86.81	406,173	13.88	466,667	86.77	-0.0416
30	12-Sep-2014	87.20	28,716,912	13.82	32,933,333	86.83	-0.3686
30	17-Sep-2014	86.09	43,046	14.00	50,000	87.49	1.3967
30	22-Sep-2014	87.49	6,561,608	13.77	7,500,000	86.09	-1.4012
30	24-Sep-2014	86.09	86,087	14.00	100,000	86.08	-0.0039
30	30-Sep-2014	86.08	86,083	14.00	100,000	86.05	-0.0337

30	2-Oct-2014	86.05	946,542	14.01	1,100,000	86.08	0.0313
30	3-Oct-2014	86.68	59,404,550	13.90	68,750,000	87.29	0.6129
30	6-Oct-2014	87.31	87,306,500	13.80	100,000,000	88.25	0.9411
30	7-Oct-2014	88.25	44,123,800	13.65	50,000,000	89.21	0.9597
30	8-Oct-2014	89.21	44,603,650	13.50	50,000,000	86.08	-3.1284
30	10-Oct-2014	86.08	8,607,890	14.00	10,000,000	88.72	2.6439
30	13-Oct-2014	88.63	11,036,926	13.59	12,451,515	88.64	0.0146
30	14-Oct-2014	89.20	8,920,480	13.50	10,000,000	86.08	-3.1296
30	21-Oct-2014	86.08	946,827	14.00	1,100,000	89.20	3.1272
30	22-Oct-2014	89.20	981,226	13.50	1,100,000	89.20	-0.0016
30	29-Oct-2014	89.20	22,300,200	13.50	25,000,000	88.25	-0.9507
30	30-Oct-2014	86.75	1,926,176	13.89	2,225,000	88.74	1.9908
30	31-Oct-2014	91.28	45,640,550	13.18	50,000,000	89.20	-2.0812
30	4-Nov-2014	89.20	4,236,995	13.50	4,750,000	89.20	-0.0017
30	5-Nov-2014	89.17	4,458,345	13.51	5,000,000	91.48	2.3162
30	6-Nov-2014	91.48	91,483,100	13.15	100,000,000	88.71	-2.7731
30	11-Nov-2014	88.71	8,871,000	13.58	10,000,000	93.26	4.5547
30	19-Nov-2014	93.26	1,398,971	12.90	1,500,000	85.01	-8.2558
30	24-Nov-2014	85.01	17,001,780	14.18	20,000,000	89.85	4.8418
30	25-Nov-2014	90.68	21,955,325	13.28	24,250,000	91.52	0.8327
30	26-Nov-2014	90.87	69,061,039	13.25	76,166,667	89.47	-1.4055
30	28-Nov-2014	87.30	392,849	13.80	450,000	87.61	0.3129
30	1-Dec-2014	87.93	879,256	13.70	1,000,000	89.30	1.3733
30	4-Dec-2014	89.84	106,085,369	13.40	118,575,000	90.96	1.1264
30	5-Dec-2014	91.55	183,103,400	13.15	200,000,000	76.24	-15.3097
30	17-Dec-2014	82.40	503,085	14.71	575,000	87.94	5.5320
30	18-Dec-2014	87.31	873,060	13.80	1,000,000	91.52	4.2161

