THE DYNAMICS OF ASSET SWAP SPREAD IN TURKEY

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by

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To my family

ABSTRACT

In response to the financial crisis, investors have been increasingly sensitive to the evolution of swap spreads, as a rising proportion of their portfolio is constituted by emerging markets debt instruments. I provide two model that link Turkey asset swap spread to local and global market dynamics. I investigate which financial and economic factors can explain the vast majority of dynamics of asset swap spreads for short and long period of time. I construct an empirical proxy of assets swap spread and run a comprehensive investigation about its economic drivers during the period 2006-2017. I find that spreads are time-varying and state-dependent, driven by local factors such as currency crash risk, yield curve shape as well as global sentiment or funding conditions.

ÖZETÇE

Finansal kriz sonrası yatırımcıların portföylerinde gelişmekte olan ülkelere ait borçlanma araçlarına daha yüksek oranda yer vermesi, değerlemesi cari piyasa değeri üzerinden günlük olarak yapılan portföyleri tahvil-swap getiri farklarına hassas hale getirmiştir. Bu çalışmada Türkiye'de varlık takasının yerel ve küresel piyasa dinamikleriyle olan ilişkisi ortaya konulmuştur. Bu kapsamda kısa ve uzun vadede varlık takası dinamiklerinin büyük çoğunluğunu hangi finansal ve ekonomik faktörlerin açıklayabileceği araştırılmış ve 2006 - 2017 yılları arasını kapsayan ampirik yaklaşım geliştirilmiştir. Bulgular getiri farklarının zamana ve duruma bağlı değişkenlik gösterdiğini ortaya koymuş, döviz kuru riski, getiri eğrisi şekli gibi yerel etkenlerin yanında küresel risk iştahı ve fonlama koşulları gibi küresel etkenler tarafından yönlendirildiğini göstermiştir.

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CHAPTER I

INTRODUCTION

Financial crisis occurred over the last decade have caused one of the most volatile periods in stock and bond markets history. Central banks followed unconventional methodologies such as lower or zero funding rates and asset purchase programs to reduce volatility and secure financial stability. Also, regulatory agencies designed precautionary models considering both quantitative and qualitative approaches. These efforts led to extreme liquidity and low cost of borrowing period on debt instruments which made high yield assets of emerging markets more attractive and foreign investors started to follow different investment strategies in order to manage risk of emerging markets portfolios.

Increasingly, investors are sensitive to the evolution of swap spreads, as a rising proportion of their portfolio is constituted by credit assets, whose spreads are correlated with swap spreads. In addition, a larger number of market players position actively for changes in swap spreads, for hedging or capital gains purposes. Asset Swap (ASW) is a type of exchange that has become more widespread in emerging markets, which have been used since the early 1990s in developed markets. Asset swap transaction is carried out with two assets where one of interest rate swap or cross currency swap is used and bond is purchased at the same maturity. It is a synthetic structure which allows an investor to swap fixed rate payments on a bond to fixed or floating rate and maintain existing credit exposure to the fixed rate bond.

ASWs are closely connected with CDS and other credit derivatives (De Wit (2006)) especially if liquidity conditions are at decent levels. The main objectives to make asset swap agreement are (i) The investor may be exposed to the credit risk of the

bond to be managed (ii) Long-term assets can be used to meet short-term liabilities by generating variable interest rate income (iii) Foreign investors may want to hedge their risks of their bond portfolio or take speculative positions against the movement of interest rate on both directions bypassing short position constraints .

Asset swap is usually executed by purchasing government bond on interest rate swap. In Turkey, TRLIBOR market, which is abbreviation of interbank borrowing and lending rates, is impractical to use as a benchmark interest rate due to its illiquidity. Since there is no available TL reference interest rate, interest rate swap can not be traded in the known sense. Therefore, cross currency swaps are widely used to hedge interest rate risk in Turkish money and capital markets.

In practice, ASW spread is defined as the difference between the yield of the bond and swap rate with the same maturity. Swap and bond markets are exposed the same market risk but they are affected by credit and liquidity conditions at different extents. The occurrence of such an arbitrage between swap and bond markets can be explained with the sovereign risk of the country. This fact is confirmed by the strong correlation between credit default swap, which is considered as one of the indicators showing the credit risk of the country, and asset swap spreads.

Asset swap is the process of exchanging foreign currency with local bonds on the net. The rise in credit default swap may not only show the default risk, but it also affects banks and financial system of a country. Therefore, there would be a counterparty risk for a foreign investor who is awaiting to withdraw foreign currency with local currency when the bond is redeemed. In this case, receiver of asset swap increases asset swap spread to the fixed payer in parallel with the increase in credit default swap.

Many studies in the literature analyze local bond spreads by separating through credit and currency crash risk. However, it has shown that the liquidity premium was also effective on the spread, which in turn was linked to the credit risk (e.g, He and

Xiong (2009) and Morris and Shin (2016)). This implies that the link is meaningful in the financial and macroeconomic context. It has became known as the taper tantrum-made local yield spreads more sensitive to liquidity. In this sense, asset swap spread movements are affected from the difference between liquidity of bond markets and swap markets.

ASW spread has also become an important target variable for researchers and practitioners in terms of mark-to-market projections and optimal investment as the risk drivers of financial markets have coexisted. In addition, it is particularly followed by long-term investors and pension funds in order to adjust investment horizon and cost of borrowing. For this reason, I investigate the evolution of ASW spread and seek for a dynamic link towards the local and global factors at different macroeconomic and financial conditions.

To examine this questions I collect large macroeconomic and financial data set and apply two different approaches with candidate variables. There are several approaches to deal with complications of econometric methods. The classic econometric models such as multivariate VAR or univariate autoregressive models have limitations to treat many variables. Working with high dimensional data set may be computationally infeasible, causes multicollinearity or robustness issues. To overcome with these problems one should find the true combination of candidates considering state and time dependencies. I construct the first model with less amount of variables and use linear regression with least square estimation. The advantage of the simple linear model is that economical significance of the factors can be explained straightforward. Moreover, I used Chow Test to determine structural breaks in the model which is capable of capturing the new state and risks on ASW spread. One drawback of this procedures is that the econometric models are still based on the few chosen variables and much of the information carried by the large data set would be discarded.

As financial and macroeconomic variables have provided richening information,

dynamic factor models became popular to deal with this problem. Since there are plenty of approaches for large economic panels I focus on the method of Stock and Watson (2002) which estimate latent unobserved factors from large number of variables to cover the information in predictors. The current studies on dynamic factor models include new factor estimation methods, model construction with valid candidate variables and determining number of factors in an optimal way. The attractive aspects of factor models are that they lead to more precise forecasts and prevent from reacting to idiosyncratic movements. Also, they do not need to depend on overly tight assumptions and can eliminate a degrees of freedom problem when the number of parameters to estimate is larger than the number of observations.

In my thesis, I proceed following steps. First, I build a model with some key financial variables which enables me to explain the movement of ASW spread in different states. Second, I apply dynamic factor analysis to panel data with around 100 macroeconomic and financial variables. My data set consists of low-frequency economic data as well as financial variables. To deal with the unbalanced data set, I use Kalman filter and principal component analysis simultaneously with state space representation which allow me to combine mixed frequency data in factor estimation process, reveal hidden unobserved synthetic factors and forecast target variable in real time.

I report the results of two different model in chapter 7. The outcomes of first model are successful in explaining changes in swap spread over short periods of time. The results of the second model consist of the analysis of the evolution of the principal components which helps in identifying the long term drivers of swap spreads.

The scope of my thesis is to present a long-term, macro perspective on asset swap spread. chapter 2 discusses the recent studies on ASW spread and related applications of dynamic factor models. chapter 3 explains the data selection and subsampling procedure. chapter 4 focuses on the features of ASW spread in Turkey

and highlights cross-correlations with risk drivers. chapter 5 discusses the handful of factors being consistently useful on swap spread variations. chapter 6 presents a top-down empirical model details. Some concluding remarks are summarized in the chapter 8.

CHAPTER II

LITERATURE REVIEW

The use of asset swap began in the early 1990s but recent studies on it have been limited and directed towards the mechanism of swap transactions. I relate my thesis to the studies on credit risk, sovereign risk and the bond risk premia which are closely connected with the factors affecting the ASW spread

The studies on bond and credit spread are divided into two parts. The first part examines the theoretical determinants in an empirical context, taking into account macroeconomic factors, such as investment / capital ratio, growth of non-farm payroll employment, ratio of labor income to total income, consumption to wealth ratio and output gap. A further studies focus on the decomposition of risk elements. (Duffie and Singleton (1997), Liu et al. (2011)). Feldhütter and Lando (2008) conclude that liquidity premia is one of the major factor for credit and swap spreads where investors willingness to seek more liquidity premium for the government bonds . In turbulent periods where risk perception turns negative, liquidity premia is highly preferential for emerging markets investors. Pape and Schlecker (2007) find evidence for developed markets and provide cointegrated regression model for swap spread and credit spread among US and European markets.

Moreover, dynamic factor models are used to combine large number of variables in recent studied. Ludvigson and Ng (2009) shows that up to 1 year ahead US excess bond return closely corresponds to real economic activity. Bork and Møller (2012) use similar analysis and estimation method for US housing market and find the predictive power of macroeconomic variables on future price discovery of real estates.

The second part deals with the pricing of credit derivatives and borrowing instruments but ignores their direct link to macroeconomic variables. Bekaert and Harvey (2002) summarize the state of asset valuation in emerging markets and emphasize that EMs provide a challenge to existing models. Table 1 summarizes selected studies economically intuitive for asset swap spread mechanism and Table 2 shows several dynamic factor model studies for asset pricing investigation.

Table 1: Related Literature on Asset Swap Spread

Authors	**Region**	**Target**	**Period**	**Methodology**
Edwards (1983)	19 EM Country	EM Sovereign Spreads	1976-1980	Regression
Feder and Uy (1985)	55 OECD Country	Credit Spread	1973-1983	Panel Regression
Haque et al. (1996)	60 EM Country	Credit Spread	1980-1993	Regression
Uribe and Yue (2003)	7 Emerging Countries	EM Bond Yields	1994-2001	Vector Autoregression
Longstaff et al. (2007)	26 Emerging Countries	Sovereign Risk	2000-2007	Regression
Aussenegg et al. (2016)	23 iBoxx European corporate bond indexes	Asset Swap Spread	2006-2009	Markov Switching
Aizenman et al. (2013)	5 Eorpean Country, 5 Middle Income Country	Sovereign Risk	2005-2010	Panel Regression

Table 2: Related Literature on Dynamic Factor Model

Authors	**Region**	**Target**	**Period**
Banerjee et al. (2003)	Euro Area	Inflation and GDP growth	1970-2000
Kapetanios and Camba-Mendez (2005)	Euro Area	Inflation	1996-2004
Ludvigson and Ng (2009)	USA	Bond Risk Premia	1964-2003
Bezemer et al. (2017)	20 EM Countries	Emerging market exchange rates	1996-2016
Clements and Galvão (2008)	USA	Output Growth	1991-2008
Bork and Møller (2012)	USA	House Price Index	1975-2011
Förster et al. (2012)	47 OECD Country	Capital Flow	1970-2001

CHAPTER III

DATA

In Turkey, 2 year zero coupon local currency bonds are issued for longer time. So, I use Turkey 2-year local bond and 2-year cross currency swap rate for my analysis.

I select the range of the data set over the period 2006 - 2017 in order to capture recent recession and expansion states of the economy. I make my analysis on weekly and monthly frequencies with different data set. The weekly model includes financial variables while the monthly model consists of more than 100 financial and macroeconomic data . I classify the data into six sub-groups as Real Economics Activity, Money Credit Quantity Aggregates, Labor Market, Prices, Financial Markets, Housing and Orders.

3.1 Subsampling

I divide the data set into three main part. Additionally, I analyze crisis period in two further subsamples. In my thesis I predetermine the pre-crisis period starts on July 2006 to June 2007, the crisis period starts on August 2007 to March 2009 and the post-crisis period starts on April 2009 to May 2010. In the crisis period between 2007-2009, credit risk and liquidity risk surged to crucial levels at different phases (Bernanke (2009)). Bernanke (2009) also explained the reaction of The Federal Reserves in terms of providing liquidity to the solvent financial institutions with default risk at low levels. During the second phase of the crisis, the Federal Reserve granted capital to some impaired borrowers to repair credit markets and boost the flow of credit mechanism .

