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Article

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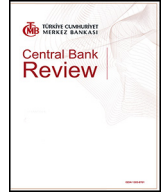
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A measure of Turkey's sovereign and banking sector credit risk: Asset swap spreads[☆]



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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 evolvement of credit risk. However, these instruments are mostly available in advanced economies, whereas the market for credit derivatives in emerging market countries, including Turkey, is limited in terms of liquidity and maturity. In this regard, this study aims to construct a proxy for the credit risk of the Turkish Treasury and banking sector in international markets by calculating asset swap spread for US dollar-denominated fixed coupon eurobonds, which requires a robust estimation of the relevant yield curves. The study firstly presents the estimation of the sovereign and banking sector yield curves and then constructs a synthetic asset swap structure to obtain embedded credit risk premia in the eurobond curves. Our findings show that the proposed credit risk indicator is vastly correlated with credit default swap premium. In addition to this, estimated eurobond curves are also useful for monitoring borrowing cost dynamics of the Turkish Treasury and banking sector in international markets.

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ÖZET

Eurobond kıymetlerinin dayanak varlık olduğu kredi temerrüt takası veya varlık takası gibi kredi türlerinin varlığı politika yapıcıların ve yatırımcıların, referans kuruluşların kredi riskinin gelişimini izlemelerine olanak sağlamaktadır. Ancak, bu enstrümanlar gelişmiş ülkelerde çoğunlukla bulunmaktayken, Türkiye gibi gelişmekte olan ülkelerde kredi türev pazarları vadeler ve dayanak varlıklar açısından sınırlıdır. Bu bağlamda, çalışmada ABD doları cinsinden Hazine ve Maliye Bakanlığı ile Türk bankalarının ihraç ettiği sabit kuponlu eurobondların ima ettiği kredi riski için varlık takası göstergesi türetilmektedir. 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 primini elde etmek için sentetik bir varlık swap yapısı oluşturulmaktadır. Önerilen kredi riski göstergesi, kredi temerrüt takas primleriyle de yüksek korelasyon göstermektedir. Ayrıca, çalışmada elde edilen eurobond getiri eğrileri, Hazine ve Maliye Bakanlığı ve Türk bankacılık sektörünün uluslararası piyasalardaki borçlanma maliyeti dinamiklerini izlemek açısından fayda sağlamaktadır.

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1. Introduction

Credit risk holds great importance especially after the Global Financial Crisis (GFC) when the financial markets experienced severe default events. These incidents had serious consequences for the well-functioning of the financial system, which necessitated the

policymakers of many developed countries to bail out systemically important institutions. On the other hand, the network effects within the overall financial infrastructure have led to externalities during the volatile episodes by hampering the soundness of the financial system. Due to the loss of investor confidence, policymakers have taken several steps to monitor the risks accumulated in the financial markets in a timely manner to prevent the financial risks from distorting the functioning of the markets.

In this context, financial institutions and regulatory agencies have focused on developing better credit risk management systems to quantify the level of credit risks. 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 enhanced the awareness of policymakers and market participants in tracking the financial market risks 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 instruments widely combined with other financial products reflecting market expectations about the credit quality of the underlying entities.

The existence of such credit derivatives written on the eurobonds such as credit default swaps, asset swaps or total return swaps allows policymakers to quantify the time-varying credit risk since the main determinant of the price changes in these securities is the credit risk developments of the reference entities. Additionally, these derivatives are crucial concerning financial deepening as they are capable of reducing the liquidity premia in the eurobond market.

Although the price formation of debt instruments largely depends on the creditworthiness of the reference entity, they might be further exposed to other risk types, mainly the 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 considering the fact that both carry a default risk which is financed at the US repo market. From the perspective of an investor, the spread earned above the funding cost is the major compensation for assuming credit risk. However, it would be misleading to exclude the interest rate risk from the spread calculation as most eurobonds are issued with fixed coupons, rather than a floating coupon structure. Consequently, disentangling the credit risk from the financial instruments is crucial for policymakers and investors. One remedy adopted in financial markets to obtain credit risk is to construct a synthetic financial derivative to decompose interest rate risk, which is called asset swap. As one of the most actively traded credit derivative instrument, asset swap grants buyers/sellers the ability 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, this derivative can also be replicated for the entities in which asset swap is not traded in the financial markets. In the existing 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 is akin to credit risk indicators measured with CDS. Accordingly, the 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 would be exhausted by market participants. De Wit (2006) compares credit risk proxies retrieved from CDS and bond markets by concluding 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 corporations. There are several studies utilizing asset swap spread as a credit risk indicator to investigate the implications of credit risk dynamics on other financial markets. Aussenegg et al. (2016) examine the time-varying behavior and the determinants of asset swap spread for 23 iBoxx European corporate indices by arguing that stock market returns, the volatility of equity instruments and the swap spreads are significantly and negatively associated during turbulent periods. Gunay (2018) employs asset swap spread, albeit other than par asset swap spread, as an alternative indicator for credit risk of Turkey to examine the volatility structure of BIST 100 index returns. Gunay (2018) concludes that credit risk indicators have a statistically significant impact on stock market volatility in the regimes characterized by considerable fluctuations.