30	19-Dec-2014	91.52	1,876,203	13.15	2,050,000	76.08	-15.4452
30	22-Dec-2014	76.08	76,077	15.86	100,000	90.54	14.4595
30	21-Jan-2015	90.54	135,804,600	13.30	150,000,000	91.54	1.0058
30	22-Jan-2015	91.54	137,313,300	13.15	150,000,000	86.11	-5.4325
30	26-Jan-2015	86.11	107,637	14.00	125,000	85.52	-0.5928
30	6-Feb-2015	86.04	601,452	14.02	683,333	86.24	0.1999
30	12-Feb-2015	85.52	4,276,195	14.10	5,000,000	90.56	5.0340
30	13-Feb-2015	90.56	4,527,895	13.30	5,000,000	86.14	-4.4210
30	24-Feb-2015	86.14	473,753	14.00	550,000	87.38	1.2406
30	25-Feb-2015	88.62	190,528,700	13.60	215,000,000	86.07	-2.5469
30	26-Feb-2015	89.86	148,719,042	13.42	163,333,333	89.84	-0.0129
30	5-Mar-2015	86.03	2,580,972	14.02	3,000,000	89.87	3.8368
30	6-Mar-2015	89.87	1,048,474	13.40	1,166,667	89.77	-0.0988
30	9-Mar-2015	89.57	44,786,450	13.45	50,000,000	89.90	0.3291
30	10-Mar-2015	90.97	90,972,750	13.24	100,000,000	88.58	-2.3893
30	2-Apr-2015	86.11	86,111	14.00	100,000	87.33	1.2217
30	9-Apr-2015	87.33	873,323	13.80	1,000,000	89.55	2.2209
30	14-Apr-2015	89.55	13,432,980	13.45	15,000,000	90.83	1.2794
30	30-Apr-2015	90.83	25,206,047	13.25	27,750,000	86.10	-4.7318
30	8-May-2015	88.95	12,238,665	13.55	13,600,000	90.54	1.5879
30	25-May-2015	90.86	101,404,894	13.25	111,600,000	89.48	-1.3803
30	4-Jun-2015	89.48	18,791,703	13.46	21,000,000	77.86	-11.6286
30	19-Jun-2015	77.86	194,639	15.50	250,000	69.34	-8.5163
30	26-Jun-2015	69.34	1,040,091	17.40	1,500,000	80.44	11.1047
30	1-Jul-2015	80.44	1,206,662	15.00	1,500,000	86.12	5.6725
30	2-Jul-2015	86.12	1,463,982	14.00	1,700,000	84.05	-2.0626
30	9-Jul-2015	84.05	840,540	14.35	1,000,000	80.46	-3.5946

30	20-Jul-2015	80.46	1,206,891	15.00	1,500,000	87.98	7.5191
30	21-Jul-2015	87.98	1,319,678	13.70	1,500,000	85.83	-2.1479
30	22-Jul-2015	85.83	5,493,158	14.05	6,400,000	86.14	0.3125
30	3-Aug-2015	86.14	16,940,721	14.00	19,665,789	86.20	0.0569
30	4-Aug-2015	87.35	174,413,800	13.80	200,000,000	87.03	-0.3287
30	5-Aug-2015	86.99	41,146,980	13.86	47,300,000	88.24	1.2488
30	6-Aug-2015	88.24	64,988,981	13.66	73,650,000	81.88	-6.3653
30	11-Aug-2015	75.51	37,755	15.99	50,000	80.49	4.9813
30	3-Sep-2015	80.49	684,174	15.00	850,000	82.43	1.9415
30	14-Sep-2015	84.37	29,530,900	14.30	35,000,000	83.23	-1.1478
30	15-Sep-2015	84.88	20,561,580	14.22	24,000,000	83.98	-0.8935
30	16-Sep-2015	77.46	57,325	15.61	75,000	78.80	1.3384
30	21-Sep-2015	83.22	44,385,280	14.50	53,333,333	83.21	-0.0109
30	22-Sep-2015	83.19	16,637,920	14.51	20,000,000	84.67	1.4774
30	23-Sep-2015	85.55	85,383,622	14.10	100,500,000	85.25	-0.2999
30	24-Sep-2015	85.54	85,544,500	14.10	100,000,000	73.64	-11.9024
30	28-Sep-2015	61.74	61,740	19.53	100,000	83.22	21.4783
30	29-Sep-2015	83.22	166,436	14.50	200,000	89.29	6.0736
30	1-Oct-2015	89.29	892,916	13.50	1,000,000	80.47	-8.8220
30	7-Oct-2015	80.47	643,757	15.00	800,000	80.24	-0.2301
30	12-Oct-2015	78.59	118,788	15.38	150,000	78.67	0.0759
30	13-Oct-2015	80.47	804,673	15.00	1,000,000	80.17	-0.2935
30	14-Oct-2015	80.17	80,174	15.06	100,000	86.10	5.9288
30	15-Oct-2015	86.10	2,023,411	14.01	2,350,000	74.77	-11.3305
30	21-Oct-2015	74.77	74,772	16.15	100,000	83.83	9.0608
30	22-Oct-2015	83.83	3,940,146	14.39	4,700,000	83.89	0.0571
30	27-Oct-2015	83.89	83,890	14.38	100,000	87.66	3.7749