Longstaff (2010) discusses that main reason of the crisis was due to the liquidity conditions. However, It turned into a credit crisis after Lehman Brothers collapse in

terms of solvency risk concerns. Thus, I assume the starting date of the credit crisis in September 2008.

Accordingly, I set liquidity crisis period (August 2007 - August 2008) and credit crisis (September 2008 - March 2009) as two further subsample in order to measure the effects of liquidity and credit-related risk drivers on asset swap spread. I also run Chow Test to discover stability of coefficients over time and identify turning point of the model.

CHAPTER IV

DYNAMICS OF ASSET SWAP SPREAD

The ASW calculations differ related to the asset classes being traded. The following formula can be applied to asset swap at nominal value and considered as a simple measurement. Assuming all payments are made on an annual basis and at the same term, the asset swap spread (ASW) will equal the present value of all payments and can be calculated as:

$$
\begin{aligned}
&(100 - P) + C \sum_{i=1}^{i} a_t i - \sum_{i=1}^{i} \Delta_i (L_i + ASW) a_t i = 0 \\
&ASW : AsswtSwapSpread \\
&C : CouponRate \\
&C \sum_{i=1}^{i} a_t i : FixedRatePayement \\
&\sum_{i=1}^{i} \Delta_i (L_i + ASW) a_t i : FloatingRatePayment \\
&L_i : LIBOR \\
&\Delta : GrowthFactor
\end{aligned}
\tag{1}
$$

In addition to this form, there are different methods for ASW calculation. The most commonly methods are as follows:

Yield / Yield : is the difference between the bond yield and the swap rate at the same maturity. It is the simplest method for calculating the yield differential. With this method, the durations are weighted and therefore the difference between the swap rate and the bond yields is based mainly without market direction. Steepening

yield curve causes widening swap spread which is incapable to provide protection for convexity. In the case of a steepened curve, it is not sufficient to compare the bonds with different coupon payment, which is in turn more suitable for flattened yield curves. The receiver of the asset swap expects a narrowing spread and profit from the swap transaction when the bond yields drop.

Price / Price (Nominal Value) : The swap spread is paid by adding on floating interest rate. The bond is purchased on the nominal value. The bond coupons form the fixed peg of the swap transaction. Floating interest rate is calculated on the dirty price of the bond. The payment is made to the receiver of the asset swap transaction as (100 - Dirty Price). As the swap curve steepens, the swap spread decreases. It is not applicable for the use in price comparisons because it is tied to the dirty price of the bond. The interest rate risk is minimal, depending on the differences between discount rates or compounded rate of the bond yield and the swap rates.

Z-Spread : One of the methods used to compare the relative price of the asset swap. It can be defined as the amount of slippage in the zero coupon swap yield curve, such as the situation where the present value of all cash flows of the bond equals the dirty price of the bond. It is the most suitable method for price comparison.

In my thesis, I use Yield / Yield method which is more suitable to investigate ASW spread in macroeconomic context. In developed markets, the factors influencing the ASW spreads are more clearly emerged, but it is difficult to establish direct causality in emerging markets. There are 5 factors in the literature that are related to ASW spread.

Yield Curve Shape : Lower yields indicate downtrend on inflation, volatility and risk premiums and results in narrowing of spread. Additionally, term structure dynamics influence yield spreads because it reflects market expectations for the future price movements. If the slope of the yield curve increases, one can choose to make

fixed-rate payments or issue floating rate bonds instead of issuing fixed interest securities. In this case, National Treasury aims to reduce duration of the sovereign debts. As a result, as the yield curve gets steeper, it is expected that the ASW spread tends to narrow. Investors also want to be swap payer in negative carry trade environment. If the curve becomes inverted it is considered to be an indicator for the recession in economical cycle which makes ASW spread to surge.

Government Bond Supply : Swap spreads reflect the supply / demand conditions between government bond and swap contract. As the stock of the government bond increases in proportion to swap contract, asset swap spread gets tighter.

One problem is defining which measure of government bond supply to take. One could take the percentage change in outstandings vs. a year ago (i.e. the proportional net supply over the past year). This will be less trending, and reflect the dynamic of the debt better than just looking at the outstanding stock of government bonds. These refinements are useful in particular for the developed markets but are not adding much to the analysis in other markets. This is also reflected in the lower correlations between swap spreads in the various maturities in the developed markets than emerging markets due to the idiosyncratic factors affected supply and demand conditions in DM's.

More generally, the problem is that it is very difficult to incorporate expectations of future supply in any analysis or supply shocks. The only timely source of expectations of fiscal balances is produced by OECD Turkey Economic Forecast Report semi-annually, which covers forecasts for the current and next fiscal years

An increase in the issuance of government bonds and liquidity conditions in bond markets cause bond yields to rise. It results widening ASW spread, increasing fiscal deficit and local bond risk premia

Credit Rating : Swap transactions are considered to be exempt from default risk, but it is accepted that the long-term differences in the yield spreads may be due

to the anticipation of credit risk.

Market Liquidity : For illiquid bonds, investors are expected to demand a higher risk premium, so it is expected that as the liquidity of the bond diminishes, the difference in ASW is expected to widen.

Repo Rate : Declining repo rates indicate a steep yield curve, which is positive for the repo-funded side and implied ASW to be widen.

ASW spread is actually the unhedged part of the bond portfolio when it is swapped. It is considered to be consist of two main components as credit risk and liquidity risk. The changes in economic cycle cause widening and tightening periods of ASW spread . The General formula of ASW is can be written as:

$$ASW = BondYield - SwapRate \tag{2}$$

In Turkey, ASW spread often moves in positive territory. In other words, government borrowing cost is above swap rate. The main reason is that liquidity condition of swap market is preferable than the local bond market which makes swap rates more efficient. Also banks and financial institutions willing to make transaction in swap market because of the attractiveness of the fixed rates in the swap market. Figure 3 illustrates mechanism of asset swap transaction commonly used in Turkish banking system.

ASW has turned negative in several times recently. This situation is difficult to interpret because it is not frequently encountered. In fact, the main reason is that the level of development of financial markets is shallow. Also, short selling constraint in bond market, investment grade rating upgrade, decreasing credit risk premium, declining bond yield in large-scale, limited bond issuance cause negative ASW spread. To summarize, if the level of the yield curve is expected to rise, the swap rates increase and the ASW decreases because it is profitable to pay fixed interest on swap agreement. If liquidity in the bond markets plunge due to new bond issuance,

it is more advantageous to sell ASW spread because the bond will be cheaper. Credit risk is priced in ASW spread for both legs where swap rates and bond rates can be considered as the cost of borrowing for the banks and government respectively.

ASW dynamics also strictly correspond to currency risk premia and sovereign risk premia. Verdelhan and Borri (2010) shows that investors seek more risk premia for holding country-specific fixed income instruments in turbulent periods where default risk is bearing in mind more frequently. Also, Jankowitsch and Pichler (2005) reveals that correlation between currency crash risk and default risk are in line with credit-related asset classes. Brunnermeier and Pedersen (2008) shows the importance of LIBOR-OIS spread on interbank and market liquidity on global level.

Figure 2 shows normalized data series of ASW spread against risk factors in different periods. Table 4 and Table 5 report pairwise correlations between risk factors and ASW spread correspond to Figure 2 in pre-crisis, crisis, post-crisis periods and all sample period as well. Also Table 3 shows descriptive statistics for ASW spread while Figure 1 provides historical price information for all periods.

	Sample	Pre-Crisis	Crisis	Post Crisis
Mean	1.16	0.72	1.69	1.01
Median	0.78	0.45	1.68	0.73
Standard Deviation	1.51	0.47	0.38	1.16
Autocorrelation	0.97	0.88	0.90	0.92

Table 3: Descriptive Statistics of Asset Swap Spread

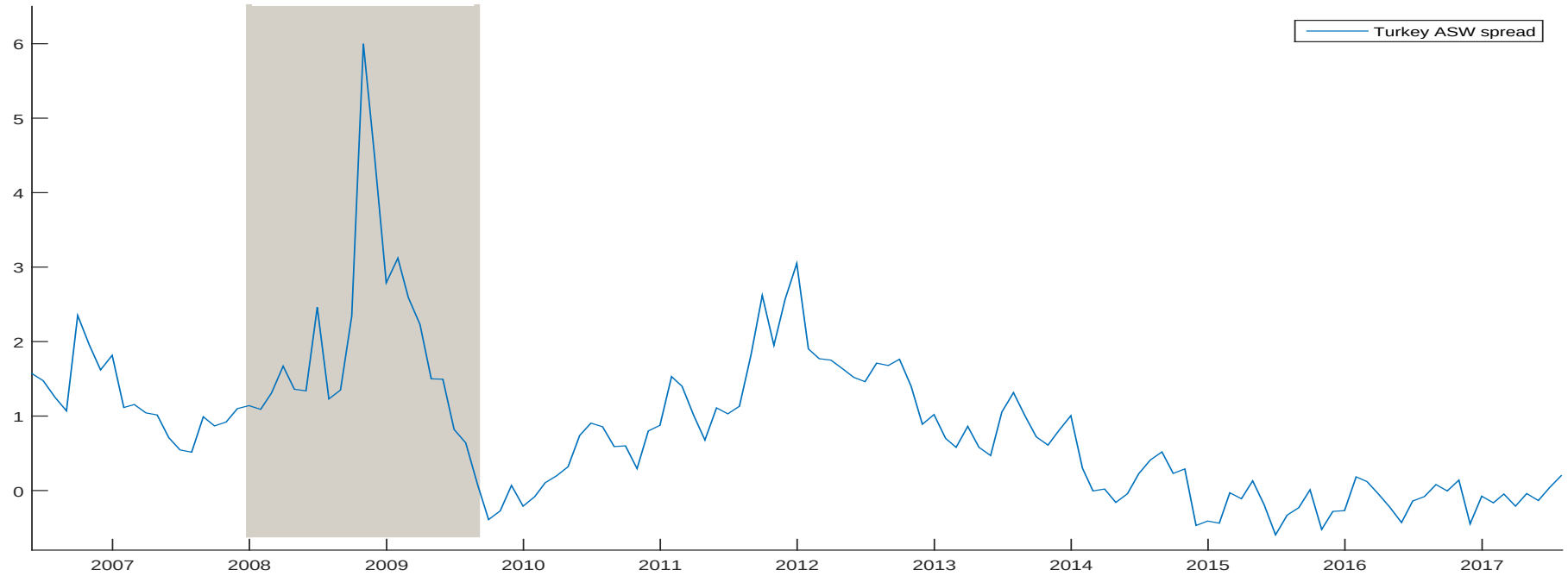


Figure 1: The chart displays the levels of 2 year ASW spread bewtween 2006 and 2017 on monthly frequency. The shaded area represents the recession period announced by National Bureau of Economic Research (NBER).

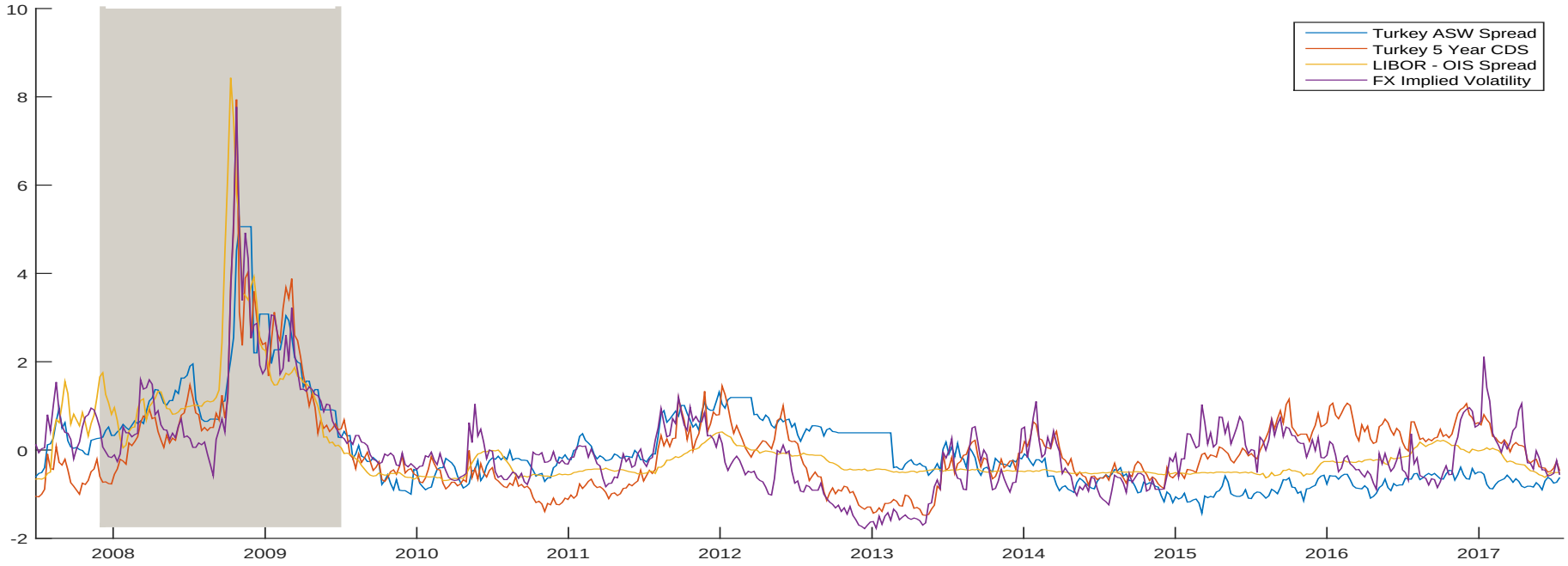


Figure 2: The chart displays the comparison of ASW spread and common risk factors between 2006 and 2017. The shaded area represents the recession period announces by National Bureau of Economic Research (NBER).

