TÜRKİYE CUMHURİYET MERKEZ BANKASI

A Measure of Turkey's Sovereign and Banking Sector Credit Risk: Asset Swap Spreads

Abdullah KAZDAL
Halil İbrahim KORKMAZ
Doruk KÜÇÜKSARAÇ
Yiğit ONAY

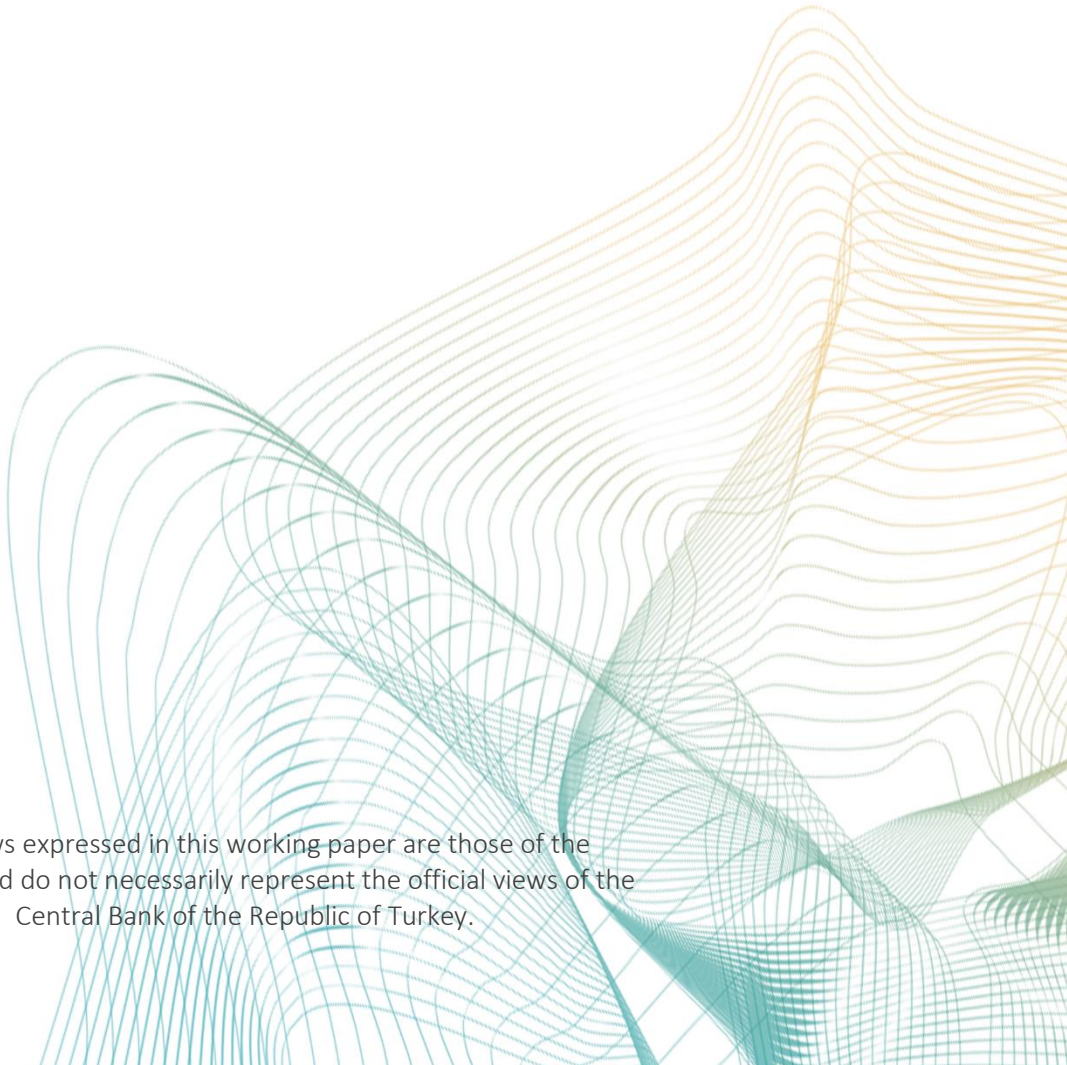
May 2020

Working Paper No: 20/07

Address:
Central Bank of the Republic of Turkey
Head Office
Structural Economic Research Department
Hacı Bayram Mh. İstiklal Caddesi No: 10
Ulus, 06050 Ankara, Turkey

Phone:
+90 312 507 80 04

Facsimile:
+90 312 507 78 96



A Measure of Turkey's Sovereign and Banking Sector Credit Risk: Asset Swap Spreads

Abdullah Kazdal, Halil İbrahim Korkmaz, Doruk Küçüksaraç and Yiğit Onay[1]

Abstract

The existence of the credit derivatives written on the eurobonds such as credit default swaps or asset swaps allows policymakers and investors to monitor the credit risk of the reference entities over time. However, credit derivatives are mainly available for the reference entities in advanced economies with high liquidity and a wide maturity spectrum whereas the market for credit derivatives in emerging market countries, Turkey in particular, is limited in terms of entities and maturities. In this regard, this study aims to obtain a proxy for the credit risk of Turkish Treasury and banking sectors in international markets by calculating asset swap spread for US dollar denominated fixed coupon Eurobonds, which requires a robust estimation of the respective yield curves that has not been presented before. The study firstly presents the estimation of sovereign and banking sector yield curves and then constructs a synthetic asset swap structure to obtain embedded credit risk premia in these eurobond curves. The proposed credit risk indicator is robust in terms of its high correlation with credit default swap premium. Besides, estimated eurobond curves are also useful for monitoring borrowing cost dynamics of Turkish Treasury and banking sector in international markets instantaneously from a comparative perspective.

Özet

Eurobond kıymetlerinin dayanak varlık olduğu kredi temerrüt takası veya varlık takası gibi kredi türevlerinin varlığı, politika yapıcıların ve yatırımcıların referans kuruluşların kredi riskini zaman içinde izlemelerine olanak sağlamaktadır. Bununla birlikte, kredi türevleri gelişmiş ülkelerde yüksek likidite ve geniş bir vade spektrumuna sahip bir şekilde bulunmaktayken gelişmekte olan ülkelerde, özellikle Türkiye'de, kredi türev pazarları vadeler ve dayanak varlıklar açısından sınırlıdır. Bu bağlamda, çalışmada, ABD dolar cinsinden Hazine ve Maliye Bakanlığı ile Türk bankalarının ihraç ettiği sabit kuponlu eurobondların ima ettiği kredi riski için varlık takası göstergesi türetmektedir. Söz konusu hesaplama ayrıca getiri eğrilerinin tahmin edilmesini de gerektirmektedir. Çalışmada öncelikle ülke ve bankacılık sektörü için getiri eğrilerinin tahminleri sunulmakta ve daha sonra söz konusu eurobond eğrilerinin ima ettiği kredi riski primi elde etmek için sentetik bir varlık swap yapısı oluşturulmaktadır. Önerilen kredi riski göstergesi, kredi temerrüt takas primleriyle de yüksek korelasyon göstermekte olup oldukça ilişkilidir. Ayrıca, çalışmada elde edilen eurobond getiri eğrileri, Hazine ve Maliye Bakanlığı ve Türk bankacılık sektörünün uluslararası piyasalardaki borçlanma maliyeti dinamiklerini karşılaştırmalı bir bakış açısıyla anlık olarak izlemek açısından fayda sağlamaktadır.

JEL Classification: G12, G15.

Keyword: Credit risk, asset swap spread, yield curve.