This paper aims to construct robust credit risk indicators for Turkish Treasury and the banking sector available at a higher frequency. The most widely used credit risk indicator in Turkey regarding 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 a pure measure of the creditworthiness of an entity. Although CDS written on eurobonds issued by Turkish Treasury are available for various maturities and traded widely in the market, they are available only for a few Turkish banks. Moreover, they are not actively traded which makes it infeasible to obtain a representative indicator for the creditworthiness of the Turkish banking sector through this instrument. In this regard, this study aims to develop a credit risk indicator by using asset swap spreads for Turkish Treasury and banking sector as the best alternative to CDS premium.

To the best of our knowledge, this is the first attempt that aims to construct asset swap spreads for eurobonds issued by the Turkish Treasury and banks as a methodological contribution. Since the sovereign and corporate eurobonds have different cash flow structures and time to maturities, the first step in the construction is to estimate eurobond yield curves. After the estimation of the yield curves, the second stage is to synthetically construct asset swaps disseminating information about the credit quality of the underlying entity at different maturities.

The findings of the study indicate that asset swap spreads are compatible with the CDS spreads throughout time demonstrating the consistency of the synthetically formed credit risk indicator. Moreover, asset swap spreads indicate that overall credit risk in Turkey has risen to unprecedented levels during the Global Financial Crisis. A similar but less dramatic movement was observed during the third quarter of 2018. In this period of acute distress in the markets, credit risks of both government and banking sectors are perceived to be elevated in the short term. The upward movement is stronger for the banking sector implying that the sensitivity of credit risk of the banking sector to tail events is observed to be higher.

Within this framework, 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 empirical methodology. Lastly, Section 4 presents the empirical findings of the study and Section 5 concludes the discussion.

2. 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 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 percent of bonds issued have fixed coupon rates (Fig. 1a). The non-residents tend to have a significant share in these

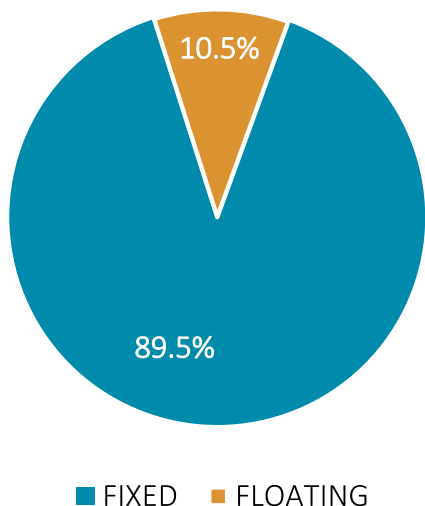


Fig. 1a. Sovereign eurobonds by interest rate type.

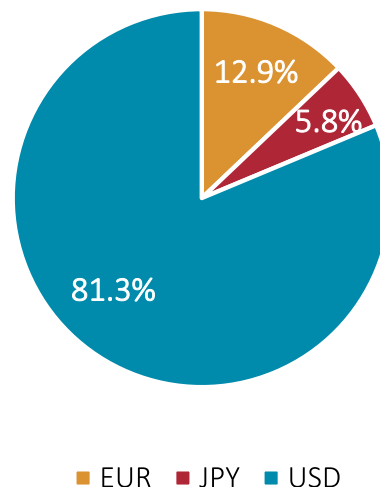


Fig. 1c. Sovereign eurobonds by currency type.

securities issued by the Treasury. Besides non-residents, domestic banks tend to hold eurobond securities in their portfolio and use them as collateral to borrow from domestic/international markets and for portfolio management purposes (Fig. 1b). Moreover, 82 percent of these issues are in US dollars, while a limited number of euro and Japanese yen issues are also observed (Fig. 1c). When the maturity structure of the outstanding eurobonds is investigated, it is observed that they have time to maturities up to 30-years whereas most of them are concentrated on the maturities between 5 and 10 years (Fig. 1d).