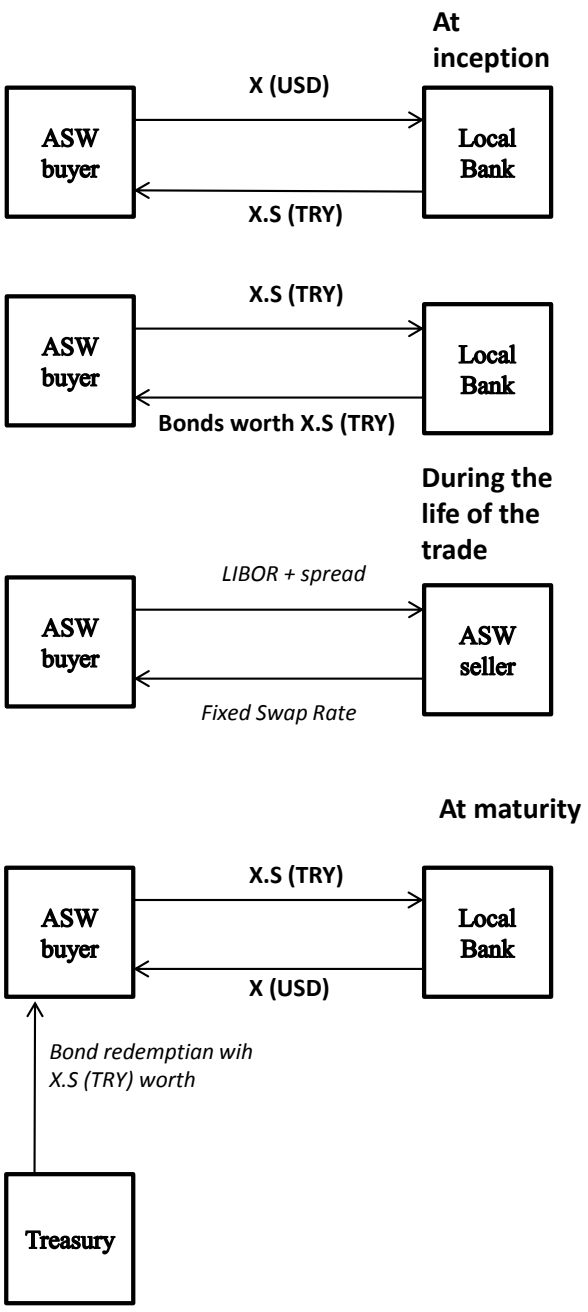


Figure 3: Asset swap mechanism in Turkey

Table 4: The tables show the pairwise correlation coefficients across risk factors and ASW spread in all sample period and pre-crisis period.

In-sample Pairwise Correlation

	Turkey 2 Year ASW	Turkey 5 Year CDS	LIBOR-OIS Spread	FX Implied Vol
Turkey 2 Year ASW	100%			
Turkey 5 Year CDS	70%	100%		
LIBOR-OIS Spread	84%	78%	100%	
FX Implied Vol	82%	79%	90%	100%

Pre-crisis Period Pairwise Correlation

	Turkey 2 Year ASW	Turkey 5 Year CDS	LIBOR-OIS Spread	FX Implied Vol
Turkey 2 Year ASW	100%			
Turkey 5 Year CDS	95%	100%		
LIBOR-OIS Spread	91%	83%	100%	
FX Implied Vol	88%	90%	78%	100%

Table 5: The tables show the pairwise correlation coefficients across risk factors and ASW spread in crisis and post-crisis period.

Crisis Period Pairwise Correlation

	Turkey 2 Year ASW	Turkey 5 Year CDS	LIBOR-OIS Spread	FX Implied Vol
Turkey 2 Year ASW	100%			
Turkey 5 Year CDS	58%	100%		
LIBOR-OIS Spread	79%	69%	100%	
FX Implied Vol	77%	71%	88%	100%

Post-Crisis Period Pairwise Correlation

	Turkey 2 Year ASW	Turkey 5 Year CDS	LIBOR-OIS Spread	FX Implied Vol
Turkey 2 Year ASW	100%			
Turkey 5 Year CDS	88%	100%		
LIBOR-OIS Spread	91%	92%	100%	
FX Implied Vol	90%	92%	94%	100%

CHAPTER V

THE DETERMINANTS

I consider two main potential sources of variation in the basis of asset swap spreads: (i) Local Factors (ii) Global Factors

5.1 Local Factors

Yield Curve Factors

Asset swaps spreads have been observed to be correlated with the shape of the yield curve, richening as the curve flattens. Segmentation of the investor base for swaps and bonds is partly responsible. Users of swaps tend to be funded investors, such as banks and proprietary trading desks. These types of investors are therefore effectively benchmarked against LIBOR. In contrast, government bond investors are usually constrained against longer duration benchmarks reducing their use of short-maturity instruments and are often cash-constrained, limiting their ability to short the market. As the curve flattens (and inverts) funded investors will increasingly show an aversion to running receiver swaps positions, given the increasingly negative carry. Government bond investors will be far less impacted when measured against their longer duration benchmark. Bonds outperform swaps and asset swap spreads tighten. Conversely, as the yield curve steepens or positively sloped, a receiver swap position will have increasingly positive carry (or less punitive negative carry) and asset swap spreads widen.

Diebold and Li (2006) show that the shape of the yield curve reflects the state of the economy and, through it, liquidity conditions and the credit risk of the banking sector. Vayanos and Vila (2009) explain the changes in the yield curve with the business cycle. Monetary policy easing, leading to a steepening of the yield curve,

is typically undertaken as the economic outlook deteriorates. Lower funding rates typically help restore the prospects for the economy, when other factors remain equal. This will, in turn, help improve the credit quality of the banking sector, and lead to tighter credit spreads. Obviously, an improvement in future growth expectations is somewhat compensated by a deterioration in the immediate economic outlook, and the balance of these two factors can be either positive or negative. But on balance, it is no surprise that swap spreads tighten as the curve steepens.

In Turkey cross currency swap markets, banks are naturally fixed payers and the counterparties are receivers. After Reserve Option Mechanism is introduced supply-demand equilibrium in the market is affected. Also, Interest Rate Corridor mechanism has an effect to short-term capital flows.

Asset swaps are synthetic securities that require the purchase of a specific underlying asset and so the cost (or benefit) of carry over time will also be a function of how the package can be financed. In the case of government bonds, repo markets (where the borrower lends the bonds as collateral) will tend to offer beneficial financing rates relative to interbank markets.

For this reason, repo is the main financing vehicle used by central bank, plus it is the only financing vehicle for funding short government positions. Hence, as well as being exposed to the spread between term structure of swap and government bond, a funded asset swap position will over time be exposed to the basis risk between the LIBOR rate on the swap and the repo rate on the bond. As the repo rate narrows and widens versus Libor, this will impact the cost of carry of the asset swap package.

Carry Trade and Crash Risk : Option Implied Volatility

Swap spreads are also driven by risk aversion, given the tendency of investors to increase demand for FX and credit-related products during periods of turmoil in the markets. I consider risk reversal parameter of USD/TRY option market as a risk aversion factor. The parameter can be obtained as the difference between implied

volatility of call option and put option with the same delta and maturity.

Under normal market condition, risk reversal must be equal to zero where expectation on particular underlying asset have a symmetry for both directions. As expectations vary in time especially under extreme circumstances, distribution of particular exchange rates are skewed negatively in terms of supply-demand condition between two currency. Thus they become a major driver of swap (and credit) spreads, even if only for short periods of time. Risk aversion will tend to widen swap spreads, influencing the decision of some market players to hedge in the swap market.. In contrast, high or improving risk appetite will lead investors and market participants to unwind their hedge positions into higher yielding ones and tightening swap spreads.

Dollar Deposit Rate

A decrease in the amount of local currency held by local banks which in turn an increase in the dollar amount leads ASW spread to turn negative. The main driver of this transaction is that depositors shift their LC deposit account to FC deposit and consequently local banks swap their dollar surplus with the foreign banks to fund their TL needs. This results in yield curve flattening.

When there is excess dollar liquidity, like in the period after 2008 crisis, asset-swap spread's tend to tighten whereas dollar deposit rates tend to decrease. Similarly, in the reverse order, when dollar liquidity decreases, asset-swap spreads tend to widen as well as dollar deposit rates increase.

5.2 Global Factors

Funding Conditions : Libor-OIS Spread

The Bankruptcy of Lehman Brothers and crisis in Europe have been challenging in terms of funding conditions which have been resulted in a sudden increase of the spreads between Libor and the comparable overnight index swap (OIS). During the crisis periods, the spread at extreme levels showed a response to credit risk and global

liquidity condition.

Libor is an interest rate that is used as a benchmark for setting other interest rates of financial transactions such as consumer lending and setting prices for financial products. It is determined by certain banks reported the rates that they are willing to pay for borrowing in different currencies ranging from overnight to an entire year. Hence it implies the expectations of banks in a certain period of time in terms of counterparty credit risk and liquidity risk..

it becomes difficult to provide funding for banks when uncertainty grows significantly. the main reason for this is that despite the demand for the funding of some banks, the counterparties are reluctant to maintain transaction in order to hold their own liquidity positions which can be interpreted as the fear of bank insolvency or credit risk premia.

On the other hand, overnight indexed swap (OIS) can be viewed as an expression of monetary policy and/or excess liquidity conditions which is historically correlated to the economic cycle. Furthermore, It is a derivative product consist of the difference between overnight interest rate and fed funds rate on the agreed maturity date without exchange of principal which makes OIS a pure indicator for the expectation of future interest rates with a negligible amount of default risk. Hence Libor-OIS spread is an effective indicator of overall funding conditions.

The empirical literature finds that the risk premiums, inherent in bond yields, tend to rise with tighter funding conditions. Sharp increases in the Libor-OIS spread refers the risk awareness of banks and other financial institutions for willing to lend to each other with counterpart risk concerns and causes asset swap spreads tend to rise.

Global FX Option Implied Volatilities

Cremers et al. (2008) show the importance of equity-options implied volatility on credit risk and finds linkage between volatility and jump risk premium against credit

spread.

Global Sentiment

Pan and Singleton (2008) use VIX option volatility index as a measure of investor's risk perception. VIX index is the weighted average of S&P500 options implied volatility with 30 days maturity. They show that EM risk premiums (i.e. Turkey and Mexico) are highly sensitive to US stock market volatility (VIX). They find evidence that VIX index is a key factor for some EM credit spreads including Turkey and has significant explanatory power especially in the periods of global event risks.

CHAPTER VI

METHODOLOGY

In my thesis, I use two different approach for completeness. The first approach is to build dynamic factor model with large number of macroeconomic and financial time series. Dynamic factor models has became a popular subject for researchers and central bankers after 2008 crisis particularly. Since Stock and Watson (2002) provide static factor model for econometric applications, dynamic representations, parameter estimation and factor selection topics are studied in the literature in a large scale. For example, Forni et al. (2005) proposes a generalized dynamic factor model which has a two-step estimation process with dynamic representation and constrained factor space derived from static form of Stock and Watson (2002).