[1] Central Bank of the Republic of Turkey.
E-mail addresses: abdullah.kazdal@tcmb.gov.tr, halil.korkmaz@tcmb.gov.tr, doruk.kucuksarac@tcmb.gov.tr, yigit.onay@tcmb.gov.tr.
The views expressed in this paper are those of the author and do not reflect the official views of the Central Bank of the Republic of Turkey. All errors are the author's own. We thank the anonymous referee for useful comments.

Non-Technical Summary

Market based credit risk indicators provide critical information in terms of monitoring the dynamics of entities' creditworthiness, measuring systemic risks and valuation of financial assets. In this regard, debt securities and credit derivatives such as credit default swaps (CDS) and asset swaps whose values mainly depend on these securities are the main credit risk based financial instruments. Especially, credit derivatives allow investors to track the perceived creditworthiness of entities. However, these securities do not exist or are not actively traded. In this regard, this study presents a methodology for obtaining asset swap spread, which is one of the main credit derivatives for the entities in advanced economies, in measuring credit risk of Turkish Treasury and banking sector throughout time.

Although asset swaps are traded separately as a financial security for the bonds issued by various countries and corporates, they are not readily available for the debt instruments issued by Turkish Treasury and banking sector. In our case, a synthetic position consisting of a fixed coupon eurobond and an interest rate swap allows us to disaggregate the credit risk inherent in eurobonds from interest rate risk by transforming the fixed coupon payments into floating rate plus credit risk spread (asset swap spread). Methodology requires estimation of yield curves for both sovereign and banking sector bonds which provides an opportunity to monitor borrowing costs of these sectors together with credit risks, as a main determinant borrowing costs, on a daily basis. As a robustness check, comparison of CDS premium for sovereign bonds with asset swap spreads at the same maturity confirms the accuracy of asset swap spread in reflecting credit risk dynamics of Turkey.

For both Turkish sovereign and banking sectors, credit risk implied by the Eurobond market tends to increase with the maturity as expected with exceptions of high-stress periods. In these periods, creditworthiness of both sovereign and the banking sector is perceived to be higher in the short term as compared to long-term, which implies that once these entities survive in the near future, the capabilities of meeting debt repayments in hard currency will be higher thereafter. Furthermore, credit risk of banking sector is observed to rise more than Turkey's sovereign credit risk indicating that higher variability of investors' risk sentiment regarding creditworthiness of banking sector leads to sharp changes in valuations of debt instruments.

I. Introduction

Credit risk is of great importance especially after the Global Financial Crisis (GFC) when the financial markets encountered default incidences of several entities. These default events had serious consequences for the healthy functioning of the financial system, which necessitated the policymakers of many developed countries to bail out systemically important institutions. On the other hand, some of the systemically important institutions are left to bankruptcy causing tightly interlinked institutions to be severely affected and hampering the soundness of the whole financial system. Due to loss in investor confidence during this period policymakers have taken several steps to monitor the risks accumulated in the financial markets in a timely manner and prevent the risks from distorting the functioning of the markets.

In this regard, financial institutions and regulatory agencies have focused on developing better credit risk management systems in order to quantify credit risks under more conservative approaches. Regulatory agencies have drawn attention to a clear understanding of the techniques for the purposes of estimating capital adequacy of financial institutions and monitoring systemic risk related issues. GFC in this regard increased the policymakers and market participants' awareness on monitoring the risks associated in financial markets and highlighted the importance of high frequency credit risk indicators. Among those, credit risk based financial instruments, especially credit risk derivatives became prominent providing market based information instantaneously about the creditworthiness of the underlying entity. Credit default swaps (CDS) and asset swaps (ASW) are such most widely used financial products in the global financial markets, reflecting market expectations about the credit quality of the reference entities.

Existence of such credit derivatives written on the eurobonds such as credit default swaps, asset swaps or total return swaps allows policymakers to monitor the credit risk of the reference entities over time since the main determinant of the changes in the prices of these securities is credit risk developments of the reference entities. Additionally, these derivatives are crucial in terms of financial deepening since they are perceived to reduce the liquidity premia in the eurobond market.

Although the prices of financial debt instruments largely depend on the creditworthiness of the reference entity, they also have exposures to other types of risks, mainly interest rate risk. Investors earn a positive risk premium by holding a long position in US dollar denominated sovereign or a specific banking sector eurobond, both are considered as risky in terms of default, financed at the US repo market. The spread earned above the funding cost by the investor is considered to be a compensation mainly for credit risk. However, it would be misleading not to incorporate interest rate risk into the spread as majority of the

eurobonds are issued in fixed coupons, rather than floating. In this regard, decomposing the credit risk from the financial instruments is crucial for policymakers and investors. One of the solutions adopted in financial markets to obtain credit risk is to construct a financial derivative to decompose interest rate risk, which is called as asset swap. Asset swap, one of the most actively traded credit derivative instrument, allows buyers/sellers to hedge and/or speculate on the credit risk of the reference entity. Asset swap is in fact a combination of a long position in fixed rate eurobond and a fixed-rate payer interest rate swap. Therefore, the derivative can be replicated for the entities in which asset swap is not traded in the financial markets. In the literature, asset swap spreads (ASW) are mainly used for comparison purposes with CDS since theoretically CDS and ASW are expected to display a close relationship as credit risk indicators. Francis et al. (2003) argue that asset swap spreads obtained for bonds issued by a reference entity is the most comparable credit risk indicator with CDS. Accordingly, CDS-bond basis is defined as the CDS premium minus the asset swap spread which is expected to display mean reverting behavior as any arbitrage opportunity is exhausted by market participants. De Wit (2006) compares credit risk indicators from CDS and bond markets and concludes that par asset swap spread and CDS premia tend to have a long run equilibrium relationship in the universe of emerging market sovereign bonds and investment grade corporates. There are also studies using asset swap spread as credit risk indicator for reference entities and investigating the relationship between credit risk and other financial markets/instruments such as stock markets. Aussenegg et al. (2016) examine the time-varying behavior and the determinants of asset swap spreads for 23 iBoxx European corporate indexes and argue that stock market returns, stock market volatility and swap spreads (difference between the swap interest rate and the interest rate on a par value sovereign bond of the same maturity) are significantly and negatively associated with asset swap spreads in turbulent periods. One other study, Gunay (2018), employs asset swap spread, albeit other than par asset swap spread, as an alternative indicator for credit risk of Turkey in the analysis of volatility structure of BIST 100 index returns. Gunay concludes that credit risk indicators are found to have a statistically significant impact on stock market volatility in high fluctuation regimes.

This study aims to construct a robust and high frequency credit risk indicators for Turkish Treasury and banking sector. Most widely used credit risk indicator in Turkey in terms of foreign currency denominated debt is CDS premium. CDS is a credit derivative, which provides insurance to its holder in case the reference entity defaults on its obligations, and is considered to be pure measure of creditworthiness of an entity. Although CDS written on Turkey's foreign currency bonds are available for various maturities and traded widely in the market, they are available only for a few Turkish banks and they are not actively traded, which makes it hard to obtain a general representative indicator regarding the

creditworthiness of the Turkish banking sector through CDS. In this regard as the best alternative to CDS premium, this study aims to obtain a credit risk indicator through asset swap spreads for Turkish Treasury and banking sector.

To the best of our knowledge, this is the first study that aims to construct asset swap spreads for eurobonds issued by the Turkish Treasury and banks in terms of the methodological frontier. Since the sovereign and corporate eurobonds have different cash flow structures and different time to maturities, the first step in the construction is to estimate eurobond yield curves for the Turkish Treasury and banking sector. After the estimation of the yield curves for both entities, the second step is to synthetically construct asset swaps which will provide information about the credit quality of the underlying entity at different maturities. Section 2 presents a general overview of the borrowing structure of Turkish Treasury and banking sector whereas section 3 provides details of the data and methodology. Lastly, section 4 presents empirical findings of the study and section 5 concludes.