30	11-Nov-2015	87.66	70,131,920	13.75	80,000,000	87.63	-0.0330
30	12-Nov-2015	87.63	34,526,969	13.76	39,400,000	88.52	0.8891
30	13-Nov-2015	91.19	216,663,163	13.20	237,600,000	77.21	-13.9812
30	25-Nov-2015	77.21	77,207	15.64	100,000	90.56	13.3494
30	27-Nov-2015	90.56	362,226	13.30	400,000	118.25	27.6954
30	22-Dec-2015	118.25	236,504	10.00	200,000	118.25	-0.0023
30	8-Jan-2016	118.25	236,499	10.00	200,000	83.78	-34.4723
30	20-Jan-2016	83.78	83,777,200	14.41	100,000,000	89.86	6.0832
30	22-Jan-2016	89.86	15,725,570	13.41	17,500,000	89.84	-0.0247
30	25-Jan-2016	89.76	26,928,480	13.43	30,000,000	84.40	-5.3650
30	29-Jan-2016	84.40	14,066,100	14.30	16,666,667	84.69	0.2909
30	2-Feb-2016	86.14	43,070,900	14.01	50,000,000	84.98	-1.1583
30	3-Feb-2016	83.83	41,912,650	14.40	50,000,000	89.94	6.1150
30	4-Feb-2016	89.94	44,970,150	13.40	50,000,000	80.52	-9.4174
30	11-Feb-2016	80.52	80,523	15.00	100,000	86.79	6.2706
30	8-Mar-2016	86.79	30,160,741	13.90	34,750,000	87.06	0.2617
30	10-Mar-2016	87.84	61,049,078	13.73	69,500,000	85.55	-2.2890
30	14-Mar-2016	83.52	16,299,109	14.46	19,227,273	83.93	0.4046
30	15-Mar-2016	87.71	87,713,400	13.75	100,000,000	84.89	-2.8231
30	18-Mar-2016	84.89	297,116	14.22	350,000	88.55	3.6589
30	6-Apr-2016	88.55	177,098	13.62	200,000	85.73	-2.8176
30	13-Apr-2016	85.73	342,926	14.07	400,000	83.25	-2.4860
30	21-Apr-2016	83.25	138,479,056	14.50	166,350,000	82.13	-1.1181
30	25-Apr-2016	82.13	82,127,500	14.70	100,000,000	75.50	-6.6323
30	26-Apr-2016	75.50	754,952	16.00	1,000,000	82.13	6.6319
30	27-Apr-2016	82.88	31,880,604	14.57	37,900,000	82.34	-0.5417
30	28-Apr-2016	83.67	32,832,835	14.44	38,233,333	85.55	1.8766

30	29-Apr-2016	86.13	11,800,070	14.01	13,700,000	99.96	13.8266
30	3-May-2016	88.94	69,460	13.75	75,000	88.94	-0.0011
30	23-May-2016	99.96	49,978	12.00	50,000	82.78	-17.1717
30	30-May-2016	82.78	3,414,865	14.58	4,125,000	86.13	3.3425
30	31-May-2016	96.15	15,865,476	12.50	16,500,000	82.49	-13.6662
30	8-Jun-2016	80.85	21,303,450	14.96	25,840,000	81.58	0.7364
30	9-Jun-2016	86.17	55,665,885	14.00	64,600,000	81.29	-4.8819
30	10-Jun-2016	76.41	76,406	15.81	100,000	82.08	5.6703
30	20-Jun-2016	83.83	2,758,964	14.41	3,225,000	88.08	4.2566
30	21-Jun-2016	90.59	5,797,754	13.30	6,400,000	81.55	-9.0404
30	6-Jul-2016	81.55	40,775	14.81	50,000	80.93	-0.6169
30	15-Jul-2016	80.93	4,046,630	14.93	5,000,000	83.28	2.3443
30	18-Jul-2016	79.40	2,459,578	15.25	3,000,000	84.08	4.6751
30	20-Jul-2016	92.63	5,557,620	13.00	6,000,000	95.05	2.4279
30	21-Jul-2016	95.05	9,505,490	12.65	10,000,000	84.79	-10.2637
30	29-Jul-2016	84.79	254,374	14.24	300,000	80.55	-4.2391
30	2-Aug-2016	80.55	1,047,177	15.00	1,300,000	92.64	12.0870
30	3-Aug-2016	92.64	1,204,308	13.00	1,300,000	84.40	-8.2433
30	10-Aug-2016	84.40	168,792	14.31	200,000	83.28	-1.1177
30	30-Aug-2016	80.00	9,440,555	15.13	11,800,000	78.63	-1.3726
30	6-Sep-2016	80.53	1,811,990	15.01	2,250,000	92.64	12.1090
30	13-Sep-2016	92.64	1,065,382	13.00	1,150,000	86.58	-6.0573
30	14-Sep-2016	80.53	483,164	15.01	600,000	80.30	-0.2274
30	16-Sep-2016	83.77	1,893,611	14.45	2,166,667	84.03	0.2637
30	19-Sep-2016	81.09	892,001	14.90	1,100,000	98.43	17.3370
30	20-Sep-2016	98.43	5,905,680	12.20	6,000,000	82.27	-16.1531
30	23-Sep-2016	82.27	148,094,820	14.68	180,000,000	86.51	4.2358

