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AN EMPIRICAL ANALYSIS OF TURKISH CREDIT DEFAULT SWAPS

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ÖZET

Yurtdışı piyasalaradaki yaygın kullanımına rağmen, Türkiye'de kredi türev araçları için yeterli finansal ve bilgi altyapısının oluşmaması nedeniyle Türk finans kurumlarının birçoğu halen Kredi Temerrüt Swaplarını bilmemekte ya da kullanmamaktadır.

Bu çalışma, Türk kredi temerrüt swaplarını farklı açılardan incelemektedir. Çalışmadan elde edilen sonuçlar, 10 yıllık swap spreadlarinin aşırı değerli olduğunu ortaya koymaktadır. Bunun da temel nedeni olarak, mevcut Kredi Temerrüt Swap piyasalarının halen yeterli ölçüde likit olmaması gösterilebilir.

Bunun yanında, Türkiye'nin mevcut borçlarına ilişkin temerrüte düşme olasılığı tahminlerinin vade yapısı incelendiğinde, Türkiye'nin gelecek beş sene içinde temerrüte düşme riskinin , özellikle tüm zamanlar için en kötü kriz senesi olarak kabul edilen 2001 yılı ile kıyaslandığında, nisbeten düşük olduğu görülmektedir.

***Anahtar Kelimeler**: Kredi türevleri, temerrüt swapları, temerrüt olasılığı, vade yapısı*

ABSTRACT

Despite its widespread use globally, majority of the Turkish financial institutions are still unaware of Credit Default Swaps (CDS), stemming mainly from insufficient financial infrastructure and information base for credit derivatives.

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This study analyzes Turkish CDS from various perspectives. The findings exhibit that 10-year spreads are found to be overpriced, primarily due to the lack of liquidity in current CDS market in Turkey.

Besides, the term structure of default probability estimations for Turkey reveal that the level and the change in default risk for Turkey for the next five years is relatively low, particularly when compared to 2001 which is marked as the worst crisis year.

Keywords: *credit derivatives, default swap, default probability, term structure*

1. INTRODUCTION

Credit default swaps (CDS from here on), on the other hand, are currently one of the most popular and widely used risk management instrument among all other credit derivative instruments, particularly in emerging markets. According to Deutsche Bank report, CDS account for 85% of the total credit derivatives market in emerging markets [1](2004).

On the other hand, the widespread use of credit derivatives and swaps in Turkey is almost negligible when compared to other countries since CDS are relatively new instruments for Turkish financial institutions. In years 2000, 2001 and 2002, numbers of quotes on CDS were 146, 471 and 475 respectively. However, considering the increase in the use of credit derivatives in the global financial markets and the mandatory implementation of Basel II Accord requirements regarding credit risk management, it is inevitable that in the near future, the use of credit derivatives will also increase in Turkey.

As to date, there are not many studies analyzing CDS in Turkey. When the role of CDS for the risk management activities in the near future is considered, this study could be regarded as one of the pioneer studies on CDS in Turkey.

2. LITERATURE REVIEW

Since credit derivatives and CDS are relatively new concepts, the current literature suffers from the scarcity of studies on CDS. Among existing studies on CDS, the subject of pricing CDS has been a focal point of study.

[1] Deutsche Bank Annual Report, 2004.

While CDS pricing and spreads are dependent upon different variables, country risk ratings is regarded to be one of the most significant variable. In one of the most recent studies, Abid and Naifar (2006), reveals that credit rating is the most significant determinant of CDS spreads. Daniels and Jensen (2005), reach similar results. They further claim that CDS market seems to react faster and more significantly than the bond market to changes in credit ratings. Micu et al. , (2004) also found out that ratings are negatively correlated to CDS spreads. In the same study, other factors that influence CDS spreads are found to be economic conjuncture, bond rates, country premium. In another relevant study, Norden and Weber, (2004) observed that CDS changes respond significantly to the rating downgrades.

There are various methods in pricing CDS. Some researchers use default probabilities to price CDS (Garcia et. al., 2001), while other studies use risk-neutral pricing theory to price CDS (Skora, 1998). Some complex simulation methods like first-passage-time default probability under jump diffusion are also used by some academicians (Joro et. al. , 2004). Hull and White (2000) conclude that risk-free rate used by market participants is about 10 basis points less than CDS rates on average.

Longstaff et. al. (2003), compare CDS premium and corporate bond yields of a sample of firms and the findings allege that the credit protection is overpriced. Singh (2003) discusses that not linking recovery value to cheapest to deliver bonds may lead to overpricing CDS.

In his study, Ranciere (2001) forms synthetic default swaps and compares them with real CDS data of Argentina. The findings of this study reveal that CDSs are overpriced in Argentina. He proposes that overpricing of CDS in Argentina may be attributed to lack of liquidity in the market, the value of embedded delivery option and repo market risks.