Besides the Treasury, Turkish banks also secure funding from the eurobond market. The eurobonds issued by banks tend to have longer maturities compared to the other liability items and they are concentrated in the maturities of 2–5 years (Fig. 2a). These securities are expected to contribute to the liquidity and interest rate risk management for the banks. Similar to the sovereign eurobonds, non-residents are the main investors for these securities. As of June 2019, the notional outstanding amount of eurobonds issued by the Turkish banking sector in the sample reached 17.35 billion US Dollars (Fig. 2b). The outstanding amount and ownership structure of the eurobonds show their importance for both issuers and investors. Therefore, it will be informative to construct an indicator focusing on the credit quality of the issuers.

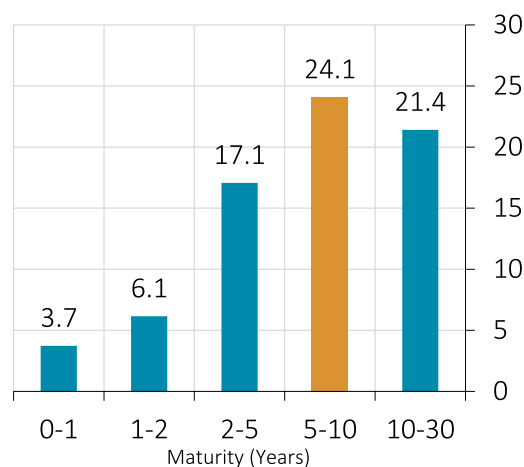


Fig. 1d. Maturity breakdown of sovereign eurobonds (billion US Dollar). Source: Ministry of Treasury and Finance

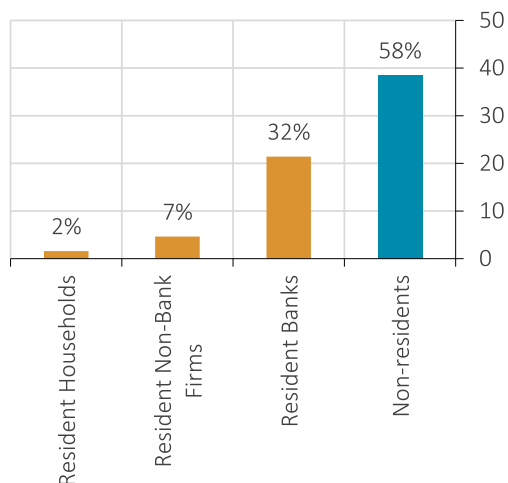


Fig. 1b. Ownership structure of sovereign eurobonds (billion US Dollar).

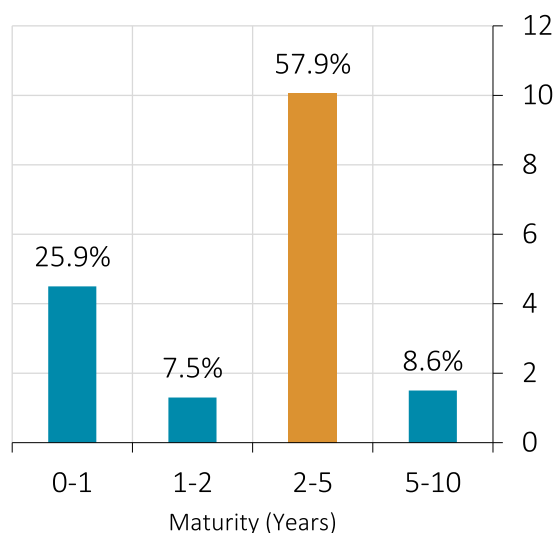


Fig. 2a. Banking sector eurobonds - maturity breakdown (billion US Dollar).

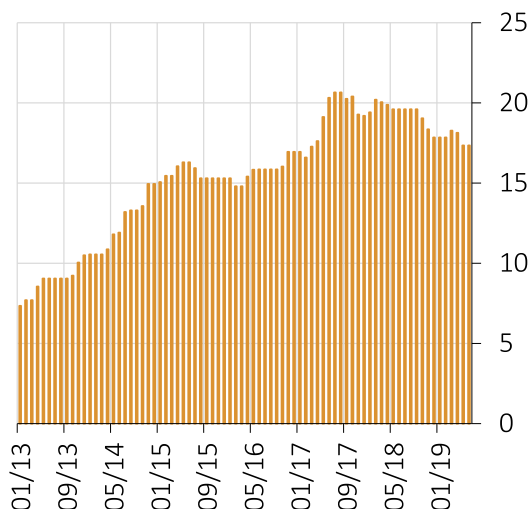


Fig. 2b. Banking sector eurobonds - outstanding notional ¹¹ (billion US Dollar). Source: Bloomberg

3. 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 sub-section describes the estimation procedure for eurobond yield curves and construction of the asset swap spread.