30	26-Sep-2016	86.51	155,719,260	13.95	180,000,000	75.51	-10.9965
30	30-Sep-2016	75.51	755,142	16.01	1,000,000	86.81	11.2967
30	4-Oct-2016	86.81	21,702,725	13.90	25,000,000	86.91	0.1022
30	5-Oct-2016	87.42	52,454,520	13.80	60,000,000	88.29	0.8690
30	7-Oct-2016	87.87	69,510,606	13.73	79,158,333	87.71	-0.1615
30	10-Oct-2016	87.32	13,098,630	13.82	15,000,000	86.88	-0.4465
30	12-Oct-2016	86.88	2,606,331	13.89	3,000,000	83.29	-3.5921
30	14-Oct-2016	83.29	83,286	14.50	100,000	83.25	-0.0339
30	19-Oct-2016	83.25	416,259	14.51	500,000	86.20	2.9479
30	25-Oct-2016	86.20	574,664	14.00	666,667	90.26	4.0598
30	26-Oct-2016	98.38	2,459,478	12.20	2,500,000	87.42	-10.9605
30	27-Oct-2016	87.42	43,709,300	13.80	50,000,000	88.03	0.6089
30	28-Oct-2016	88.03	66,172,800	13.70	75,000,000	87.73	-0.2984
30	31-Oct-2016	88.04	44,019,800	13.70	50,000,000	98.25	10.2072
30	1-Nov-2016	98.25	49,123,400	12.22	50,000,000	87.42	-10.8289
30	7-Nov-2016	87.42	56,821,635	13.80	65,000,000	88.67	1.2509
30	8-Nov-2016	88.67	57,634,720	13.60	65,000,000	77.98	-10.6911
30	15-Dec-2016	77.98	77,978	15.50	100,000	86.23	8.2477
30	10-Jan-2017	86.23	32,248,300	14.00	37,400,000	88.66	2.4361
30	12-Jan-2017	88.66	33,159,401	13.61	37,400,000	75.12	-13.5407
30	17-Jan-2017	75.12	112,681	16.10	150,000	81.67	6.5458
30	19-Jan-2017	81.67	28,093,310	14.80	34,400,000	81.08	-0.5907
30	30-Jan-2017	81.08	5,188,858	14.91	6,400,000	81.54	0.4616
30	1-Feb-2017	81.54	5,381,475	14.82	6,600,000	80.60	-0.9400
30	2-Feb-2017	80.60	40,299	15.00	50,000	81.17	0.5729
30	9-Feb-2017	78.90	836,492	15.35	1,033,333	83.21	4.3116
30	21-Feb-2017	94.11	47,053	12.79	50,000	108.39	14.2816

30	28-Feb-2017	108.39	54,193	11.00	50,000	81.70	-26.6911
30	8-Mar-2017	81.70	5,065,133	14.80	6,200,000	83.42	1.7200
30	10-Mar-2017	83.42	2,127,100	14.49	2,550,000	83.19	-0.2288
30	14-Mar-2017	84.18	6,178,505	14.36	7,366,667	84.16	-0.0111
30	15-Mar-2017	83.15	7,068,065	14.53	8,500,000	83.02	-0.1330
30	20-Mar-2017	82.89	13,262,048	14.58	16,000,000	80.59	-2.2985
30	18-Apr-2017	80.59	40,295	15.00	50,000	83.32	2.7356
30	25-Apr-2017	83.32	2,499,747	14.50	3,000,000	81.79	-1.5338
30	28-Apr-2017	81.79	122,687	14.78	150,000	118.00	36.2083
30	11-May-2017	118.00	59,000	10.00	50,000	84.76	-33.2409
30	17-May-2017	84.76	1,271,378	14.25	1,500,000	82.53	-2.2253
30	12-Jun-2017	80.31	40,154	15.05	50,000	83.34	3.0284
30	16-Jun-2017	83.34	666,690	14.50	800,000	86.71	3.3720
30	28-Jun-2017	86.69	68,064,829	13.93	78,500,000	81.10	-5.5958
30	6-Jul-2017	75.52	37,758	16.02	50,000	83.27	7.7512
30	27-Jul-2017	83.27	83,268	14.52	100,000	84.23	0.9600
30	31-Jul-2017	84.23	842,280	14.35	1,000,000	79.41	-4.8213