The same methodology will be used in empirical analysis of CDS for Turkey in the following section.

3. EMPIRICAL ANALYSIS OF CDS IN TURKEY

When compared to the developed markets, CDS market in Turkey is very thin and not widely used by companies and financial institutions. As of September 2005, only one bank had CDS transactions. The amount of CDS assets in the portfolio of Turkish Foreign Trade Bank at the end of periods 2003, 2004 and

2005/9 were 14,020 YTL[2], 40,500 YTL and 40,320 YTL respectively. Apart from Turkish Foreign Trade Bank, Dogan Holding was the single firm that has used CDS contracts and had a CDS contract worth of 324,000 YTL in its 2005 first quarter balance sheet.

In CDS contracts in Turkey, Turkish Banks act as protection sellers whereas foreign financial institutions that are in long position in Turkish Bonds act as the primary protection buyers and enter into CDS contracts with Turkish Banks to decrease their risk exposure on Turkish sovereign bonds.

The empirical analysis of Turkish CDS consist of two parts: First part of the analysis will attempt to answer the question whether Turkish CDS are fairly priced by comparing actual CDS prices with synthetic default prices derived from "No Arbitrage Condition" using Ranciere (2001)'s methodology. In the second part, the term structure of default probability and risk for Turkey will be forecasted by using the most recent CDS data obtained.

3.1 Data and Descriptive Statistics

The data used in the analysis cover a period of 5 years spanning from October 2000 to October 2005. However, the complete data set is only used for extracting the general pattern and behavior of Turkish CDS throughout various economic conjunctures. For descriptive statistics as well as pricing and default probability analyses, only two-month data spanning from October to December 2005 is used. The reason is to employ the most updated data and information to determine the current condition of CDS in Turkey as well as making forecasts for the near future.

The descriptive statistics of daily Turkish CDS rates for different maturities and for the sub sample period (October 2005-December 2005) are provided in Table 1. As expected, the mean and standard deviation values for Turkish CDS rates increase in parallel with the maturity. On the other hand, the incremental change in standard deviation values decline with maturity. This result might be explained by the fact that Turkey's economic outlook is considered to much more stable in the long term even though there are temporal fluctuations in the short term.

[2] YTL indicates new Turkish lira which is in effect since January 2005.

Table 1: Descriptive Statistics for Turkish CDS (October 3rd - December 5th 2005)

CDS / Maturity	*Mean*	*Standard Deviation*	*Skewness*	*Kurtosis*
1 YR CDS	36,55	14,06	0,71	-0,34
2 YR CDS	67,76	16,43	0,20	-1,11
3 YR CDS	107,10	18,65	-0,22	-0,76
4 YR CDS	147,57	21,19	0,00	-0,78
5 YR CDS	189,00	22,24	0,02	-0,81
10 YR CDS	257,93	22,50	0,06	-0,84

For testing whether Turkish CDS are fairly priced or not, the methodology applied is similar to the one used by Ranciere (2001). Specifically, the following equation, which indicates the zero arbitrage condition from the protection seller's point of view, is used to test if CDS are over or under priced:

$$ds = s - f \qquad \text{(Equation 1)}$$

where

ds = Default spread (premium)

s= Spread over LIBOR

f= LIBOR rate – repo rate

Assuming that the swap protection is funded by repo market, then zero arbitrage condition implies that f=s.

In Equation 1, the difference between the default premium and the spread over LIBOR is called the credit-derivatives cash basis.

$$\text{Basis} = f = ds - s \qquad \text{(Equation 2)}$$

The basis is equal to the break-even funding LIBOR spread. There are also some other elements that affect the default swap cash basis including liquidity, cheapest-to-deliver option and accrued interest (Singh, 2003).