Forecasting procedure is also crucial part of dynamic factor models. Rünstler and Bańbura (2007) provide two-step approach fed by the model of Doz et al. (2007) and estimation method of Doz et al. (2012). This joint approach deals with curse of dimensionality by carrying out principal component analysis. The rest of the parameters are estimated via standard linear regression. In the second step, all estimated parameters and latent factors are converted to state space representation. Afterward, Kalman filter and smoother are applied as forward backward algorithms with known parameters. Jansen and de Winter (2016) applied the method on Eurozone GDP and reveals that adding lagged predictor of target variable as an endogenous response in autoregressive term can improve forecast accuracy. Bańbura and Modugno (2014) present a dynamic factor model with maximum likelihood estimation. The model can be considered as as a parametric approach against non-parametric PCA. Bańbura and Modugno (2014) also shows feasible solution with modified Expectation-Maximization

algorithm for large data set as cross-sectional size tends to infinity.

Another two-step approach is provided by Koopman and de Winter (2014). the first step is the same as former proposed models where principal component analysis is used to estimate latent factor. In the second step, latent variables and target variable are considered as a dependent variable in state space framework. All parameters are estimated via maximum likelihood estimation straightforward. Finally, Kalman filter and smoother are used for in-sample and out of sample analysis as well as missing value treatment.

In my thesis I follow Stock and Watson (2002) and Koopman and de Winter (2014) for my analysis. Let X_{it} denotes a set of observable variable where $i = 1; ...; N$ is cross-sectional unit $t = 1, ..., T$ is time period. I transform observed variables of panel data to stationary form. I represent latent factors and dynamics of ASW spread as linear system equation.

$$\begin{aligned} y_t &= a_t + \beta_t(L)F_t + \epsilon_t \quad t = 1..T \\ X_t &= \Lambda F_t + e_t \quad t = 1..T \end{aligned} \tag{3}$$

y_t is ASW spread at time t, a_t is the constant term,$\beta_t(L)$ is the slope coefficients with Lth finite order lag polynomial. F_t is the set of latent variables, Λ is factor loading matrix. ϵ_t and e_t are prediction error and idiosyncratic error respectively.

In the second step, I follow Koopman and de Winter (2014) and convert dynamic factor model to state space model. I estimate principal components and model parameters of latent factors and ASW spread in state space framework. State space model consists of two different equation as observation equation and transition equation which can be shown as

$$\begin{pmatrix} y_t \\ \hat{F}_{PC,t} \end{pmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{pmatrix} y_t^* \\ F_t \end{pmatrix} + \begin{pmatrix} \epsilon_t \\ \tilde{e_t} \end{pmatrix} \tag{4}$$

$$\begin{bmatrix} 1 & -\Theta_{Fy} & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} y_{t+1}^* \\ F_{t+1} \\ F_t \end{pmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & \phi_1 & 0 \\ 0 & 1 & 0 \end{bmatrix} \begin{pmatrix} y_t^* \\ F_t \\ F_{t-1} \end{pmatrix} + \begin{pmatrix} \eta_t \\ \xi_t \\ 0 \end{pmatrix} \tag{5}$$

where $\tilde{e_t}$ is the stochastic shocks to estimated latent factors which are represent local business cycle. $Var(\tilde{e_t})$ is matrix of error terms for linear equation system with zero mean and unknown variance. ϵ_t and $\tilde{e_t}$ are assumed to be serially uncorrelated with zero mean and diagonal covariance matrix. On the contrary of static factor models, dynamic factor models are weakly correlated with lead lag relationship. I specify F_t as $AR(p_\psi)$ and $VAR(p_F)$ respectively so as to exploit dynamic relation of the linear system of equation and set the state space of the model for $p_\psi = p_F = 1$.

Another crucial step of the model construction is to determine the number of factors properly. Bai and Ng (2002) summarizes consistent estimation methods of optimal number of factor selection and show precise results for various cross section (N) and time series (T) dimensions. While most of the previous studies assume information criterion under the assumption of fixed N or T , Bai and Ng (2002) propose non-restricted models based on observed data as N and T tend to infinity where the model assumptions holds for data set serially correlated. Therefore, I follow BIC criterion of Bai and Ng (2002) where the model performs well for most of the data settings.

For my analysis, I collect data set with around hundred series. In data preparation step, I subtract set of candidate variables based on two criteria. First criteria is to

subtract variables which have more than 50 percent missing observation for all sample period. Second criteria is to eliminate variables by regressing each one of them on dependent variable. I discard variables which have almost no explanatory power on ASW spread. Boivin and Ng (2006) reveals that even most of the factor model theories are developed for the use of large panels, extraction of factors from as few as 50 variables perform well compared to the one extracted from more than 100 series.

The model I use for my analysis is not applicable for an unbalanced data set with missing values, data announcement mismatches and mixed frequency. Also it contains estimated factors $F_{PC,t}$ rather than observed variables X_t. To cope with this problem I use Kalman filter and smoother with AR(1) process. Kalman filter helps me to keep the process simple where variables with missing values return their long term trend quickly.

The second approach I use is to run linear regression model based on local and global financial time series. I re-run the model in sub-sample periods in order to test economical significance. Also, I use Chow Test to determine stability of parameters and structural breaks in recession periods. It enables me to reveal the type of crisis in the presence of independent variables of the model which have time-varying impact on ASW spread. Th Chow test procedure can be shown as

$$y_t = a + bx_{1t} + cx_{2t} + \epsilon \tag{6}$$

Chow test divides the time series to two different group as

$$y_t = a_1 + b_1 x_{1t} + c_1 x_{2t} + \epsilon \tag{7}$$

$$y_t = a_2 + b_2 x_{1t} + c_2 x_{2t} + \epsilon \tag{8}$$

The Chow Test assumes that model parameters in subgroups are equal as $a_1 = a_2$, $b_1 = b_2$ and $c_1 = c_2$. The test statistics of Chow test equation is $(S_{all} - (S_1 + S_2)/k)/((S_1 + S_2)/(N_1 + N_2) - 2k)$. S and N are sum of squared residuals and number of observations for specified samples respectively.

A methodological problem is swap spreads and the residuals obtained by doing OLS regressions on the levels of the various variables, are auto-correlated, something which is also confirmed by the Durbin-Watson tests. This means that an OLS regression is not the optimal estimator of the underlying relationship, and that the coefficients are more volatile than if there is no autocorrelation (or if one corrects for autocorrelation). I have conducted the OLS regression analysis on weekly changes (rather than levels) to try to account for the autocorrelation. In general, the resulting coefficients are similar to those found by doing regressions on levels. This is one of the reasons why I have used regressions done on levels, rather than changes in weekly model. Another problem with regression on changes rather than levels (or a more advanced error correction), is that the residual produced from the model will be very close to zero, or fade away quickly.

CHAPTER VII

RESULTS

Over the long run swap spreads in Turkey exhibit distinct behavior, on the back of common macro drivers, resulting in a strong correlation among US 10Y benchmark rate and slope of yield curve (see Figure 5, Figure 6). These correlations have, however, changed significantly over the past 10 years as some other global and local factors have prevailed. For example in credit crisis period, investors shifted their positions to the safest possible asset classes as risk drivers rose jointly. Also ASW spread started to move with credit related factors such as CDS and risk aversion factors like dollar deposit rate. In European crisis, global factors simply explain most of the variation of ASW spread while local factors remained steady. Overall, combination of all factors have been informative on ASW spread behavior in all sample for 11 years (see Table 6). Figure 4 illustrates the rolling window regression result for 10 years period where the selected local and global factors capture ASW spread variation in different market regimes.

In order to develop a unified framework on the drivers of swap spreads I run a long term (11 years) linear regression on 2Y swap spread then find market variables which are correlated to ASW spread over time. I find that swap spread is mostly driven in the long run by the shape of yield curve, which I measure using 10y-3m local bond rate, as an expression of monetary policy and/or excess liquidity conditions. In addition, swap spreads are also driven by risk aversion, given the tendency of investors to increase demand for hedging activity on the swap curve.

Over the past few years some of these long-term relationship of swap spreads to fundamental variables have been challenged by central banks staying firmly on hold

and limited volatility of policy rates, which has reduced the sensitivity of swap spreads to macro variable while increasing the relevance of flight to quality and risk aversion.

The results of dynamic factor model match with the weekly linear regression model. The analysis of the evolution of the principal components helps me in identifying the long term drivers of swap spreads across various factors. The capability of first few factors to explain the overall variability of swap spreads over the past 10 year has remained high, as idiosyncratic factors have prevailed more recently.

I use IC criterion to determine optimal number of factors which indicates first 12 principal components as a candidate variable for my analysis. The first 12 factors explain %60 of the co-movement of panel data (See Figure 7). In the next step, I follow BIC criterion to reveal the significant factors which have explanatory power on ASW spread. I select F1, F3, F6 for my analysis where the combination of three factor explain %30 of panel data and %45 of ASW spread variation (See Figure 8).

I conduct correlation and multiple regression analysis to examine the relationship between ASW spread and synthetic predictors. Table 8 summarizes results of analysis where ASW spread is positively and significantly correlated with F1 in different volatility regimes, indicating that those with higher scores on these variables tend to have higher ASW spread. F3 and F6 are negatively correlated with ASW spread. The multiple regression model with all three predictors produced %41 R square value overall. As can be seen in Table 8, significancy of the predictors varies over time. Moreover, F1 is the strongest predictor in recovery periods and crisis period as well.

I relate the factor-components with panel data by regressing each variables on predictors to discover which part of the economic drivers influences ASW spread dynamics. Figure 10 shows that F1 is mostly correlated with financial variables subgroup which has a positive slope coefficient in all periods. It can be interpreted as ASW spread is widening while the risks in the financial markets increases.

F3 is mostly effected by Prices subgroups with negative slope coefficient (see Figure 11). Prices subgroup includes consumer prices, producer prices and commodity prices which are all inflation related data that central bank tracks to keep the inflation under control. Since inflation is the primary factor for funding rate, F3 is the substantial part of modeling ASW spread.

F6 has a small effect on ASW spread. It is mostly correlated with Money, Credit and Quantity Aggregation subgroup and mostly money supply sight deposit variable (see Figure 12). Money supply operation is mostly conducted by bond supply with the idea that lower issuance tends to drive swap spreads wider. Roche (2011) explains the money supply dynamics of economy in details. Figure 14 illustrates the predictors against observed panel data variables where F1 and F3 are mostly correlated with USD/TRY and consumer price index respectively.

One crucial part of dynamic factor models are the forecasting procedure for different time horizons. Although it is not the main object of my study, it would be informative to add the out-of-sample forecasting performance as a part of the model. I set linear regression, moving average, and autoregressive models as benchmarks which are widely used in the literature. I test the model performance for 1, 2, 4 ,8 months ahead and use mean squared forecast error (MSFE) for comparison. I choose %30 of the observation to mesure the out-of-sample performance. It should come as no surpise that dynamic factor model beats all the benchmark models for all time horizons because it provides more calibrated parameters and adapts second moment statistics through state space model (see:Table 9). Also, (Figure 13) illustrates forecasting process of dynamic factor model .

Categories	Regressors	All Sample	Credit Crisis	European Crisis	Pre-Tapering	Post-Tapering
Global Factors	**Euro Basis 5**	**0.41**	0.10	-0.03	**-0.43**	**0.26**
		[9.24]	[1.14]	[-0.16]	[-2.92]	[-3.06]
	US 10 Year Yield	**-0.51**	**-0.23**	**-0.28**	-0.04	**-0.26**
		[-3.42]	[-3.36]	[-1.81]	[0.39]	[-3.82]
	VIX	**0.21**	0.25	**-0.17**	**-0.24**	0.07
		[6.03]	[1.78]	[1.91]	[-2.06]	[1.27]
	Libor-OIS Spread	**-0.12**	0.03	**0.72**	0.15	**-0.27**
		[-3.42]	[0.46]	[5.85]	[1.21]	[-3.51]
Local Factors	**Turkey Dolarization**	**0.58**	**0.24**	0.11	**0.93**	**0.51**
		[20.59]	[4.14]	[1.47]	[6.95]	[8.88]
	Turkey 5 Year CDS	0.04	**0.30**	-0.02	0.36	**-0.23**
		[1.06]	[2.34]	[-0.17]	[2.41]	[-3.52]
	TRY Risk Reversal	-0.04	-0.07	0.13	0.04	**-0.12**
		[0.09]	[-0.74]	[1.69]	[0.43]	[-2.74]
	Turkey Yield Slope	**0.30**	**0.35**	**0.36**	**-0.24**	**0.58**
		[12.83]	[5.43]	[1.69]	[-2.54]	[10.57]
	R^2	**0.83**	**0.83**	**0.81**	**0.88**	**0.67**

Table 6: Regression model $y_t = \beta_0 + BX_t$: Table reports the estimates of ASW spread on variables named in each row. The model is re-run for predetermined periods stated on the first row of the table . Coefficients are estimated for each period. Statistically significant coefficients at the 5% or better confidence interval are highlighted in bold. A constant is always included in the regression even though its estimate is not reported in the table. Newey(1980) corrected t-statistics are reported in brackets.