3.1. Data

As presented in the previous part, a significant portion of the foreign currency eurobond issuances of the Turkish Treasury and banking sector are denominated in US dollar. Therefore, we proceed by constructing the yield curves for eurobonds on US dollar-denominated securities. Although eurobonds had started to be issued before 2000, the sample with an adequate number of traded securities each day with different maturities to estimate the yield curve is only available for the period after 2005. As of June 2019, a total of 39 eurobonds with maturities up to 30 years are obtained on a daily frequency for which at least 11 different price data is available each day.

Similarly, the 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 banks with similar characteristics and credit ratings. To this end, senior-unsecured eurobond prices of 8 public and private banks with alike credit scores are chosen for the estimation. Issuances with notional amounts below 300 million US dollar are excluded to insulate our results from market microstructure effects due to the liquidity concerns. Given the data availability, eurobond yield curve estimation is performed after 2013 during which more than 13 different securities are available on each day so that a smooth and reliable curve could be obtained.

In addition to sovereign and banking sector eurobond securities, the asset swap spread construction requires a financial instrument denominated in US dollars, which is perceived to be default-free. In line with the common market practice and academic studies,² the

² 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 a small but non-zero default risk premium.

study uses the 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 market practice. In this regard, overnight index swap rates are taken from Bloomberg for the maturities up to 15 years.

3.2. 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 depicts the estimation process whereas the details of each step are explained thoroughly in the following parts of the sub-section.

The estimation procedure of eurobond yield curves is not straightforward due to the existence of non-regularities in coupon payment dates of the securities. Almost all eurobonds have semi-annual coupon frequency, but a non-negligible number of eurobond securities pay their first coupon in 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 the precise yield curve.³ The study tackles this problem by constructing cash flows of each security based on historical price data rather than 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;

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

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

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

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 of less than 3 months are excluded in the yield curve estimation due to the liquidity concerns. The objective function for each day t ;

³ To the best of our knowledge, there is no publicly available historical data for Eurobond coupon dates.

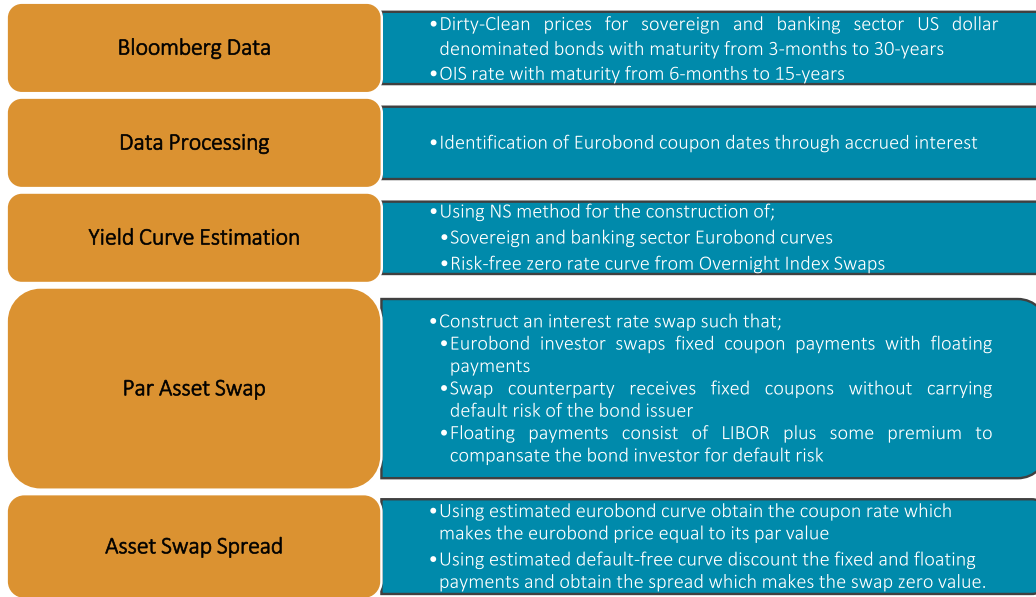


Diagram 1. Asset swap spread estimation process.

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

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 $P_t^{i, \text{fitted}}$ 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 the default-free yield curve using par OIS rates. This conversion is applied through the similar methodology adopted in Güney, Kazdal and Küçüksaraç (2018) 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 a 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 compensation for the default risk eurobond investor bears (See Diagram 2).