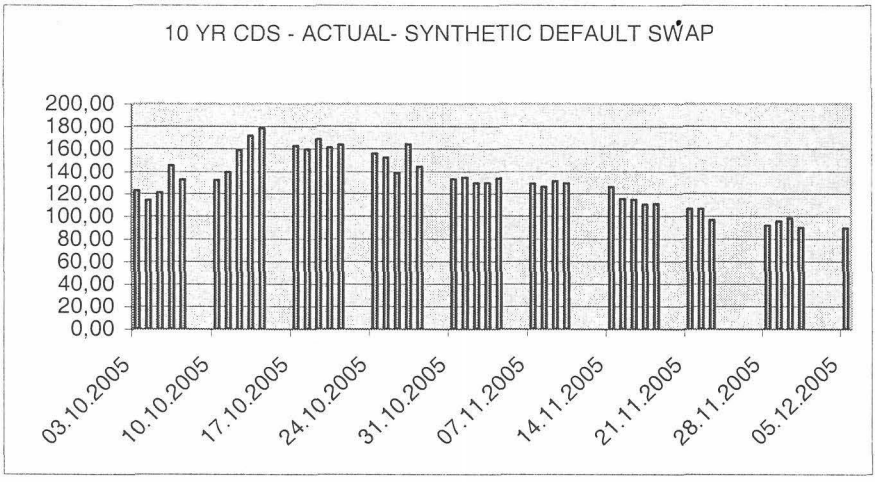
3.2 Basis Analysis for Turkey

In the basis analysis for Turkish CDS, 10-year maturity CDS data is used for liquidity aspects.

In the absence of any market imperfections, for any default swap, the actual and synthetic price derived from the zero arbitrage condition in Equation 2 should be equal.

Figure 1 displays the difference between the actual and the synthetic 10-year default swap rates over the period October 2005-December 2005.

Figure 1: Actual CDS vs. Synthetic Default Swap



On average, the actual default swap is trading 131 basis points above the synthetic default swap created by shorting the Turkish Government Eurobond. This difference can be explained by, the lack of liquidity in the default swap market and the value of the embedded delivery option. It also implicitly reflects the repo market risks. Short position in default swaps is usually covered by short position in cash via the repo market.

These results indicate that Turkish CDS are overpriced for the selected period. These results are consistent with the findings of other studies in emerging markets (Ranciere, 2001).

3.3 Term Structure of Default Probability Analysis for Turkey

In the second part of the analysis, the methodology in Ranciere 's study will be used again to examine the default probability term structure and risk for Turkish government bonds underlying to CDS contracts. Using the estimated values of recovery value of underlying bonds, the term structure of default probability for Turkey will be derived.

The variables used in the analysis are listed and defined below:

$DS_{t,t'}$: Default Spread between t and t'

$R_{t,t'}$: Risk Free Rate between t and t'.

P_{st} : Default Probability between t and t+6 months given there is no default before t

P_t : Default Probability between t and t+1 given there is no default before t

S_t : Survival Probability of an obligation at time t

D_t : Cumulative Default Probability of an obligation at time t

H_t : Probability of a default between t and t+1

R : Recovery rate.

In the term structure analysis of the default probabilities for Turkey, initially the forward default swap spreads are determined by using zero arbitrage condition such that:

$$\left(1 + R_{1,2} + DS_{1,2}\right) = \frac{\left(1 + R_{0.2} + DS_{0.2}\right)}{\left(1 + R_{0,1} + DS_{0.1}\right)} \qquad \text{(Equation 3)}$$

Using this formula iteratively, one- year forward default spreads can be derived for all future periods.

Once the forward default swap spreads are calculated and each one-year interval is treated independently, then the forward spread rate reflects the conditional default risk for the selected period. Recalling that the default premium paid every 6 months covers the expected cost of default for the given 6-month period, the *risk neutral valuation principle* is applied to obtain the conditional 6-month default probability P_{st} using the following equation:

$$\left(1 + R_{t,t'} / 2\right) = \left(1 - P_{st}\right) * \left(R_{t,t'} + DS_{t,t'} / 2\right) + \left(P_{st} * R\right) \qquad \text{(Equation 4)}$$

In the next step, the survival probability, default probability and default probabilities by each time interval are calculated.

In Ranciere's study, the probability calculations for Argentina and Brazil are made for an exact date. However, taking a single date into account might be misleading and insufficient to generalize the results. Thus, in this study, same calculations are performed on an extended sample spanning from October 3rd, 2005

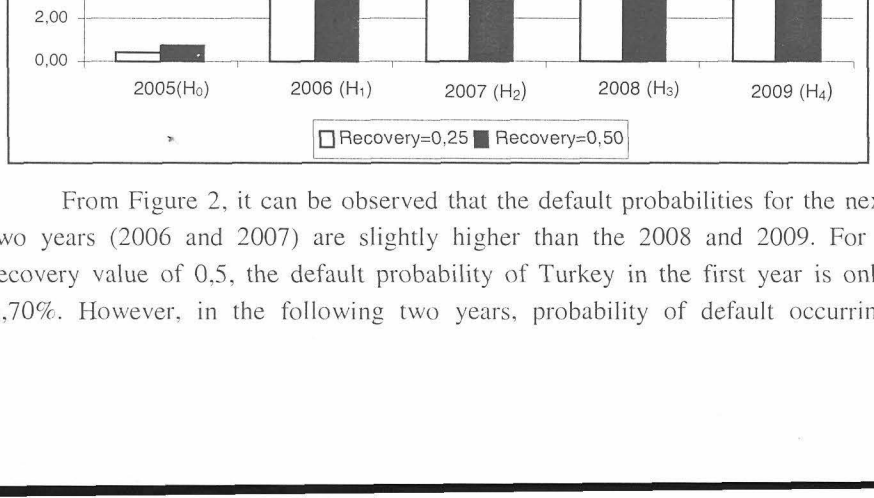
to December 5th, 2005. The average values calculated for the default probabilities, survival probabilities, cumulative default probabilities and probability of a default occurring precisely in any one-year time interval with recovery values of 0.25 and 0.5 are provided in Table 2.