II. Overview of Eurobonds Issued By Turkish Treasury and Banking Sector

Turkish Treasury and banks are the main issuers of eurobonds in Turkey. In this regard, the Treasury taps the eurobond market each year to obtain foreign currency funding. The outstanding amount of eurobonds issued by Treasury is worth 72.4 billion US dollars as of June 2019 and 90% of bonds issued have fixed coupon rates (Figure 1.a). The non-residents tend to have a significant share in these eurobond securities issued by the Treasury in order to obtain exposure to Turkish sovereign securities. Besides non-residents, domestic banks tend to have eurobond securities in their portfolio and use these securities as collateral to borrow from domestic/international markets and for portfolio management purposes (Figure 1.b). Moreover, 82 percent of these issues are in US dollars, while a limited number of euro and Japanese yen issues are also available (Figure 1.c). . When the maturity structure of the outstanding eurobonds is investigated, it is observed that they have time to maturities up to 30-year whereas most of them are concentrated on the maturities between 5 to 10 years (Figure 1.d).

Figure 1.a - Sovereign Eurobonds By Interest Rate Type

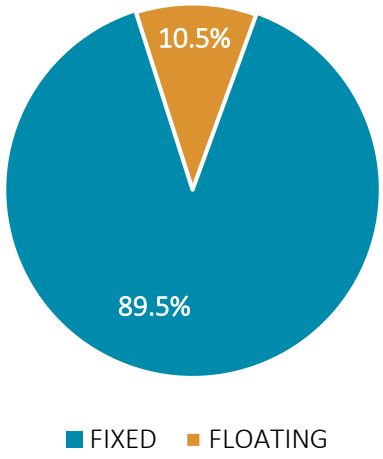


Figure 1.b Ownership Structure of Sovereign Eurobonds
(Billion US Dollar)

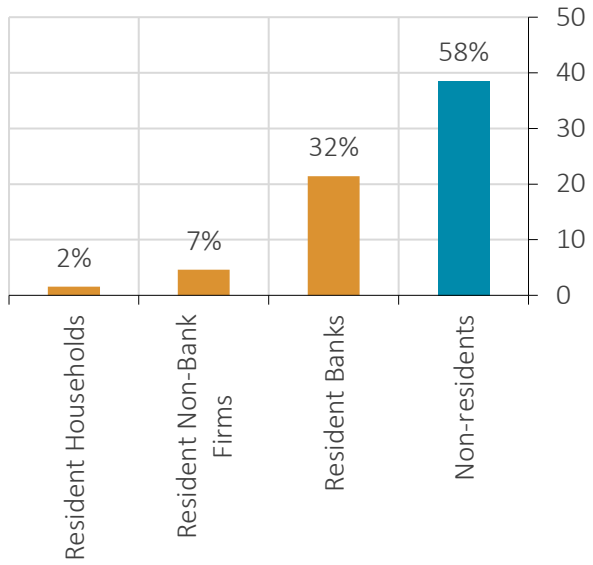


Figure 1.c Sovereign Eurobonds By Currency Type

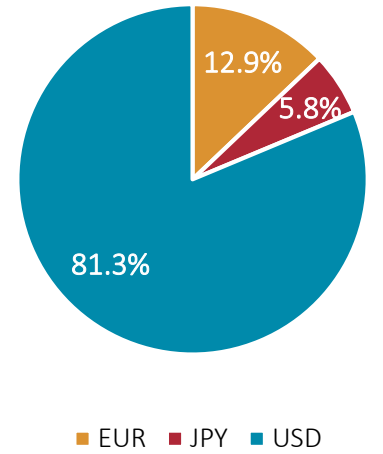
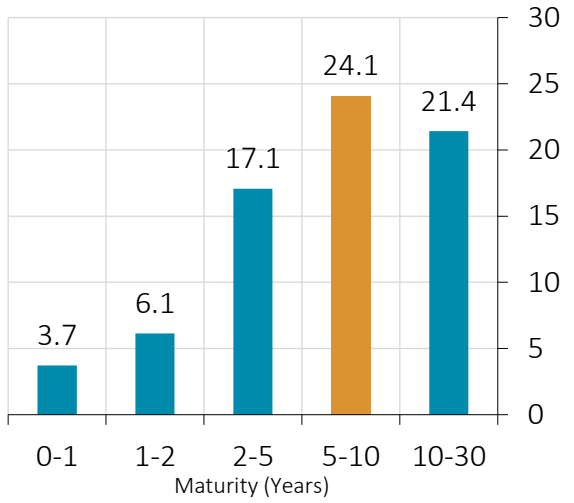


Figure 1.d Maturity Breakdown of Sovereign Eurobonds
(Billion US Dollar)



Beside the Treasury, Turkish banks also obtain funding from the eurobond market. The eurobonds issued by banks tend to have longer maturities compared to the other liability items and the maturities for the outstanding eurobonds are concentrated in the maturities of 2 to 5 years (Figure 2.a). These securities are expected to contribute to the liquidity and interest rate management for the banks. Similar to the sovereign eurobonds, non-residents are the main investors for these securities and as of June 2019, notional outstanding amount of eurobonds issued by the Turkish banking sector in the sample totals 17.35 billion US Dollars (Figure 2.b).

Figure 2.a: Banking Sector Eurobonds - Maturity Breakdown (Billion US Dollar)

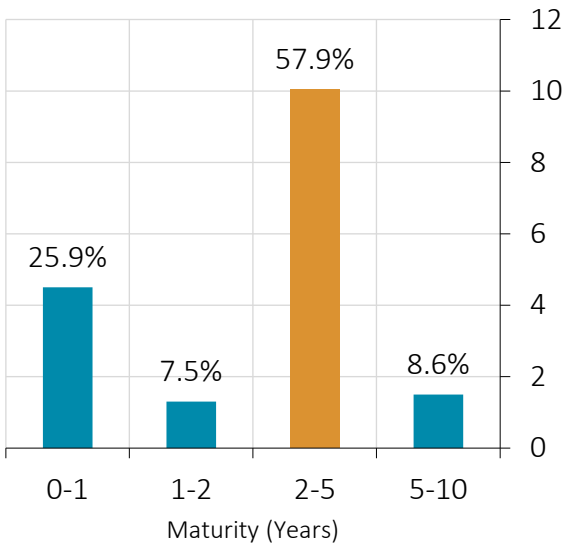
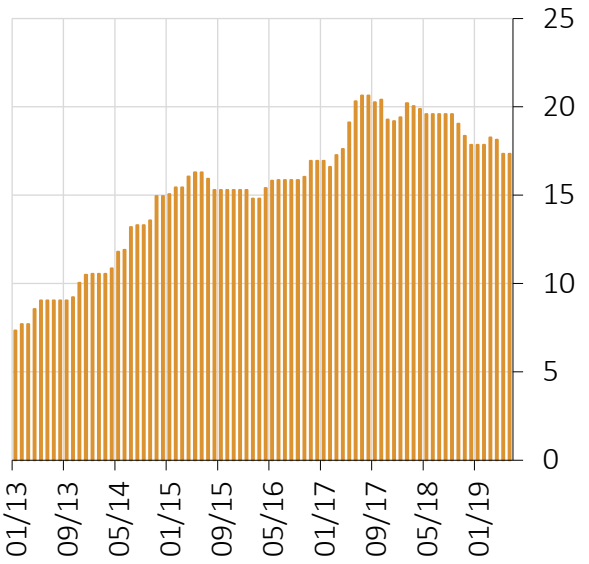


Figure 2.b: Banking Sector Eurobonds - Outstanding Notional [2](Billion US Dollar)



The outstanding amount and ownership structure of the eurobonds show their importance for both issuers and investors. Therefore, it is useful to obtain an indicator which focuses on the credit quality of the issuers. In this regard, the next part presents the data and methodology adopted in the study.