Row	Period	Hypothesis	Statistic F	p-value	Chow Test Coefficients Tested	Significance level
1	Credit Crisis	1	12.485	0.0062	All	0.05
2	European Crisis	1	11.189	0.0073	All	0.05
3	Pre-Tapering	1	8.979	0.0154	All	0.05
4	Post-Tapering	1	8.174	0.0217	All	0.05

Table 7: Chow test (break point) results at 0.05 significance level (2-tailed)

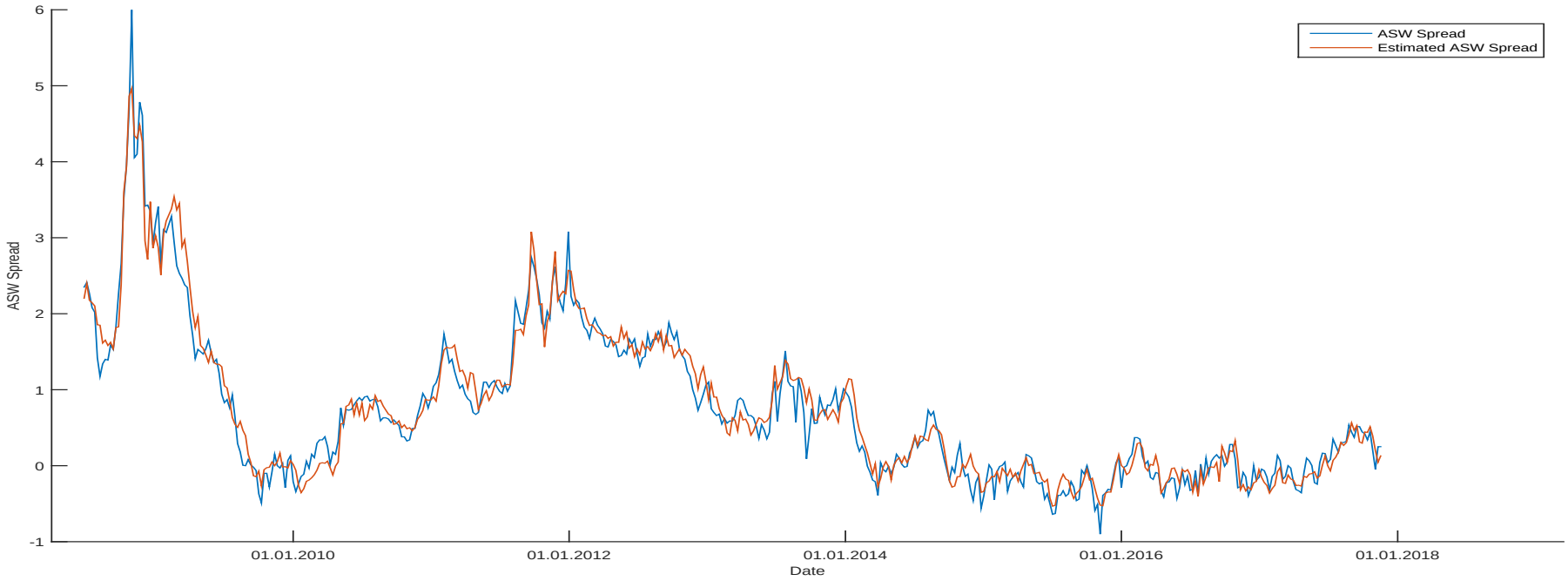


Figure 4: The graph shows 52-week rolling window regression estimates and ASW spread over time. The variables used in the model are the factors explained in details.

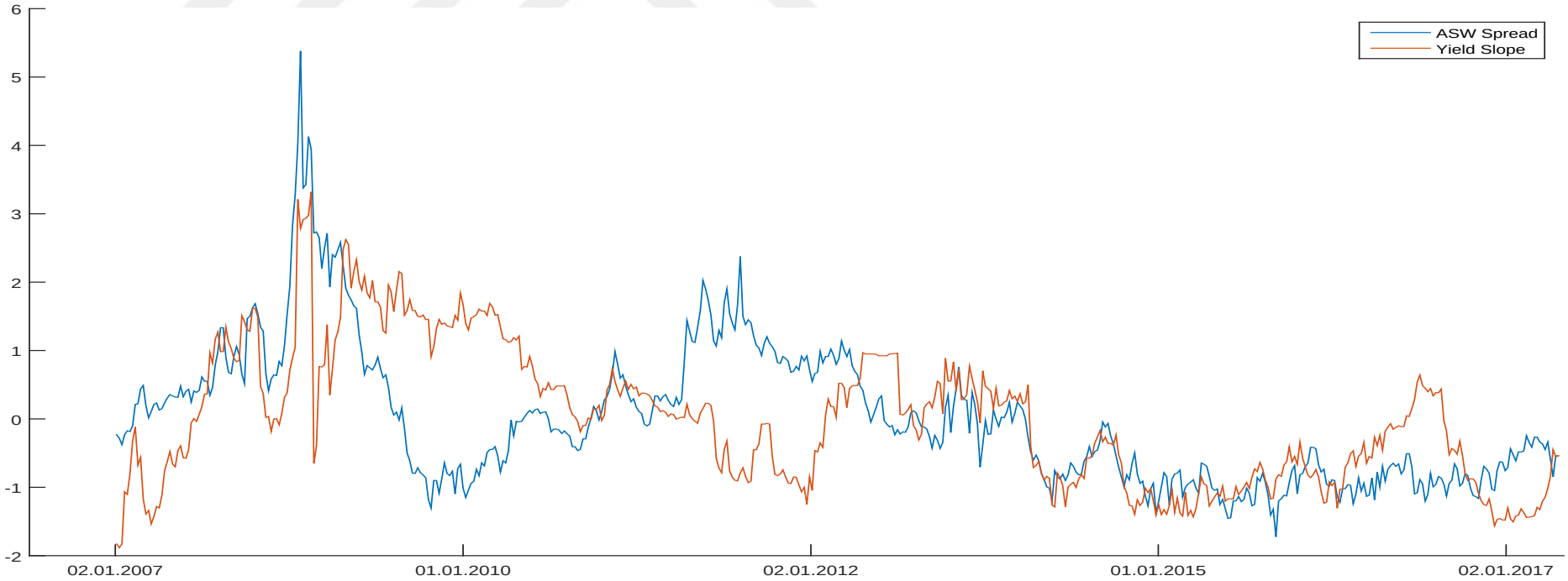
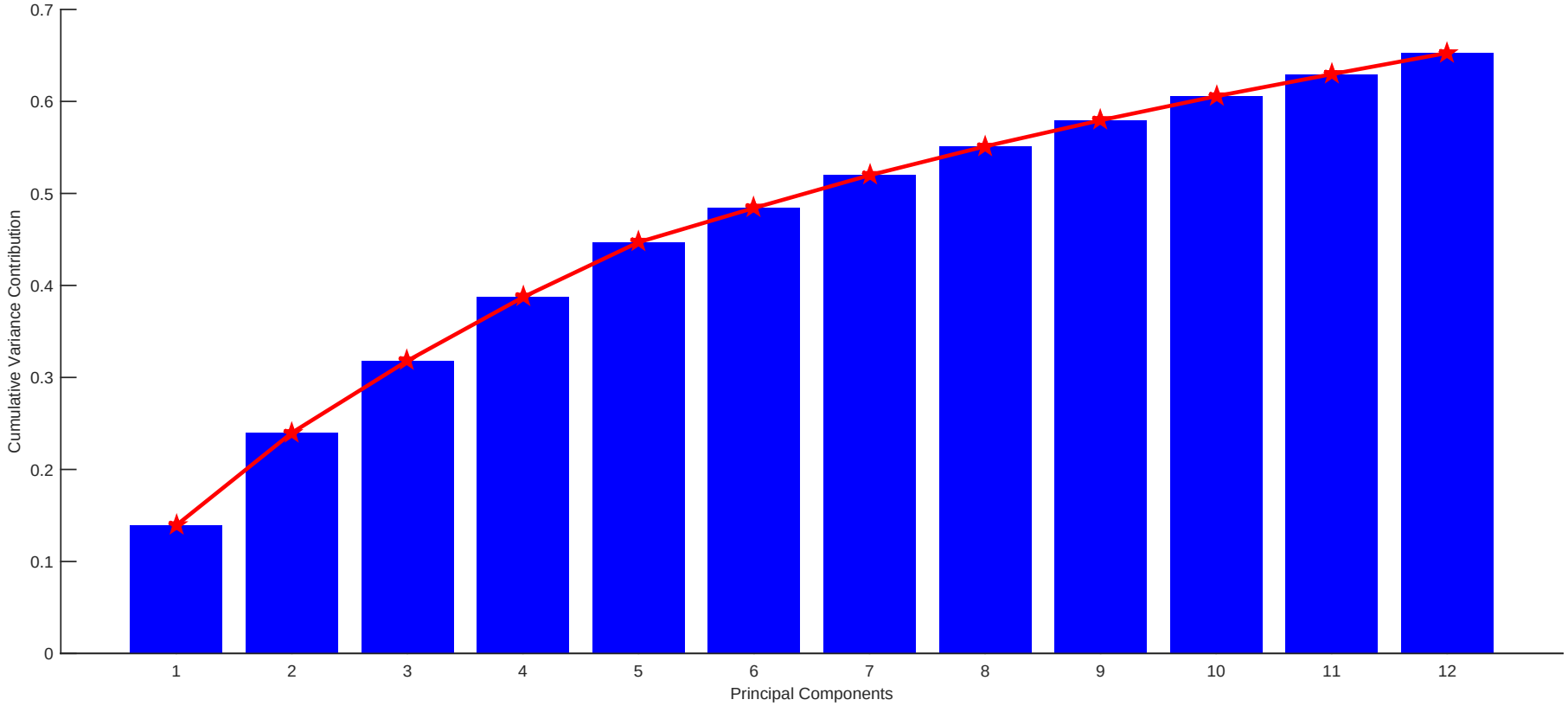


Figure 5: Time series of Turkey yield curve slope against the targeted series ASW spread. The yield curve slope is calculated as the difference between 10 year zero coupon local bond rate and 3 month local bond rate.

Figure 6: Time series of generic 10 year US treasury yield againts the targeted series ASW spread.