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. Denoting initial date by t_0 and some future dates by t_1, \dots, t_n where $t_0 < [t_1, \dots, t_n]$, t_0 value of the asset swap can be expressed as follows:

$$B(t_0, t_n) - 100 = \delta C \sum_{i=1}^n df(t_0, t_i) - \sum_{i=1}^n \delta [LIBOR(t_{i-1}, t_i) + Spread(t_0, t_n)] df(t_0, t_i) \quad (4)$$

where $B(t_0, t_n)$ denotes the price of the underlying synthetic Eurobond at time t with maturity t_n , and $df(t_0, t_i)$ stands for discount factor at time t_0 with maturity t_i obtained from overnight index swap yield curve, and δ represents the coupon frequency. Additionally, $LIBOR(t_{i-1}, t_i)$ is the London Inter-bank Offered 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 ($Spread(t_0, t_n)$).

The value of the floating payments in the interest rate swap at the issue date (t_0) can be written as follows⁴:

$$\sum_{i=1}^n \delta LIBOR(t_{i-1}, t_i) df(t_0, t_i) = 100 - 100df(t_0, t_n) \quad (5)$$

Since we construct par-asset swap spread, $B(t_0, t_n)$ is at par value. Hence resulting spread from this asset swap equation is as follows:

¹ US Dollar-denominated senior and unsecured bonds are chosen for entities with similar creditworthiness in the universe of the Turkish banking sector. Bonds with notional below a certain level are not included in the calculations. Furthermore, callable bonds of commercial banks and Sukuks issued by participation banks are excluded as well.

⁴ A detailed derivation for equation (5) can be found in Kucuksarac et al. (2018).

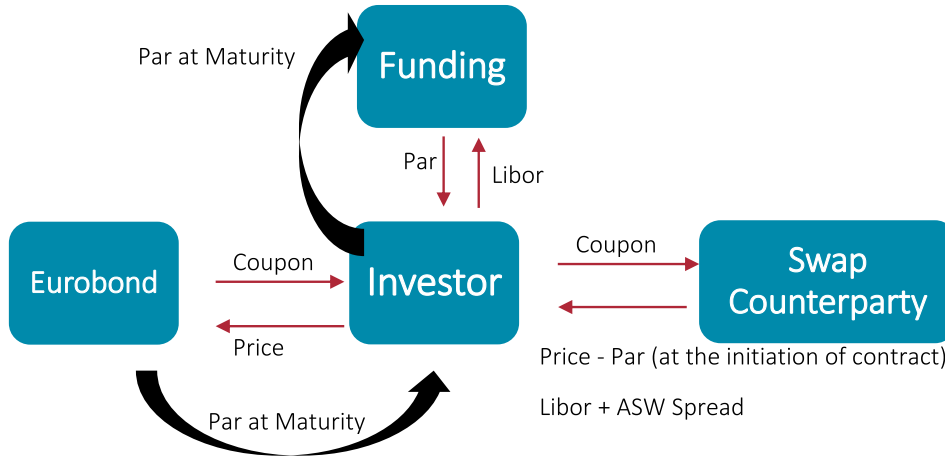


Diagram 2. Par asset swap mechanism.

$$Spread(t_0, t_n) = \frac{\delta C \sum_{i=1}^n df(t_0, t_i) + [100df(t_0, t_n) - 100]}{\delta \sum_{i=1}^n df(t_0, t_i)} \quad (6)$$

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 stage entails discounting all the cash flows using the OIS rates which are perceived to be default-free. Finally, we obtain the par asset swap spread using equation (6), which indicates the premium eurobond investor demands for credit risk of the bond issuer.

4. Empirical findings

This section initially 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 exist certain episodes when the aforementioned indicators diverge from each other. Then, the asset swap spreads, constructed using the methodology described above, are presented for various maturities starting from 2005 for the Treasury and from 2013 for the Turkish banking sector up until June 2019.

Fig. 3a and Fig. 3b demonstrate the evolution of yield curves for US dollar-denominated eurobonds of the Treasury and the banking sector, respectively. Following the Global Financial Crisis, the yields on various maturities (level of the yield curve) oscillate within a band and peak during the period of the Taper Tantrum. However, the borrowing costs tend to be quite low compared to historical averages during the same period, mainly due to the quantitative easing policies adopted by the central banks of advanced countries. Furthermore, both curves tend to be upward sloping for almost all of the estimation period implying a positive risk premium demanded by the investors to hold longer-maturity securities.