III. Data and Methodology

This section firstly introduces the data used in the estimation of eurobond yield curves for sovereign and banking sectors. Then, the methodology section presents the estimation procedure for eurobond yield curves and construction of the asset swap spread, respectively.

III.I. Data

As presented in the previous section, a significant part of the foreign currency eurobond issuances of the Turkish Treasury and banking sector are denominated in US dollar. In this regard, the yield curves for eurobonds will be constructed on US dollar- denominated securities. Although eurobonds have started to be issued before 2000, the sample with enough securities each day with different maturities to estimate yield curve only exists after 2005. As of June 2019, a total of 39 eurobonds with maturities up to 30 years are obtained on a daily frequency basis where at least 11 different price data is available each day.

[2] US Dollar denominated senior and unsecured bonds are chosen for entities with similar creditworthiness in the universe of the Turkish banking sector. Bonds with notionals below certain level are not included in the calculations. Furthermore, callable bonds of commercial banks and Sukuks issued by participation banks are excluded as well.

Similarly, construction of eurobond yield curve for the Turkish banking sector is based on US dollar denominated securities. However, the selection of the banks in the sample is quite crucial since estimating a single eurobond yield curve requires the selection of the banks with similar characteristics and similar credit ratings. To this end, senior-unsecured eurobond prices of 8 public and private banks with similar credit ratings are chosen to estimate the yield curve. Issuances with notional amounts below 300 million US dollar are excluded to ensure liquidity. Due to data availability, eurobond yield curve estimation is performed after 2013 where more than 13 different securities are available each day such that a smooth and reliable curve is obtained.

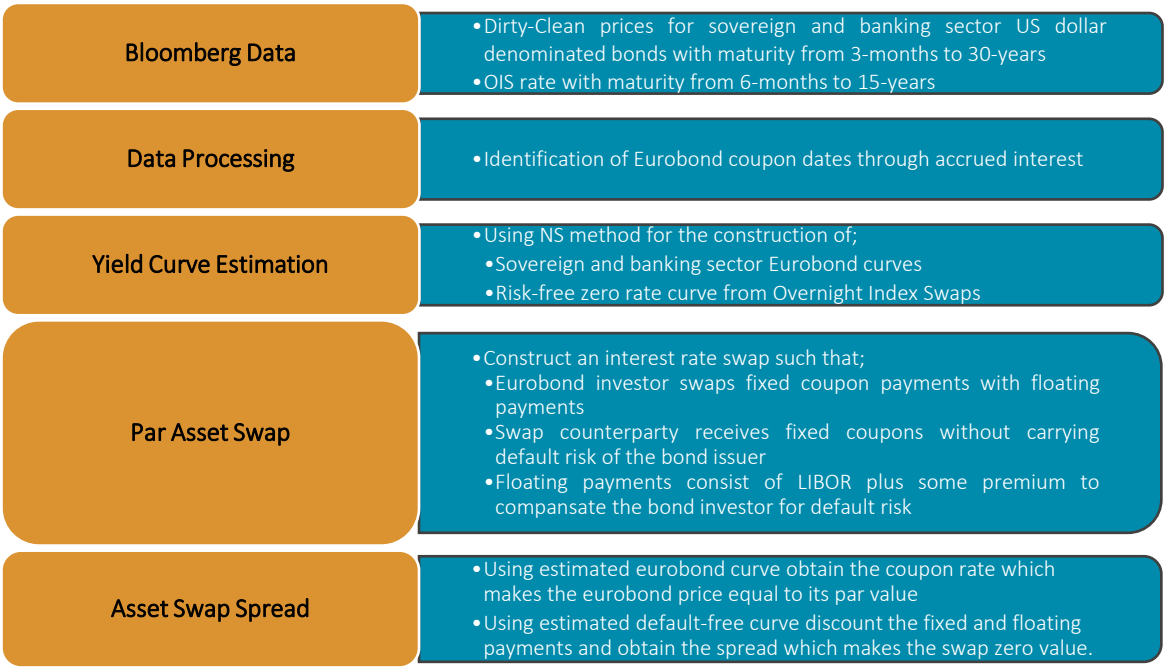
In addition to sovereign and banking sector eurobond securities, the asset swap spread construction requires a financial instrument in US dollars, which is perceived to be default free. In line with the common market practice and academic studies[3], the study uses overnight index swap (OIS) rate. Since the counterparty risk in overnight index swap transactions is negligible, OIS rate is often treated as the default-free rate as a market practice. In this regard, overnight index swap rates from Bloomberg are obtained for the maturities up to 15 years.

III.II. Methodology

This section presents a summary of the detailed methodology adopted in the construction of asset swap spread. Since it is a multi-step approach, Diagram 1 allows one to follow the estimation process whereas the details of each step are explained thoroughly in the following part of the section.

[3] Hull, John C. and White, Alan, LIBOR vs. OIS: The Derivatives Discounting Dilemma (2013) presents a detailed explanation on the issue. They show that OIS rate is the cost of funding with fully collateralized derivatives whereas a higher LIBOR incorporates small but non-zero default risk premium.

Diagram 1: Asset Swap Spread Estimation Process



Estimation procedure of eurobond yield curves is not straightforward due to existence of non-regularities in coupon payment dates of the securities. Nearly all of eurobonds have semiannual coupon frequency but a non-negligible number of eurobond securities pay their first coupon on a month different than the 6-month after the issuance. Since the bond price is the sum of the discounted cash flows, constructing such data is required for the estimation of precise yield curve[4]. The study tackles with this problem by constructing cash flows of each security based on historical price data rather than depending on the issuance date and fixed coupon rate. In this regard, we use the fact that actual coupon payment occurs on the day where the dirty price of the bond becomes equal to the clean price of the bond and specify the first coupon payment date.

The price of a fixed coupon bond with maturity t_n at time t can be written as follows;

$$P(t,t_n) = \sum_{i=1}^{n} Ce^{-r(t,t_i)(t_i-t)} + Fe^{-r(t,t_n)(t_n-t)} \quad (1)$$

where $r(t,t_i)$ denotes the continuously compounded zero rate at time t for time to maturity $t_i - t$ years, C and F stand for the coupon amount and the face value of the bond, respectively. Since the zero rates are not observable in the market, it requires yield curve estimation. In this regard, this study uses the Nelson-Siegel methodology, which has been extensively used by the market and central banks due to its flexibility, robustness and easy

[4] To the best of our knowledge, there is no publicly available historical data for Eurobond coupon dates.

implementation. Under the Nelson-Siegel model, the continuously compounded zero rates are modelled as follows;

$$r(t,t+m) = \beta_{0,t} + \beta_{1,t}\left(\frac{1-e^{-\frac{m}{\tau_t}}}{\frac{m}{\tau_t}}\right) + \beta_{2,t}\left(\frac{1-e^{\frac{-m}{\tau_t}}}{\frac{m}{\tau_t}} - e^{\frac{-m}{\tau_t}}\right) \quad (2)$$

where $\beta_{0,t}$, $\beta_{1,t}$ and $\beta_{2,t}$ denotes the level, slope and curvature at time t and m stands for the time to maturity. τ_t represents the location of the hump in the yield curve at time t. The Nelson-Siegel parameter estimates are obtained through nonlinear optimization where the objective function is to minimize the difference between the actual price and fitted price weighted by the inverse of the Macaulay duration of the eurobonds. The eurobonds with the remaining maturity less than 3 months are excluded in the yield curve estimation due to liquidity concerns. The objective function for each day t ;

$$min_{\beta,\tau} \sum_{i=1}^{n}\left(\frac{P_t^i - P_t^{i,fitted}}{D_t^i}\right)^2 \quad (3)$$