Figure 7: The figure shows absolute value of cumulative variance explained by each factors selected by IC cretiron



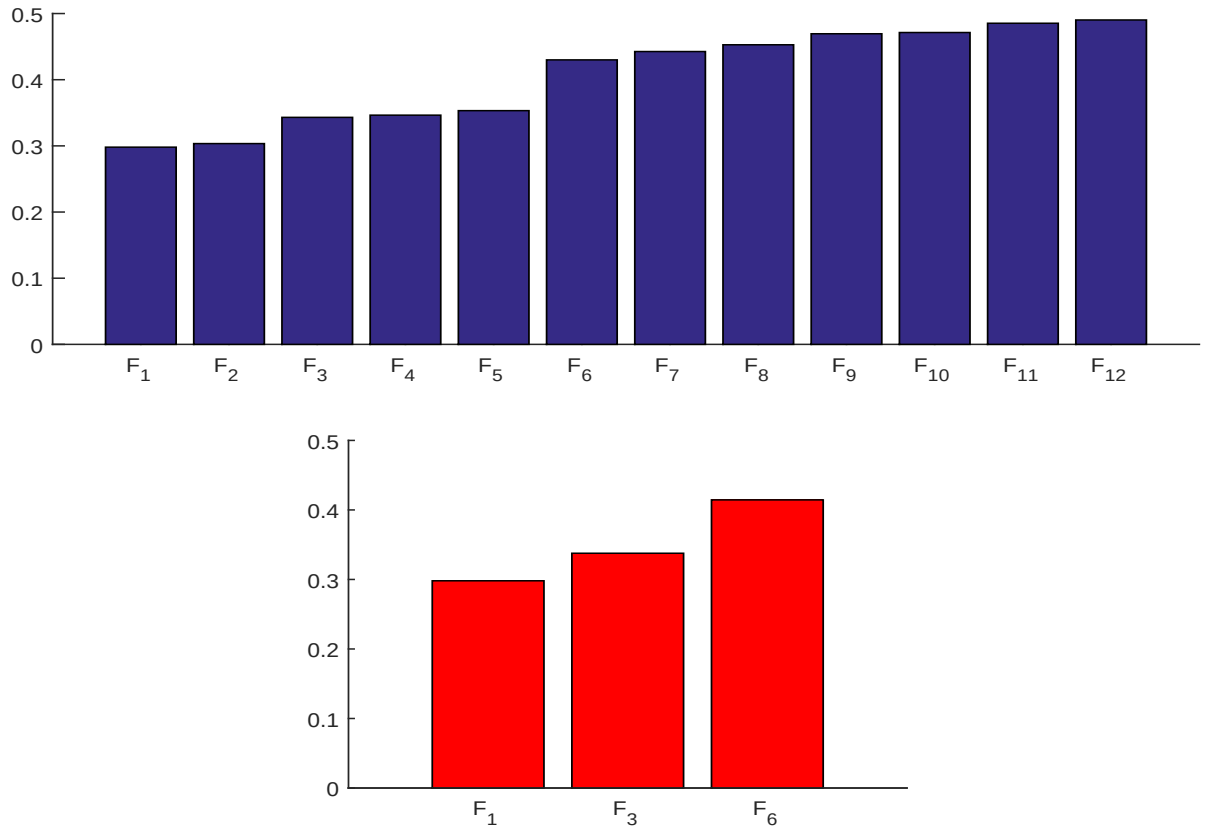


Figure 8: The first bar chart shows the contribution of factors to explain target variable. Y-axis represents the adjusted r-square with each variable added to model. The second chart shows r square contribution of the factor selected by Bayesian Information Criterion.

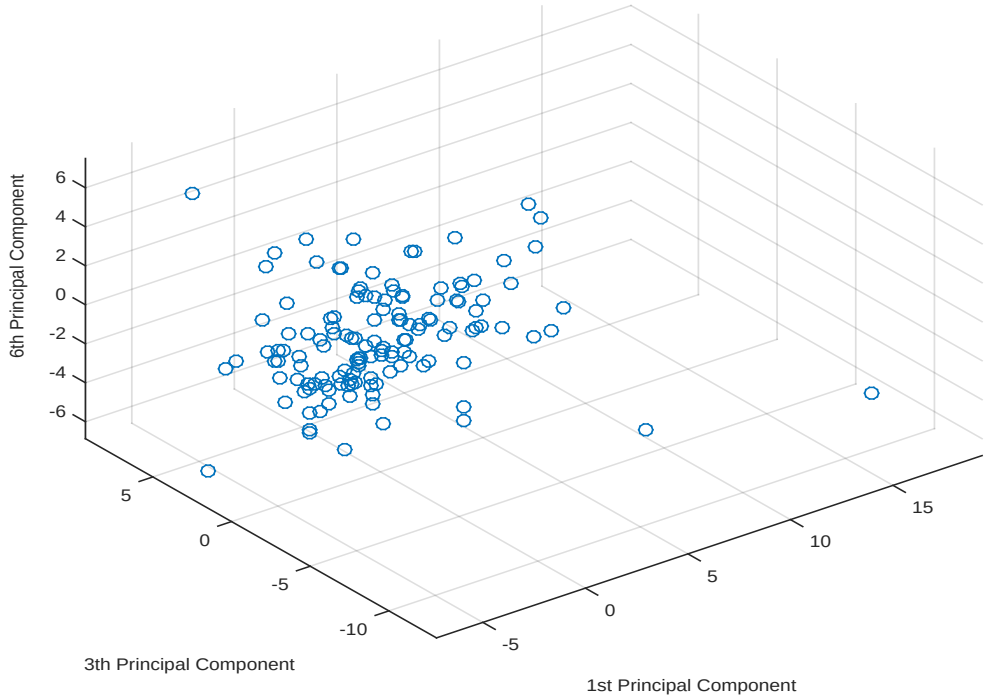


Figure 9: Variability of panel data along the first, third and sixth principal component axes.

Figure 10: The bar chart displays the R^2 statistics by regressing each time series in the panel data on the y-axis on the first factor loading, F_1. The time series are categorized into six subgroups: Financial Variables, Housing and Orders, Money and Credit Quantity Aggregates ,Labour Market, Prices, Real Economic Activity . The subgroups are separated by lines

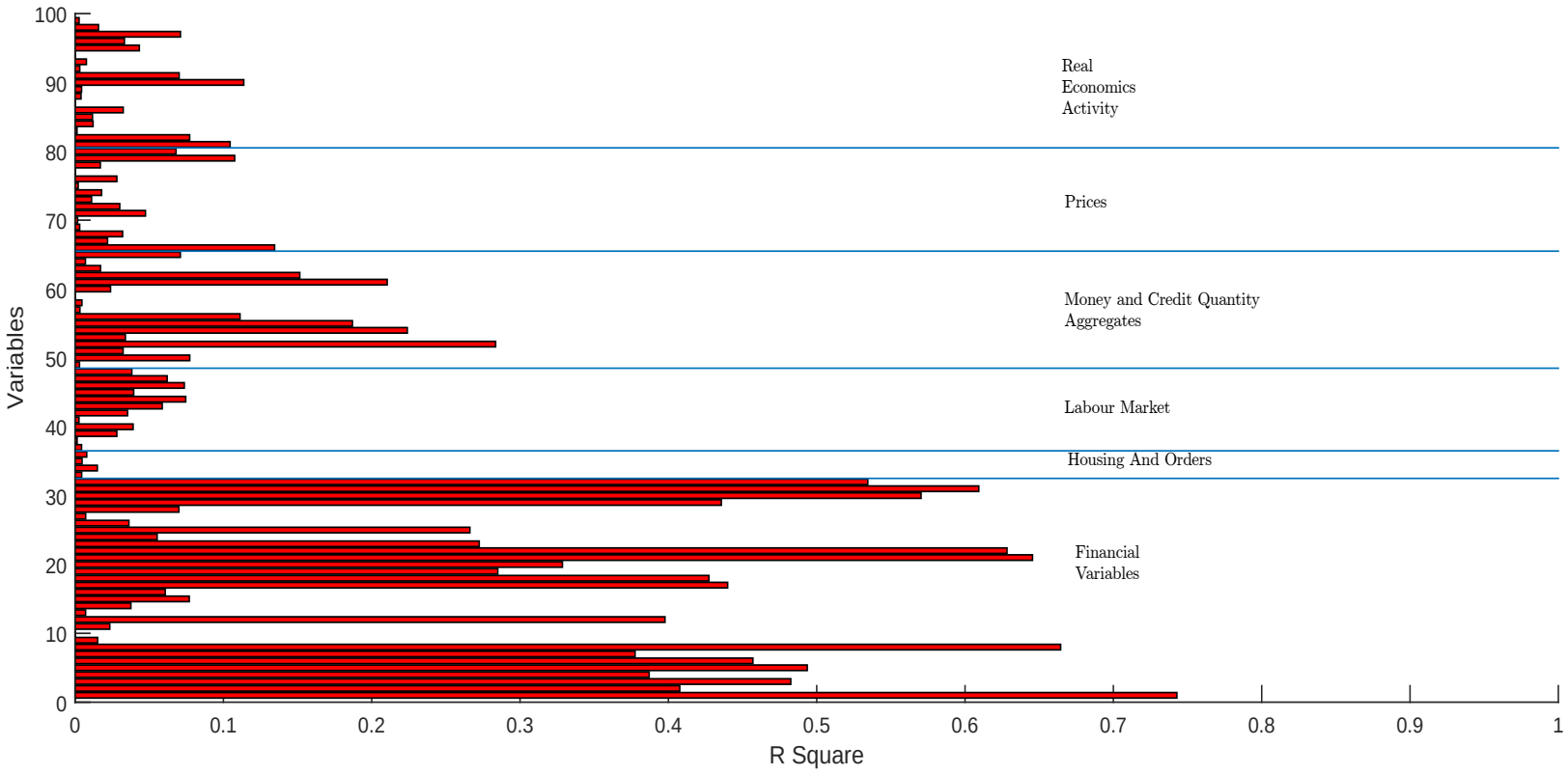


Figure 11: The bar chart displays the R^2 statistics by regressing each time series in the panel data on the y-axis on the first factor loading, F_3. The time series are categorized into six subgroups: Financial Variables, Housing and Orders, Money and Credit Quantity Aggregates ,Labour Market, Prices, Real Economic Activity The subgroups are separated by lines

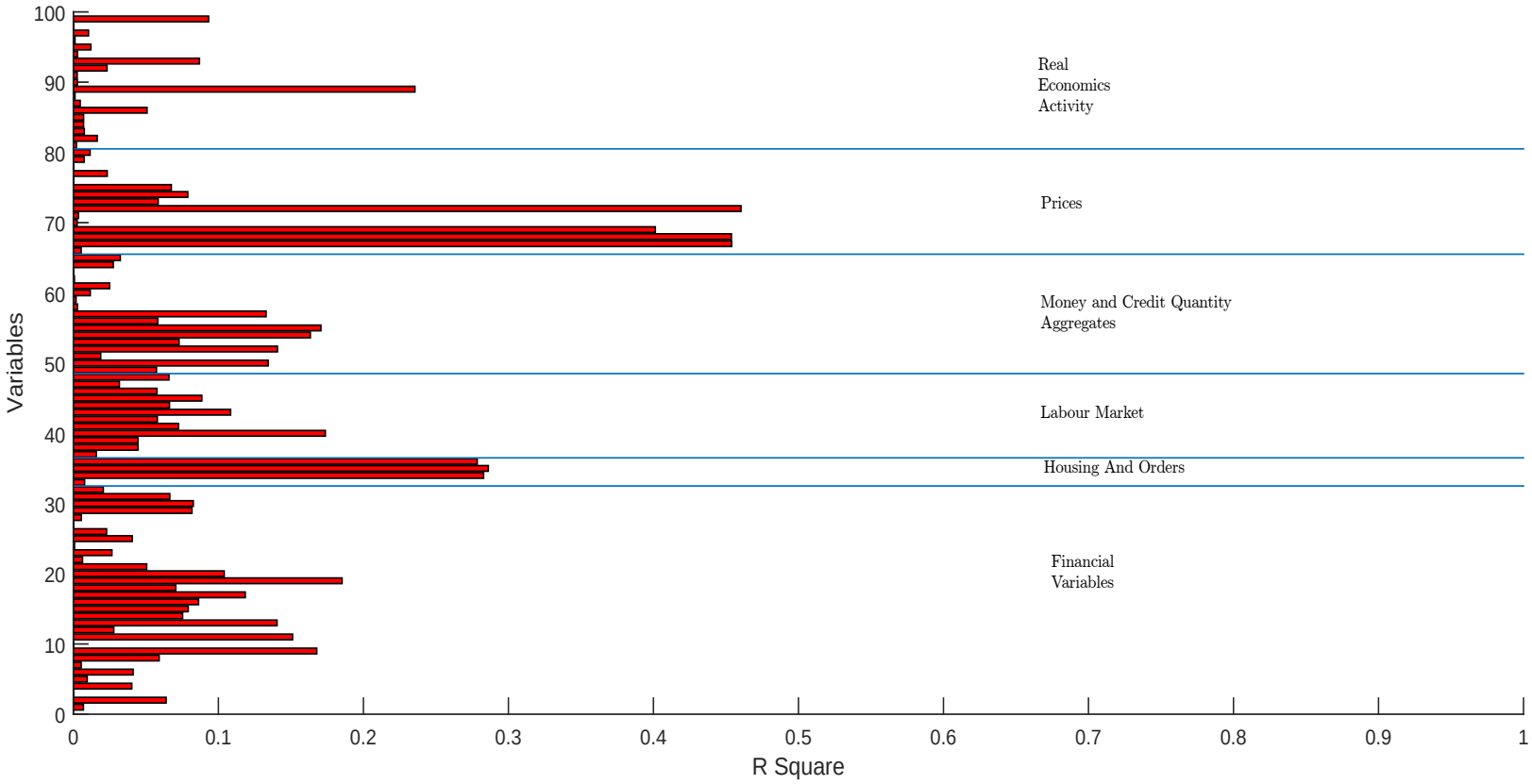


Figure 12: The bar chart displays the R^2 statistics by regressing each time series in the panel data on the y-axis on the first factor loading, F_6. The time series are categorized into six subgroups: Financial Variables, Housing and Orders, Money and Credit Quantity Aggregates ,Labour Market, Prices, Real Economic Activity The subgroups are separated by lines