During the period of the local financial turmoil in August 2018, US dollar-denominated short-term borrowing costs of both Turkish Treasury and banks in international markets are observed to increase the levels above 8 percent for sovereign and 15 percent for the banks. Simultaneously, bear-flattening movement occurred in both curves hinting that short-end of the curve shifts upward more than the long-end. The degree of the flattening movement is so strong that both curves are observed to be inverted where the short-term rates stay above the long-term ones. 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 were temporary and displayed an upward sloping behavior together with the restoration of confidence in the

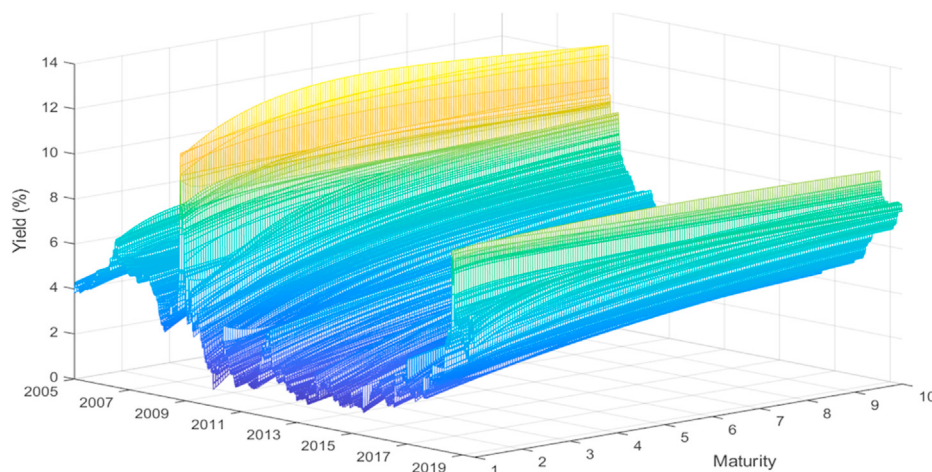


Fig. 3a. Sovereign eurobond yield curve (US Dollar denominated, %).

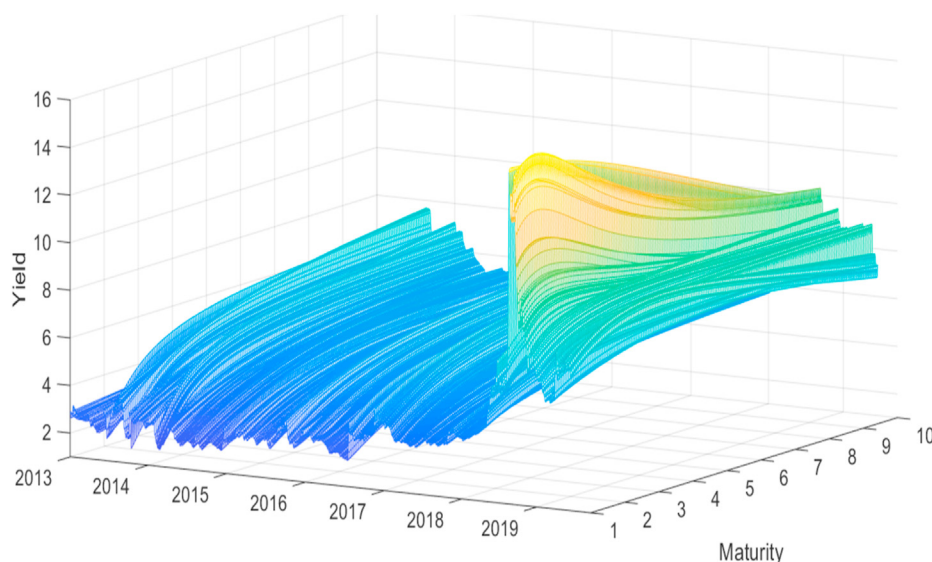


Fig. 3b. Turkish banking sector eurobond yield curve (US Dollar denominated, %).