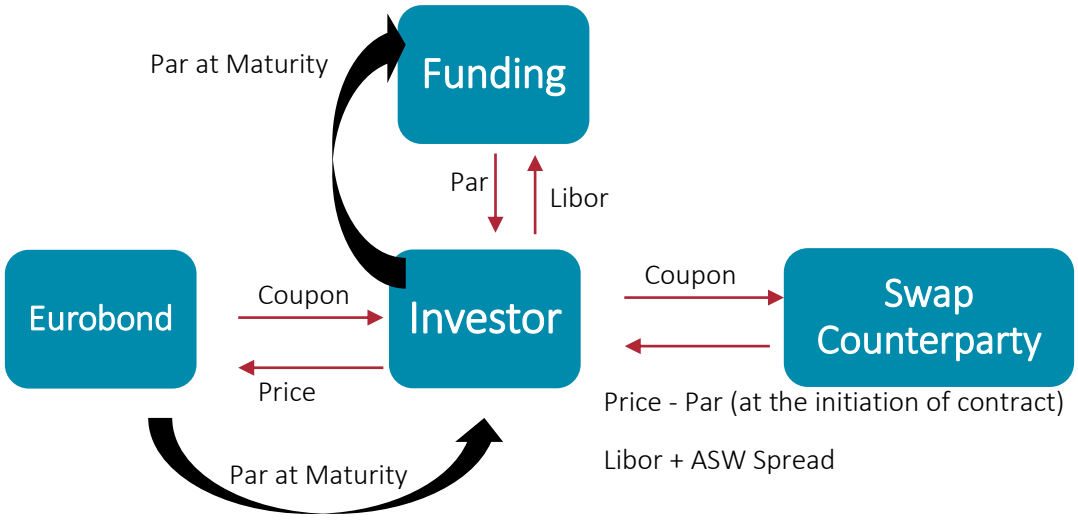
where D_t^i denotes the Macaulay duration of eurobond i at time t, n stands for the number of eurobonds available each day. P_t^i and $P_t^{i,fitted}$ denote the dirty price of eurobond i and fitted price at time t.

With the estimated Nelson-Siegel parameters the sovereign and banking sector eurobond yield curves are constructed. Besides the eurobonds, asset swap spread construction also requires the estimation of the yield curve for overnight index swap rates. However, since the overnight index swap rates are par rates rather than zero rates, the same approach has been adopted for the construction of default-free yield curve using par OIS rates. This conversion is applied through the similar methodology adopted in Güney, Kazdal and Küçüksaraç (2018) study such that the fixed leg of the overnight index swap can be considered as a bond that pays quarterly coupon payments based on OIS fixed rate with par value.

The next step is to obtain credit risk premium embedded in the eurobond securities. To this end, an asset swap is constructed synthetically using the eurobond yield curves. As depicted in the diagram below, an asset swap is a combination of a long position in a fixed rate bond with a fixed-rate-payer interest rate swap such that the owner of the bond changes the cash flow structure of the fixed coupon bond into floating payments. In this swap counterparty pays the floating rate which is LIBOR or EURIBOR in common market practice depending on the currency plus a constant premium to compensate the eurobond investor for bearing the credit risk. Through the asset swap, the counterparty receives the fixed coupon

payments of eurobond without carrying default risk of the issuer. In case of a default, the bond owner receives the recovery value and gives up future cash flows but still has to pay the fixed payments of the swap agreement. In this regard, the asset swap spread is considered to be a compensation for the default risk eurobond investor bears.

Diagram 2: Par Asset Swap Mechanism



In order to obtain the asset swap spread, a par asset swap is constructed including fixed coupon payments of a eurobond at par. This convenience allows one to obtain asset swap spread as a credit risk indicator without any further price or interest adjustment. The par asset swap can be mathematically expressed as follows;

$$P(t,t_n) - 100 = \delta C \sum_{i=1}^{n} df(t,t_i) - \sum_{i=1}^{n} \delta[LIBOR(t_{i-1},t_i) + Spread(t,t_n)]\, df(t,t_i) \quad (4)$$

where $P(t,t_n)$ denotes the price of the underlying Eurobond at time t with maturity t_n, and $df(t,t_i)$ stands for discount factor at time t with maturity $t_i - t$ obtained from overnight index swap yield curve, and δ represents the coupon frequency. Additionally, $LIBOR(t_{i-1},t_i)$ is the rate applied during the period between t_{i-1} and t_i. Since these variables are obtained, it is possible to calculate the asset swap spread ($Spread(t,t_n)$).

The value of the floating payments in the interest rate swap at the issue date can be written as follows[5];

$$\sum_{i=1}^{n} LIBOR(t_{i-1},t_i)\, df(t,t_i) = 100 - 100 df(t_n) \quad (5)$$

[5] A detailed derivation for the equation 5 can be found in Kucuksarac et al. (2018).

Since we construct par-asset swap spread, $P(t, t_n)$ is at par value. Hence resulting spread from this asset swap equation is as follows;

$$Spread(t, t_n) = \frac{\delta C \sum_{i=1}^{n} df(t, t_i) + [100 df(t_n) - 100]}{\delta \sum_{i=1}^{n} df(t, t_i)} \quad (6)$$

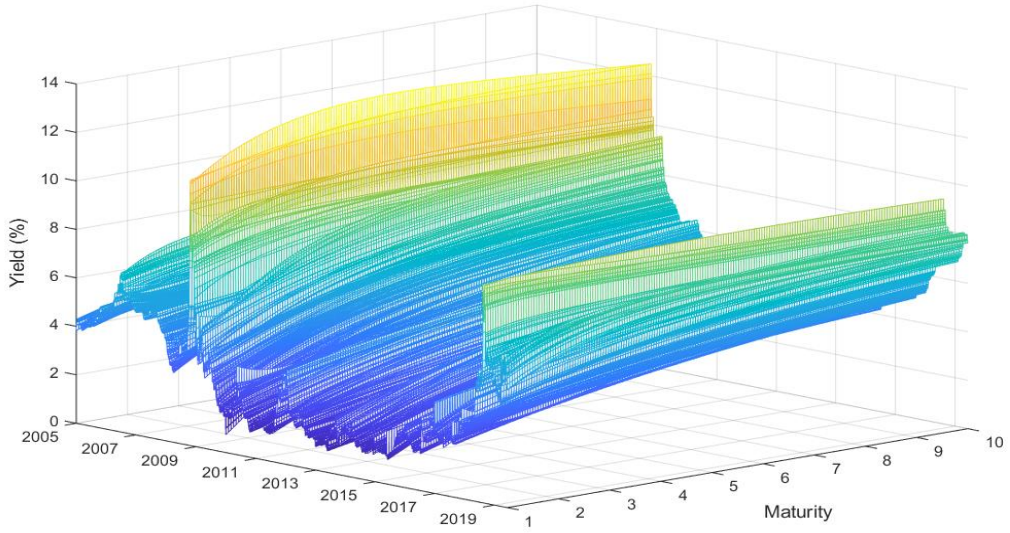
In the construction of asset swap spread, the first step is to obtain the coupon rate of eurobond such that the price of the eurobond is at its par value. In this regard, using the eurobond curves we synthetically generate eurobond securities at par value. The second step is to discount all the cash flows using the overnight index swap rates which are perceived to be default-free. Finally, we obtain the par asset swap spread using the equation 6, which indicates the premium eurobond investor demands for credit risk of the bond issuer.