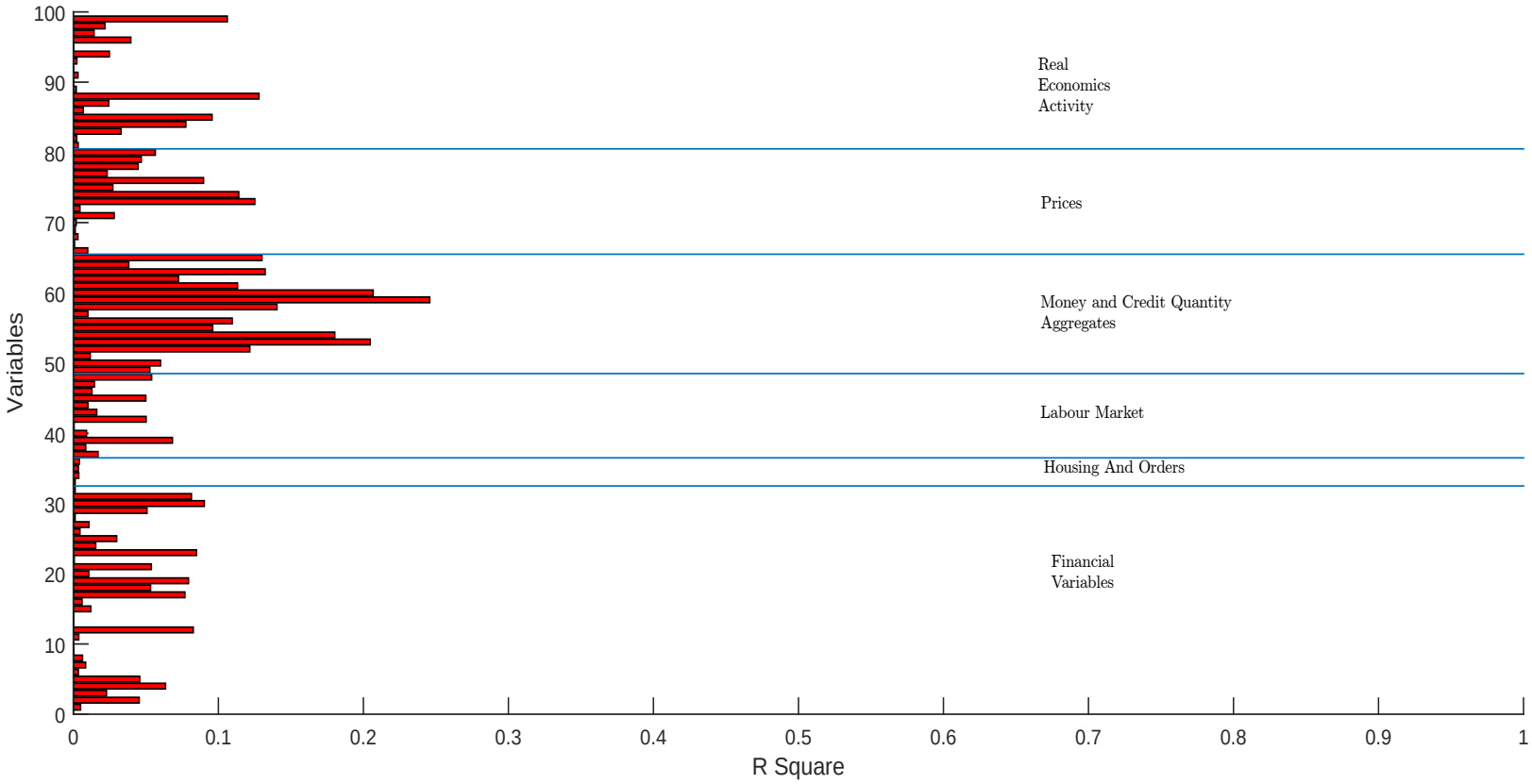


Figure 13: The line charts display h-step ahead forecasting result of dynamic factor model and ASW spread. The blue line represents the initial poinf for out-of-sample analysis

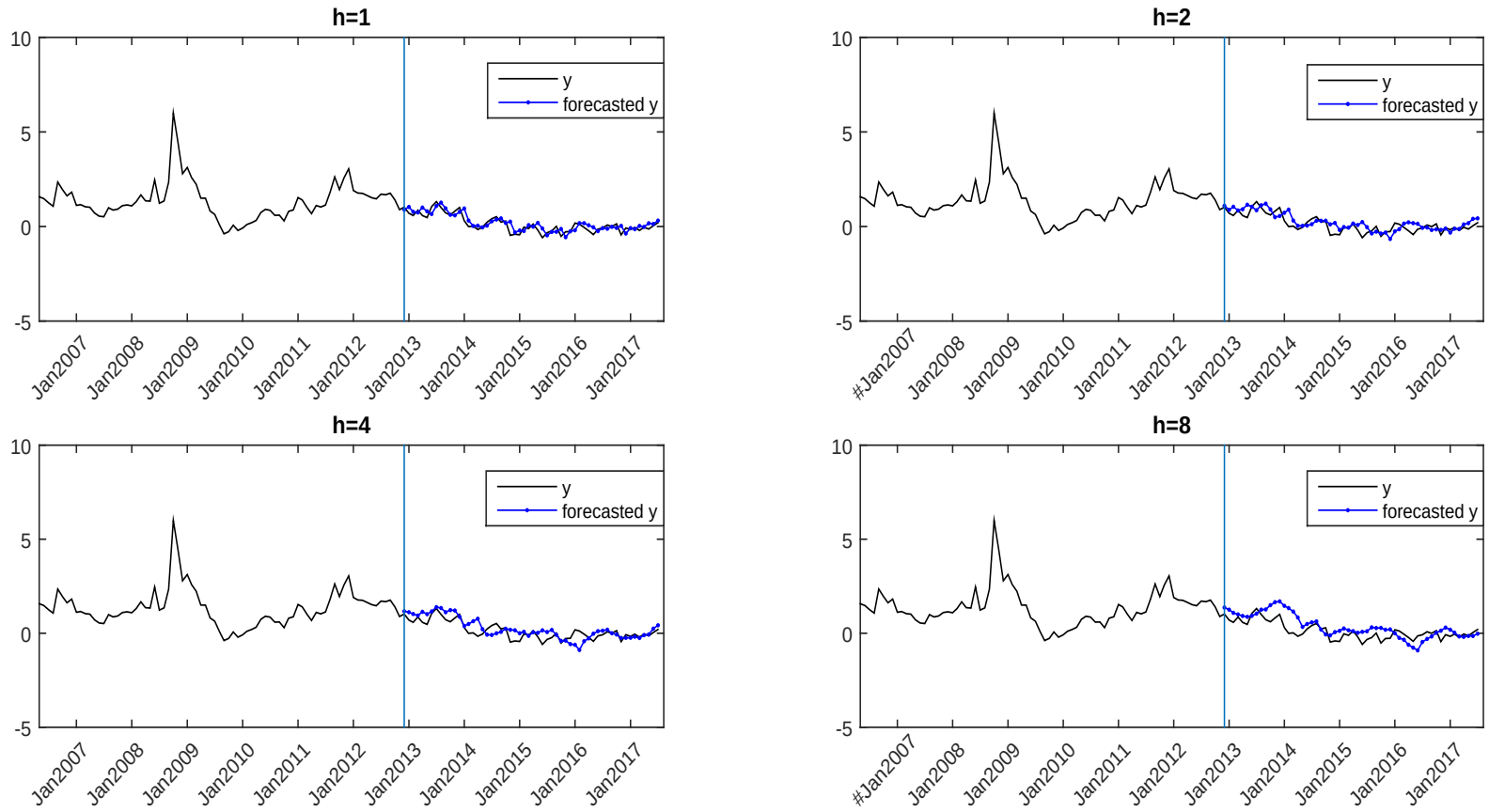
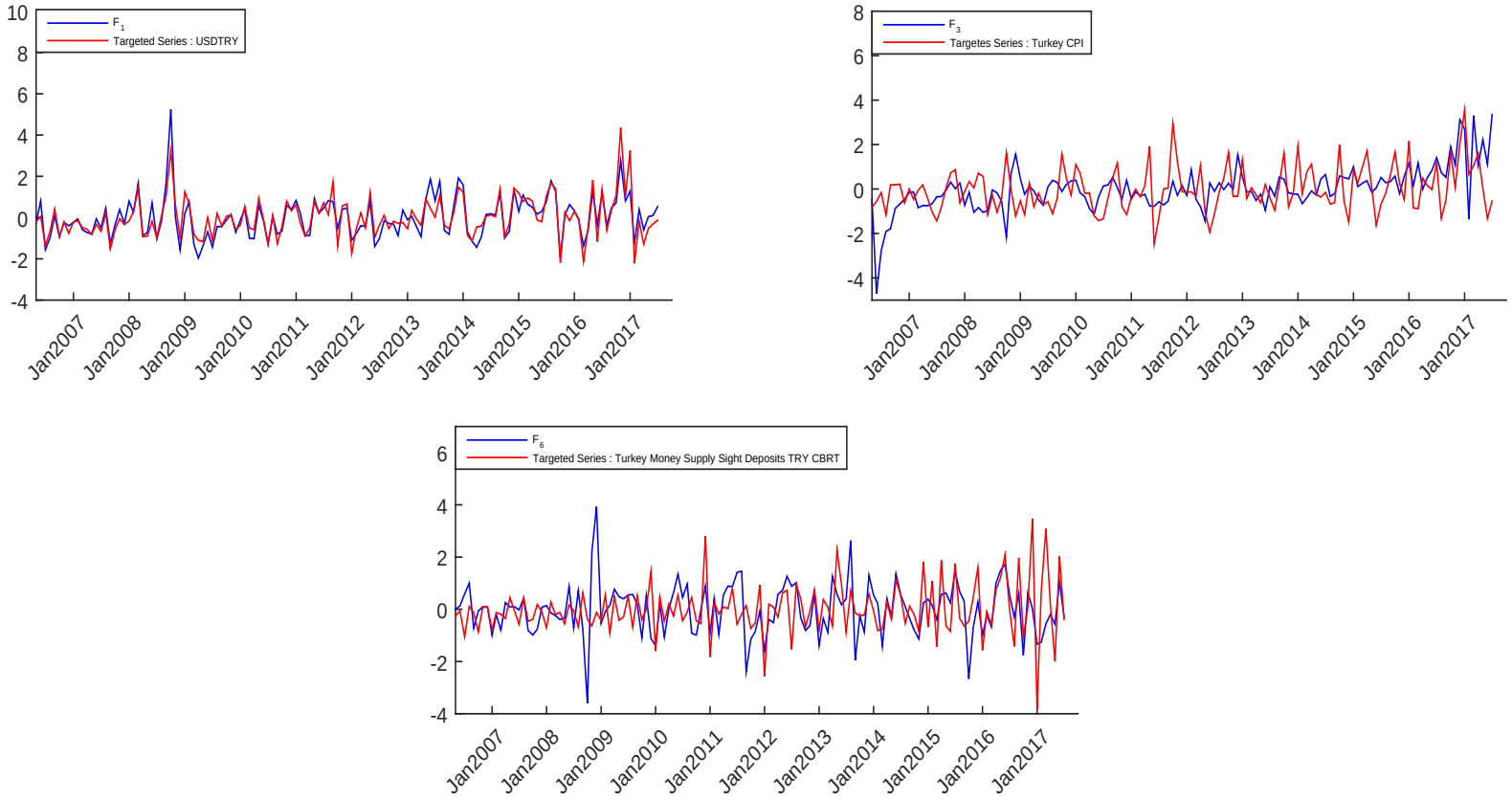


Figure 14: Time series of estimated factors against observed variables. Estimated factors are plotted in blue lines and target series are plotted in red lines. Observed variables are selected based on its explanatory power on estimated factors



		$F_{1,t}$	$F_{3,t}$	$F_{6,t}$	R^2
All Sample	(a)	**0.08** [7.51]			29%
	(b)		**-0.04** [-2.34]		4%
	(c)			**-0.07** [-3.32]	7%
	(d)	**0.08** [8.16]	**-0.04** [-2.97]	**-0.08** [-4.14]	41%
Credit Crisis	(a)	**0.15** [6.99]			66%
	(b)		**-0.37** [-5.37]		53%
	(c)			**-0.30** [-5.32]	52%
	(d)	**0.09** [3.87]	-0.12 [-1.67]	**-0.11** [-1.98]	76%
European Crisis	(a)	**0.13** [5.31]			49%
	(b)		-0.05 [-0.93]		0.4%
	(c)			-0.04 [0.94]	0.5%
	(d)	**0.13** [4.71]	0.02 [0.42]	0.02 [0.55]	47%

Table 8: Regression Model $y_t = \beta_0 + BF_t$: Table reports the estimates of ASW spread on estimated factors named in each row. The model is re-run for pre-determined periods stated on first row of the table . Coefficients are estimated for each period. Statistically significant coefficients at the 5% or better confidence interval are highlighted in bold. A constant is always included in the regression even though its estimate is not included in the table. Newey(1980) corrected t-statistics are reported in brackets.