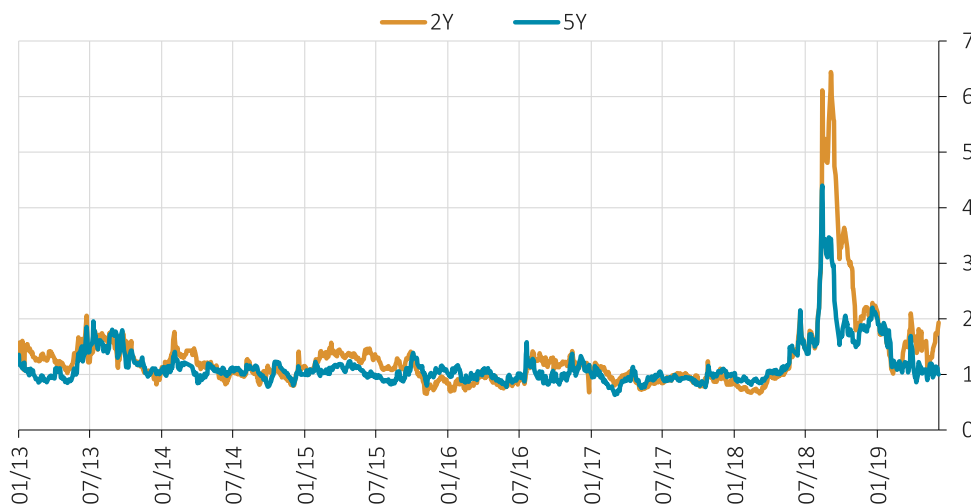


Fig. 4. Turkey banking sector - sovereign eurobond spreads (%).

financial markets after the period of rapid depreciation of Turkish Lira.

Constructed eurobond yield curves of Turkish Treasury and banking sector can be used to obtain the spread of zero rates for specific maturities. Fig. 4 demonstrates the evolution of US dollar borrowing costs faced by the public and financial sector of Turkey in the international markets. 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 the public sector. The rise in the spreads can be attributed mainly to the market perception that the ability of the financial sector in Turkey to meet its external obligations deteriorates more than that of the public sector. This conjecture will be validated when asset swap spreads for both sectors are examined in the upcoming parts of this section.

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 (Fig. 5a & Fig. 5b). The results indicate 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

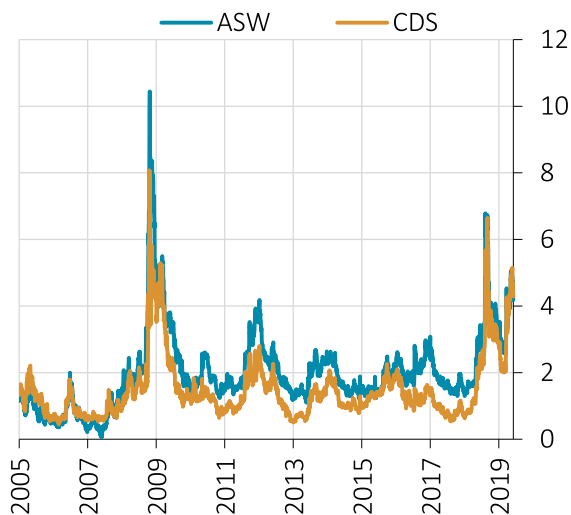


Fig. 5a. Sovereign ASW – credit default swap (2-year, percentage).

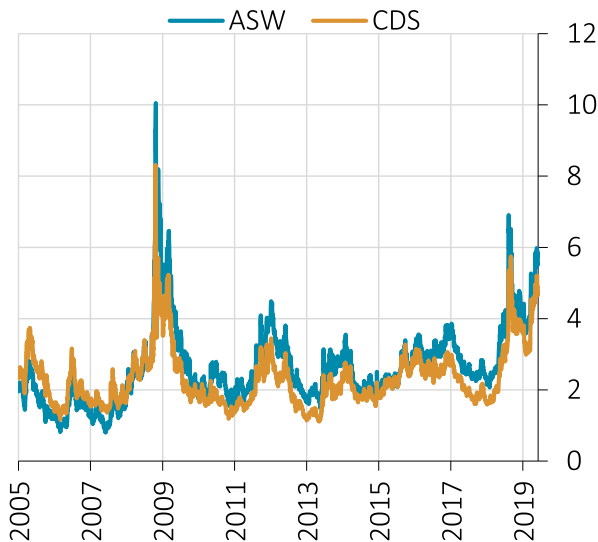


Fig. 5b. Sovereign ASW – credit default swap (5-year, percentage).

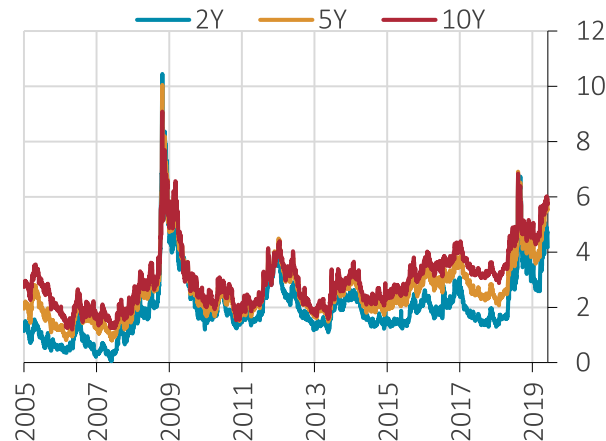


Fig. 6a. Sovereign asset swap spread (%).