IV. Empirical Findings

This section firstly presents the yield curve estimation results for the US dollar denominated eurobonds issued by the Treasury and Turkish banks. The borrowing cost of the Treasury and the banks in the international markets are compared to figure out whether there are some periods they diverge from each other. Then the asset swap spreads, constructed using the methodology described above, are presented for various maturities from 2005 to June 2019.

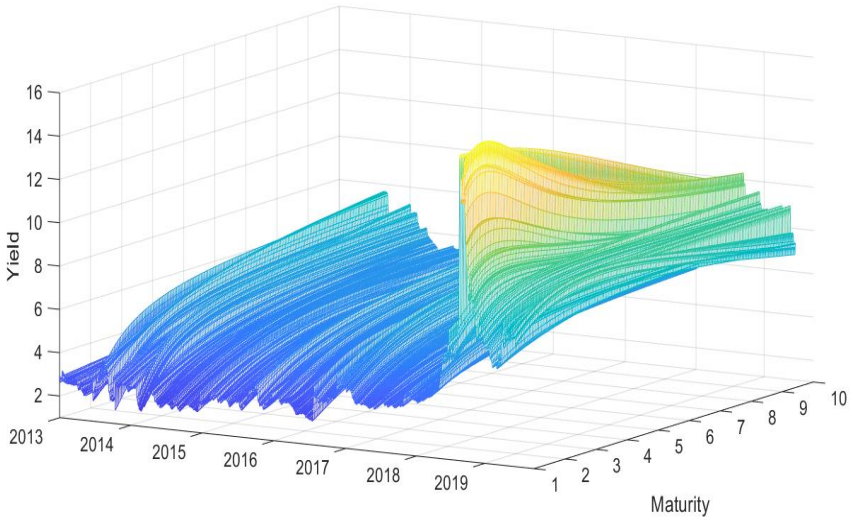
Figure 3.a and Figure 3.b demonstrate the evolution of yield curves for US dollar denominated the eurobonds of the Treasury and the banking sector, respectively. In the aftermath of the Global Financial Crisis, the yields for various maturities (level of the yield curve) oscillate in an interval and peak during the period of taper tantrum. However, the borrowing costs tend to be quite low compared to historical averages during this period mainly due to the quantitative easing policies adopted by the central banks of advanced countries. Furthermore, both curves tend to be upward sloping almost throughout the estimation period implying a positive risk premium demanded by the investors for longer-maturity securities.

Figure 3.a Sovereign Eurobond Yield Curve (US Dollar Denominated, %)



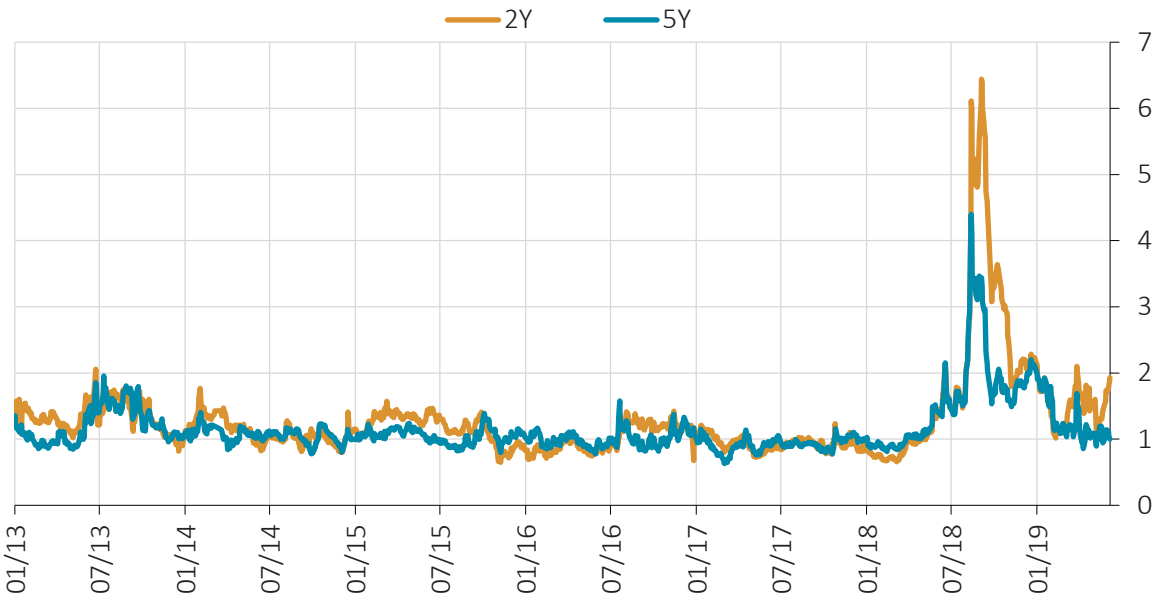
During the period of the financial distress in August 2018, US dollar denominated short terms borrowing costs of both Turkish Treasury and banks in international markets are observed to increase levels above % 8 for sovereign and % 15 for the banks. In the meantime, bear-flattening movement occurred in both curves implying that short-end of the curve shifts upward more than the long-end section. The degree of the flattening movement is so strong that both curves are observed to be inverted where short term rates are above long term rates. During this period, the yields of the eurobonds for the banking sector tend to rise higher than those of the sovereign eurobonds. However; inverted shapes of the curves do not last long and become upward sloping together with the calmness in the market after the period of rapid depreciation of Turkish Lira against other currencies.

Figure 3.b Turkish Banking Sector Eurobond Yield Curve (US Dollar Denominated, %)



Constructed eurobond yield curves of Turkish Treasury and banking sector can be used to obtain the spread of zero rates for specific maturities. Figure 4 demonstrates the evolution of US dollar borrowing costs of the public and financial sector of Turkey in the international markets comparatively. As seen below, the banking sector has the ability to borrow 127 and 114 basis points higher on average in terms of zero rates for maturities of 2 and 5 years, respectively. Since the maturities of eurobonds of the banking sector are concentrated on the maturity bracket of 2 and 5 years, we do not present the extrapolated yield levels for 10 years. The long end of the Eurobond curve for the banking sector does not reflect the fundamentals of the sector as a whole. The spreads seem to be stable around 100 basis points for maturities of 2 and 5 years until the second quarter of 2018, since then a more dramatic rise in the US dollar borrowing costs of financial sector is observed as compared to public sector. The rise in the spreads can be attributed mainly to the market's view that the ability of the financial sector in Turkey to meet its external obligations deteriorate more than that of public sector. This conjecture will be shown to be true when asset swap spreads for both sectors are examined in the latter part of the section.

Figure 4 Turkey Banking Sector - Sovereign Eurobond Spreads (%)



One of the best ways to figure out whether the synthetically constructed asset swap spreads are in line with the market risk indicators, we compare them with the CDS spreads for the maturities of 2 and 5 years (Figure 5.a & Figure 5.b). The results show that the asset swap spreads are compatible with the CDS spreads throughout time, which shows the consistency of the synthetically formed credit risk indicator. It is also noticed that the spread between ASW and CDS changes sign after the Global Financial Crisis (GFC) and there exists a persistent level of spread thereafter. This can be attributed to several factors due to

fundamental and technical differences between aforementioned credit derivative instruments[6].