Row	Model	Benchmark	horizon h=1	h=2	h=4	h=8
1	Dynamic Factor Model	Linear Regression	0.912	0.826	0.911	0.885
2	Dynamic Factor Model	Mean	0.217	0.355	0.168	0.271
3	Dynamic Factor Model	AR(p)	0.832	0.304	0.293	0.479

Table 9: The table shows out-of-sample performance of factor model against pre-specified benchmark models for 1, 2, 4, 8 ahead forecasts. The numbers for each forecasting horizon introduce mean squared forecast error (MSFE) as $MSFE_{model}/MSFE_{benchmark}$.

CHAPTER VIII

CONCLUSION

To summarise, I have identified the most important drivers behind movements in asset swap spread. I have found that these variables are not only significant on a statistical basis, but as importantly, their relevance make intuitive sense. I have then used these drivers to build two different model on weekly and monthly basis.

The model with monthly frequency data shows the predictive power of macroeconomic drivers over the period of 2006 Q2 to 2017 Q3. Dynamic factor model enables me to build a model of swap spreads on fundamental business cycle variables, on which I tend to have forward looking views. I extract common drivers of business cycle and find strong relationship with panel data. The estimation procedure differs from the many studies in the literature. I used two-steps approach where I used principal component analysis in the first step and convert target variable and estimated factors in state space framework with vector autoregressive representation. This procedure enables me to treat all variables and estimate model parameters simultaneously. I use AR, moving average and linear regression models as a benchmark for out-of-sample analysis based on relative mean square forecast error (MSFE). The estimated predictive factors perform much better in both in-sample and out-of-sample tests than the other benchmark models.

The model with weekly frequency reveals short term drivers of asset swap spread. I find that local factor and global factors explain asset swap variation with different magnitude and time-dependencies based on market conditions. On local factors side, slope of yield curve has the most explanatory power while US 10 Year Yield is the leading factor on global side. I then used Chow Test to determine the type of crysis

occured recently. Chow test helps me to reveal the sensitivity of risk drivers on asset swap spread in recession and expansion period of the economy.

This thesis is the first study focused on asset swap spread dynamics in emerging markets. It contributes to literature by presenting the interaction between asset swap spread and business cycle with flexibility of dynamic factor model. Furthermore, weekly model with financial variables explain the short-term variation of asset swap spread straightforwardly. There can be several researches to extend this study. One extension could involve analyzing asset swap spread of other EM countries within the same period of time. This could reveal EM specific risk factors and increase predictive power of models. One advantage of this approach is that it could allow modeling swap spreads in various markets under common simplified framework, which captures the long-term fundamental drivers of swap spreads. Additionally, panel data can be constructed with various number of candidate variables for factor analysis so as to investigate statistical property of data set and its effect on the estimation progress

CHAPTER IX

APPENDIX

The table shows each financial and economic time series of panel data used in model construction. First and second column show data names and sources respectively. The last column is for transformation type where Δln and $\Delta^2 ln$ denote first and second logarithmic differences. Δlev denotes first differences and lev is for level of the series.

Table A
(Turkey)

1	Turkey Confidence Index Real Sector	Central Bank of Turkey	Δln
2	Turkey Consumer Confidence	State Institute of Statistics	Δln
3	OECD Turkey Comp Leading Indic Trend Res Stock SA	OECD	$\Delta^2 ln$
4	Turkey Industry Turnover 2010=100	State Institute of Statistics	Δln
5	Turkey Industrial Production 2010=100	State Institute of Statistics	Δln
6	Turkey Industrial Production Manufacturing 2010=100	State Institute of Statistics	Δln
7	Turkey Industrial Production Mining 2010=100	State Institute of Statistics	Δln
8	Turkey Industrial Production Electricity 2010=100	State Institute of Statistics	Δln
9	Turkey Motor Vehicle Industry Production Total	OSD	Δln
10	Turkey Capacity Utilization NSA	Central Bank of Turkey	Δln
11	Turkey Balance of Payments Portfolio Investment Liabilities	Central Bank of Turkey	lev
12	Turkey Balance of Payments Net Errors & Omissions	Central Bank of Turkey	lev
13	Turkey Balance of Payments Direct Investment in Turkey	Central Bank of Turkey	lev
14	Turkey Domestic Debt Position Total	Central Bank of Turkey	Δln
15	Turkey Budget Deficit Primary Balance Before Interest	Republic of Turkey Treasury	lev
16	Turkey Trade Balance	State Institute of Statistics	Δln
17	Turkey Total Exports	State Institute of Statistics	Δln
18	Turkey Total Imports	State Institute of Statistics	Δln
19	Turkey Balance of Payments Current Account	Central Bank of Turkey	Δln
20	Turkey GDP Constant Prices	State Institute of Statistics	Δln
21	Household Consumption - Total	State Institute of Statistics	lev
22	Household Consumption - Housing	State Institute of Statistics	lev
23	Household Consumption - Durables	State Institute of Statistics	lev
24	Household Consumption - Services	State Institute of Statistics	lev
25	Turkey Labor Statistics Unemployment Rate SA	State Institute of Statistics	Δln
26	Turkey Labor Statistics Employment Rate SA	State Institute of Statistics	Δln
27	Agriculture Forestry Hunting & Fishing	State Institute of Statistics	Δln
28	Mining & Quarrying	State Institute of Statistics	Δln
29	Manufacturing	State Institute of Statistics	Δln
30	Electricity Gas & Water	State Institute of Statistics	Δln
31	Turkey Construction in Thousands	State Institute of Statistics	Δln
32	Wholesale & Retail Trade	State Institute of Statistics	lev
33	Transportation & Communication	State Institute of Statistics	Δln

Table A
(Turkey)

34	Finance & Insurance	State Institute of Statistics	Δln
35	Community Social & Personal Services	State Institute of Statistics	lev
36	Turkey Unemployment Non-institutional Civilian Population	State Institute of Statistics	$\Delta^2 ln$
37	Turkey Unemployment Labor Force	State Institute of Statistics	Δln
38	Turkey Unemployment Employed	State Institute of Statistics	Δln
39	Turkey Unemployment Monthly	State Institute of Statistics	Δln
40	Turkey Unemployment Labor Force Participation Rate	State Institute of Statistics	Δln
41	Turkey Unemployment Non-agricultural Unemployment Rate	State Institute of Statistics	Δln
42	Turkey Unemployment Youth Unemployment Rate	State Institute of Statistics	Δln
43	Turkey Unemployment Not in The Labor Force	State Institute of Statistics	Δln
44	OECD Turkey Construction Permits Issued Residential Buildings	OECD	lev
45	Turkey Real Sector Confidence Index Volume of Orders (Current Situation)	Central Bank of Turkey	Δln
46	Turkey Real Sector Confidence Stocks of Finished Goods (Current Situation) SA	Central Bank of Turkey	Δln
47	Turkey Real Sector Confidence Index Export Orders (Next 3 Months) SA	Central Bank of Turkey	Δln
48	Building Permits - State	State Institute of Statistics	Δln
49	Building Permits - Coop	State Institute of Statistics	Δln
50	Building Permits - Private	State Institute of Statistics	lev
51	Building Permits - Total	State Institute of Statistics	lev
52	S&P GSCI Index Spot CME	Standard & Poor's	Δln
53	Turkey PPI	State Institute of Statistics	Δln
54	Turkey PPI Agriculture	State Institute of Statistics	Δln
55	Turkey PPI Industry	State Institute of Statistics	Δln
56	Turkey PPI Crude Petroleum & Natural Gas	State Institute of Statistics	Δln
57	Turkey PPI Manufacturing	State Institute of Statistics	Δln
58	Turkey PPI Food & Beverages	State Institute of Statistics	Δln
59	Turkey CPI	State Institute of Statistics	Δln
60	Turkey CPI Food & Non Alcoholic Beverages	State Institute of Statistics	Δln
61	Turkey CPI Alcoholic Beverages & Tobacco	State Institute of Statistics	Δln
62	Turkey CPI Housing Water Electricity Gas & Other Fuels	State Institute of Statistics	Δln

Table A
(Turkey)

63	Turkey CPI Furnishings Household Equipment & Routine House Maintenance	State Institute of Statistics	Δln
64	Turkey CPI Transport	State Institute of Statistics	Δln
65	S&P GSCI Agriculture Index Total Return CME	Standard & Poor's	Δln
66	S&P GSCI Precious Metals Index Total Return	Standard & Poor's	Δln
67	Turkey Consumer Loans Total	Central Bank of Turkey	Δln
68	Deposit Money Banks Loans Private Sector - Housing	Central Bank of Turkey	$\Delta^2 ln$
69	Deposit Money Banks Loans Private Sector - Consumer & Other	Central Bank of Turkey	$\Delta^2 ln$
70	Deposit Money Banks Loans Private Sector	Central Bank of Turkey	Δln
71	Turkey Money Supply M1	Central Bank of Turkey	Δln
72	Turkey New Money Supply M2	Central Bank of Turkey	Δln
73	Turkey New Money Supply M3	Central Bank of Turkey	Δln
74	Turkey Money Supply Time Deposits TRY	Central Bank of Turkey	Δln
75	Turkey Money Supply Sight Deposits FX	Central Bank of Turkey	Δln
76	Turkey Money Supply Sight Deposits TRY CBRT	Central Bank of Turkey	lev
77	Turkey Money Supply Bank Vaults	Central Bank of Turkey	Δln
78	Turkey Money Supply Sight Deposits TRY	Central Bank of Turkey	Δln
79	Turkish Money Supply Time Deposits FX	Central Bank of Turkey	Δln
80	Turkey Intl Weekly Reserves	Central Bank of Turkey	Δln
81	Turkey Money Supply Repos	Central Bank of Turkey	lev
82	Turkey Money Supply Money Market Funds	Central Bank of Turkey	Δln
83	Weighted Average Interest Rates for Turkish Lira Banks Loans - Commercial	Central Bank of Turkey	Δln
84	USD	Central Bank of Turkey	Δln
85	EUR	Central Bank of Turkey	Δln
86	YEN	Central Bank of Turkey	Δln
87	Swiss franc	Central Bank of Turkey	Δln
88	Implied Vol	Central Bank of Turkey	Δln
89	Risk Revrsal	Central Bank of Turkey	Δln
90	Turkey Real Effective Exchange Rate Broad	BIS	Δln
91	CDS - Country	Bloomberg Indices	Δln
92	CB Rate	Central Bank of Turkey	Δln

Table A
(Turkey)

93	Weighted Average Interest Rates for Turkish Lira Banks Loans - Cash	Central Bank of Turkey	Δln
94	Weighted Average Interest Rates for Turkish Lira Banks Loans - Vehicles	Central Bank of Turkey	Δln
95	Weighted Average Interest Rates for Turkish Lira Banks Loans - Housing	Central Bank of Turkey	Δln
96	Composite	Istanbul Stock Exchange	Δln
97	Composite	Istanbul Stock Exchange	Δln
98	Banking	Istanbul Stock Exchange	Δln
99	Indutrial	Istanbul Stock Exchange	Δln
100	Utulities	Istanbul Stock Exchange	Δln
101	Turkey Non-Residents Holdings of Equity Stock	Central Bank of Turkey	Δln
102	Turkey Non-Residents Holdings Government Domestic Debt Securities (GDSS) Stock	Central Bank of Turkey	Δln

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