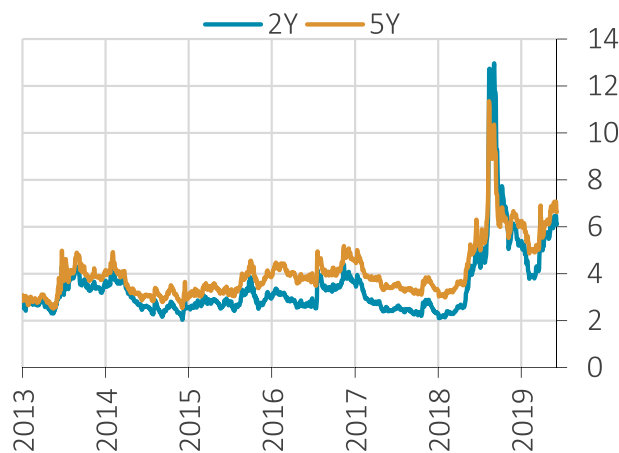


Fig. 6b. Banking sector asset swap spread (%).

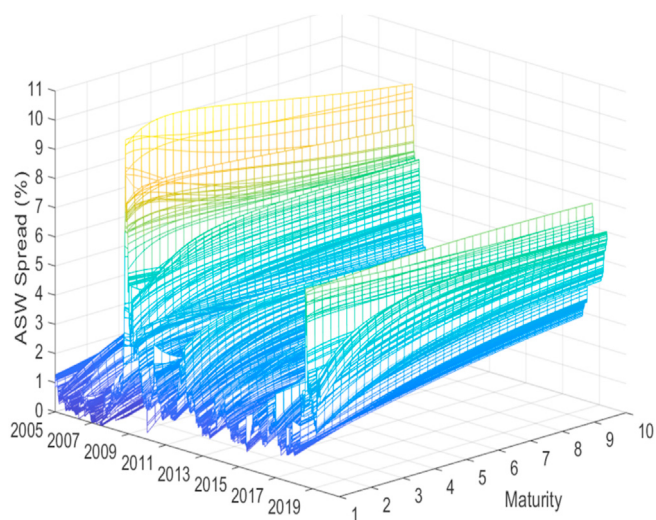


Fig. 6c. Sovereign asset swap spread surface.

several factors due to fundamental and technical differences between the aforementioned credit derivative instruments.⁵

Asset swap spreads for the banking sector, which is available for the period after 2013 and for the maturities of 2 and 5 years, point out similar dynamics with sovereign bonds (Fig. 6a to 6d). For both the sovereign and Turkish banking sector, credit risk implied by the Eurobond market is increasing with maturity as expected with the exception of high-stress periods. In such periods, the credit risk of both the sovereign and the banking sector is perceived to be higher in the short term implying that once these entities survive in the near term, 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

⁵ The 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).

events in financial markets. In this regard, asset swap spreads for the banking sector are observed to react more abruptly than their sovereign counterparts indicating that higher variability of investors' risk sentiment towards creditworthiness of the banking sector leads to sharp changes in valuations of debt instruments.

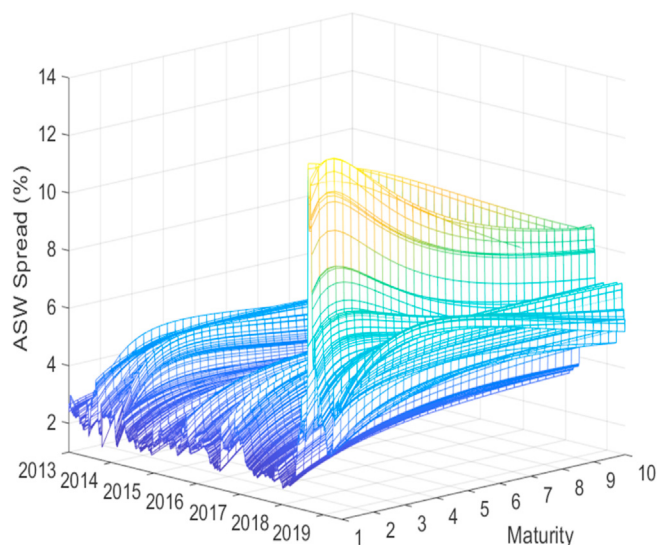


Fig. 6d. Banking sector asset swap spread surface.

5. Conclusion

Credit risk indicators allow policymakers, regulators, risk managers and investors to monitor the developments in the credit-worthiness 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 and enable risk managers or 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 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 the 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 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 jumps up until the third quarter of 2018.

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 percent 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 the 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 policymaking, risk management and valuation purposes.

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