Figure 5.a: Sovereign ASW – Credit Default Swap
(2-Year, Percentage)

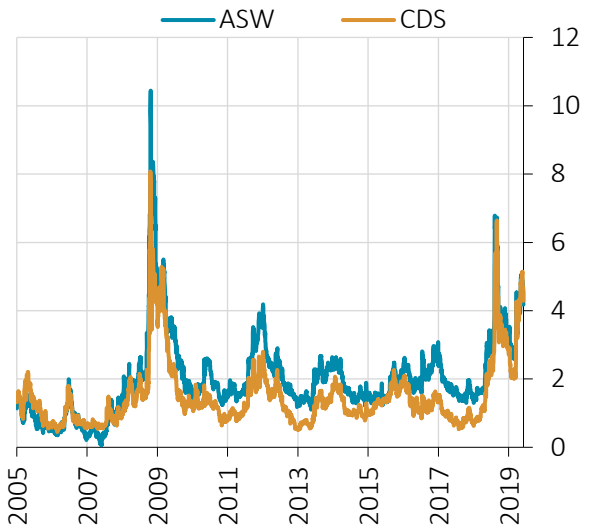
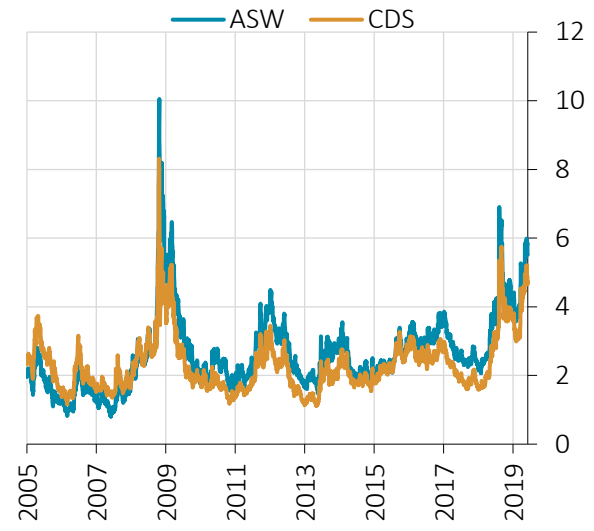


Figure 5.b: Sovereign ASW – Credit Default Swap
(5-Year, Percentage)



Asset swap spreads for banking sector, which is available for the period after 2013 and for the maturities of 2 and 5 years, point out to a similar dynamics as sovereign bonds imply (Figures 6.a to 6.d). For both sovereign and Turkish banking sector, credit risk implied by the Eurobond market is increasing with the maturity as expected with exceptions of high-stress periods as mentioned above. In these periods, credit risk of both sovereign and the banking sector is perceived to be higher in the short term as compared to long term implying that once these entities survive in the near future, their capabilities of meeting debt repayments in foreign currency will be higher thereafter. Furthermore, it is possible to deduce the responsiveness of credit risk indicators against tail events in financial markets comparatively. In this regard, asset swap spreads for banking sector are observed to react more abruptly than their sovereign counterparts indicating that higher variability of investors' risk sentiment towards creditworthiness of banking sector leads to sharp changes in valuations of debt instruments.

[6] Divergence between credit risk indicators can be attributed to the factors including but not limited to, liquidity conditions, cheapest to deliver option embedded in CDS contracts, funding costs, payment of accrued interest in case of default. Further discussion can be found in De Wit (2016).

Figure 6.a: Sovereign Asset Swap Spread
(%)

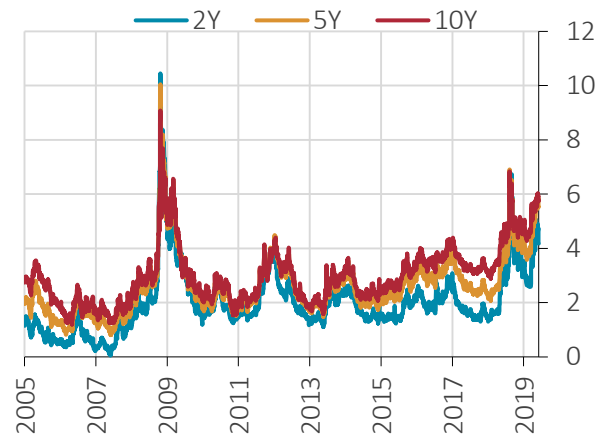


Figure 6.b: Banking Sector Asset Swap Spread
(%)

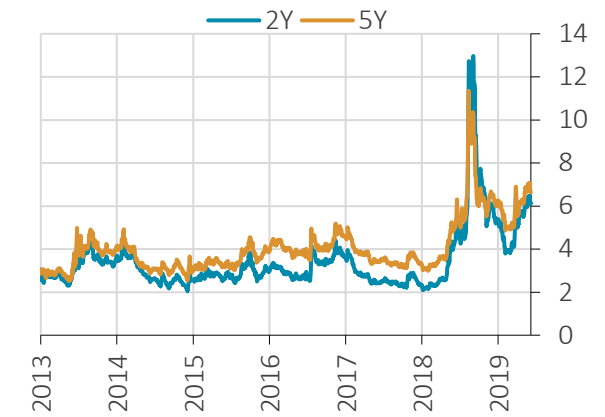


Figure 6.c Sovereign Asset Swap Spread Surface

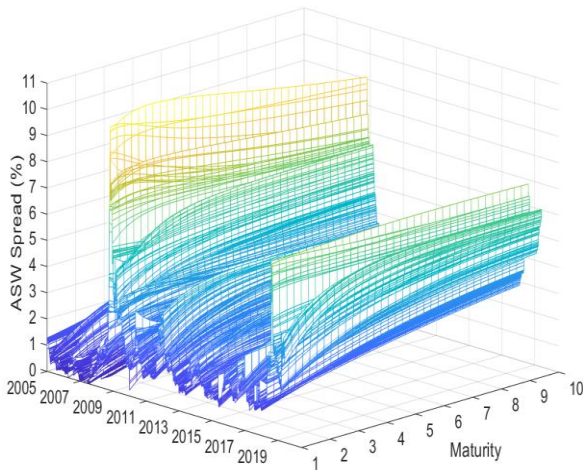
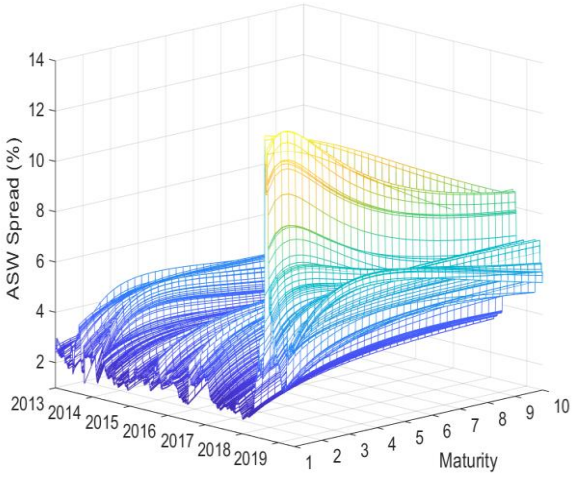


Figure 6.d Banking Sector Asset Swap Spread Surface



V. Conclusion

Credit risk indicators allow policy makers, regulators, risk managers and investors to monitor the developments in the creditworthiness of reference entities. Tracking the changes in the credit risk of entities help authorities notice the risks threatening the financial system and take necessary measures before posing any serious threat, enable risk managers and investors to make their valuations of risky assets in a more effective way. Although the credit rating agencies provide information about the credit outlook of several entities ranging from sovereigns to corporates worldwide, credit related financial instruments with underlying assets of reference entities provide a high frequency market based indicators enabling users to be informed about developments instantaneously. Additionally, previous findings suggest that the market-based indicators precede the changes in the credit ratings.

In this regard, this study aims to obtain a proxy for the perceived credit risk of Turkish Treasury and banking sector in international markets by calculating asset swap spread from US dollar denominated fixed coupon eurobonds.