Table 2: Default probabilities (P_t), Survival probabilities (S_t), Cum. Default probabilities (D_t) and Probability of a default occurring precisely in any one-year time interval (H_t)

R=0.25				R=0.5			
Variable	Value	Variable	Value	Variable	Value	Variable	Value
P_0	0,47	D_0	0,47	P_0	0,69	D_0	0,70
P_1	5,91	D_1	6,36	P_1	8,67	D_1	9,31
P_2	6,06	D_2	12,04	P_2	8,88	D_2	17,37
P_3	6,14	D_3	17,44	P_3	9,01	D_3	24,82
P_4	6,10	D_4	22,49	P_4	8,95	D_4	31,55
S_0	99,53	H_0	0,47	S_0	99,30	H_0	0,70
S_1	93,64	H_1	5,89	S_1	90,69	H_1	8,61
S_2	87,96	H_2	5,68	S_2	82,63	H_2	8,06
S_3	82,56	H_3	5,41	S_3	75,18	H_3	7,45
S_4	77,51	H_4	5,04	S_4	68,45	H_4	6,73

The graphical representation of default probabilities by in a certain time interval (H_t) for Turkey is illustrated in Figure 2.

Figure 2: Default Probabilities by Time Interval for Turkey



From Figure 2, it can be observed that the default probabilities for the next two years (2006 and 2007) are slightly higher than the 2008 and 2009. For a recovery value of 0,5, the default probability of Turkey in the first year is only 0,70%. However, in the following two years, probability of default occurring

precisely in 2006 and 2007, ranges approximately between 7% and 9% and decreases slightly from onwards.

This result might be adhered to two primary reasons: Firstly, resulting from the stand-by agreements with IMF, Turkey is required to make almost 9 Billion SDR payments to the fund in 2006 and 2007 which in turn might create some volatility and additional risks, particularly currency risk. Secondly, the general elections as well as President of Republic elections to be held in 2007 are also expected to increase the political risk. Thus, these developments in the near future are embedded into risk estimations for Turkey.

Accordingly, because of its inverse relationship with the default probability, it can also be observed from Table 2 that the survival probability is at its maximum level in the first year. It decreases almost uniformly for the following years. For the last year, survival probability is 77,51% and 68,45% for recovery values of 0,25 and 0,5 respectively.

In Ranciere's study, cumulative default probability of Argentina on August 3rd 2001 is calculated as 80%. Using same methodology, using 10-year CDS spread, cumulative default probability of Turkey can be calculated as 11,025% on the same exact date. On the other hand, using the same methodology, and 10-year spreads, cumulative default probability for Turkey on December 5th, 2005 can be calculated as 2.19%. These results are not surprising, since 2001 was a period of economic downturn both for Turkey and Argentina. Furthermore, a significant decline in estimated cumulative default probability for Turkey from 2001 to 2005 indicate that, currently Turkey is perceived as a much more stable economy when compared to past. These findings are especially remarkable when current findings are compared with year 2001, in which Turkey has gone through its most severe economic crises to date.

5.CONCLUSION

The use of credit derivatives among financial institutions for risk management purposes is increasing sharply in last years. The standardization of the documentation for credit derivatives is expected to further enhance this trend. Turkish financial institutions, however, are still shy in using credit derivatives for risk management purposes. This is not very surprising since the term "derivatives" is relatively recent for Turkish finance environment. This attitude is considered to change in the near future, particularly, by the widespread implementation of Basel II and some other risk assessment techniques.

The results from the analyses showed that Turkish CDS are overpriced stemming mainly from the lack of liquidity and the value of the embedded delivery option.

The term structure of default probability analysis for Turkey demonstrate that there is not a significant change in risk perception of Turkey even though there might be a slight increase in risk perceptions in the next two years resulting from political ambiguity and possible currency fluctuations.

The results from default probability analysis also suggest that currently Turkey is considered to be a stable and suitable market by foreign investors for the next five years following the major crises experienced in 2001 and 2002.

By the widespread use and increased liquidity of CDS in Turkey, it can be asserted that the difference between actual default swaps and synthetic default spreads will decrease and calculation of term structure of probability of default will provide more accurate results.

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