Asset swap is a synthetic position that combines a fixed coupon bond with a fixed rate payer interest rate swap. Asset swap holder pays the fixed coupon payments of the bond to swap counterparty and receives the floating rate consisting of Libor plus the asset swap spread. This allows the asset swap holder to disaggregate the credit risk of the debt instrument from interest rate risk inherent in fixed coupon bonds. Asset swap for several entities across the world is traded separately in the market so that it can be obtained directly from market quotations as a credit risk proxy. However, since asset swaps are not readily available for eurobonds issued by Turkish Treasury and banks, spreads need to be quantified synthetically.

However, the calculation of par asset swap spread for different maturities requires estimation of yield curves for eurobonds issued by Turkish Treasury and banking sector separately. Construction of yield curves for US dollar denominated public and financial sector eurobonds make it possible to figure out the coupon amounts of a hypothetical bond for the desired maturity whose value is at its par and corresponding coupon payments to be exchanged in the interest rate swap. These outputs are also useful for eliciting the dynamics of borrowing costs of Turkish Treasury and banking sector in international markets from a comparative perspective.

The findings of the study related with the yield curves reflect the time series of borrowing costs of both public and financial sectors in Turkey. Both curves are upward sloping implying a positive risk premium demanded by the investors for longer-maturity securities almost

throughout the estimation period. On average, Turkish banks could borrow 127 and 114 basis points higher on average than Turkish Treasury in terms of zero rates for maturities of 2 and 5 years, respectively. In the post Global Financial crisis period, borrowing costs of both sectors lie in an interval without displaying jumps up until the third quarter of 2018 during when yield curve is inverted and yields rise to historically high levels.

Asset swap spreads as a credit risk proxy obtained for sovereign bonds show that Turkey's credit risk rise to record high levels above 10% during the Global Financial Crisis. Similar but less dramatic movements are observed during the sell-off period in TRY in the third quarter of 2018. In this period of high distress in the markets, credit risks of both sectors are perceived to be higher in the short term. The movement is more dramatic for the banking sector implying that the responsiveness of credit risk of banking sector with respect to tail events is observed to be higher. All in all, this study presents comparable market based proxies for the credit risk of both Turkish Treasury and banking sector measuring their capabilities in meeting their US dollar denominated external debt in the form of eurobonds. Time-varying and high frequency credit risk indicators provide valuable tools to various parties in terms of policy making, risk management and valuation purposes.

References

Akinci, O., Gurcihan, B., Gurkaynak, R., & Ozel, O. (2006). Devlet ic borçlanma senetleri icin getiri egrisi tahmini (No. 0608).

Aussenegg, W., Götz, L., & Jelic, R. (2016). European asset swap spreads and the credit crisis. The European Journal of Finance, 22(7), 572-600.

De Wit, J. (2006). Exploring the CDS-bond basis. National Bank of Belgium working paper, (104).

Francis, C., A. Kakodkar, and B. Martin. 2003. "Credit Derivatives Handbook – A Guide to Products, Valuation, Strategies and Risks." Merrill Lynch Global Securities Research and Economics Group.

Gunay, S. (2018). An analysis through credit default swap, asset swap and zero-volatility spreads: Coup attempt and Bist 100 volatility. Borsa Istanbul Review.

Hull, John C. and White, Alan, LIBOR vs. OIS: The Derivatives Discounting Dilemma (April 1, 2013). The Journal of Investment Management, Forthcoming; Rotman School of Management Working Paper No. 2211800.

Kucuksarac, D., Kazdal, A., & Guney, I. E. (2018). "Estimation of Currency Swap Yield Curve". CBRT Research Notes in Economics (No.1803).

Central Bank of the Republic of Turkey

Recent Working Papers

The complete list of Working Paper series can be found at Bank's website

(**http://www.tcmb.gov.tr**)

Nowcasting Turkish GDP Growth with Targeted Predictors: Fill in the Blanks
(Mahmut Günay Working Paper No. 20/06, May 2020)

Bank Lending and Maturity: the Anatomy of the Transmission of Monetary Policy
(Selva Bahar Baziki, Tanju Çapacıoğlu Working Paper No. 20/05, March 2020)

Do Local and Global Factors Impact the Emerging Markets's Sovereign Yield Curves? Evidence from a Data-Rich Environment
(Oğuzhan Çepni, İbrahim Ethem Güney, Doruk Küçüksaraç, Muhammed Hasan Yılmaz Working Paper No. 20/04, March 2020)

The Role of Imported Inputs in Pass-through Dynamics
(Dilara Ertuğ, Pınar Özlü, M. Utku Özmen, Çağlar Yüncüler Working Paper No. 20/03, February 2020)

Nowcasting Turkish GDP with MIDAS: Role of Functional Form of the Lag Polynomial
(Mahmut Günay Working Paper No. 20/02, February 2020)

How Do Credits Dollarize? The Role of Firm's Natural Hedges, Banks' Core and Non-Core Liabilities
(Fatih Yılmaz Working Paper No. 20/01, February 2020)

Hidden Reserves as an Alternative Channel of Firm Finance in a Major Developing Economy
(İbrahim Yarba Working Paper No. 19/36, December 2019)

Interaction of Monetary and Fiscal Policies in Turkey
(Tayyar Büyükbaşaran, Cem Çebi, Erdal Yılmaz Working Paper No. 19/35, December 2019)

Cyclically Adjusted Current Account Balance of Turkey
(Okan Eren, Gülnihal Tüzün Working Paper No. 19/34, December 2019)

Term Premium in Turkish Lira Interest Rates
(Halil İbrahim Aydın, Özgür Özel Working Paper No. 19/33, December 2019)

Decomposing Uncertainty in Turkey into Its Determinants
(Emine Meltem Baştan, Ümit Özlale Working Paper No. 19/32, December 2019)

Demographic Transition and Inflation in Emerging Economies
(M. Koray Kalafatcılar, M. Utku Özmen Working Paper No. 19/31, December 2019)

Facts on Business Dynamism in Turkey
(Ufuk Akçiğit, Yusuf Emre Akgündüz, Seyit Mümin Cılasun, Elif Özcan Tok, Fatih Yılmaz Working Paper No. 19/30, September 2019)

Monitoring and Forecasting Cyclical Dynamics in Bank Credits: Evidence from Turkish Banking Sector
(Mehmet Selman Çolak, İbrahim Ethem Güney, Ahmet Şenol, Muhammed Hasan Yılmaz Working Paper No. 19/29, September 2019)

Intraday Volume-Volatility Nexus in the FX Markets: Evidence from an Emerging Market
(Süleyman Serdengeçti, Ahmet Şensoy Working Paper No. 19/28, September 2019)

Is There Asymmetry between GDP and Labor Market Variables in Turkey under Okun's Law?
(Evren Erdoğan Coşar, Ayşe Arzu Yavuz Working Paper No. 19/27, September 2019)

Composing High-Frequency Financial Conditions Index and Implications for Economic Activity
(Abdullah Kazdal, Halil İbrahim Korkmaz, Muhammed Hasan Yılmaz Working Paper No. 19/26, September 2019)

A Bayesian VAR Approach to Short-Term Inflation Forecasting
(Fethi Öğünç Working Paper No. 19/25, August 2019)

Foreign Currency Debt and the Exchange Rate Pass-Through
(Salih Fendoğlu, Mehmet Selman Çolak, Yavuz Selim Hacıhasanoğlu Working Paper No. 19/24, August 2019)

Two and a Half Million Syrian Refugees, Tasks and Capital Intensity
(Yusuf Emre Akgündüz, Huzeyfe Torun Working Paper No. 19/23, August 2019)