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Credit Scoring of Turkey with Semiparametric Logit Models

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Abstract: The aim of this study is to determining the factors which could affect the credit scoring to reveal the relationship between economical policies implemented in Turkey and the credit ratings given by credit scoring agencies with econometrics method along with comparisons among countries. When the countries own resources are not enaugh to finance economical growth, countries are needed for foreign investments.These foreign investments are wanted by countries as direct foreign investments or financial investments. Both kinds want to have a trust on types of economies to invest on them. For this reason it is needed to have a indicator for safety of a country to invest .The most important indicator developed for this purpose is credit rate. Thus, figures of GDP, Current Account Balance, Foreign Borrowing and Inflation of Turkey in the year of the 2000-2015 using parametric and semiparametric logit models. The semiparametric methods best fitting models using best fitting smoothing methods when the combines that best features of the parametric and nonparametric approaches when the parametric model violated. We used the data of IMF World Economic Outlook Database and IMF Article IV countries reports, Moody's,Standart&Poors and Fitch main reports on site.

Keywords: Semiparametric logit; Credit scoring; Credit scoring agencies.

1. Introduction

In the recent years the credit scoring more important and efficient credit scoring is a score that determines if a lender will be eligible to borrow money from lending institutions. Credit scoring is a technique by which financial institutions develop numerical score each applicant agency so as to reduce the probability of delinquency or payment default of countries.

Especially the new financial gelişmeler how the affect the countries and chrisis is become one of the question and it is started to discus. Many emerging countries could'nt pay their borrows and started to borrow chrisis in 1982 as the Mexico did. After that in 1990 the emerging countries to came up against financial chrisis then the chrisis factor's results and reasons are criticized with credit scoring acencies calculate criteia and approaching to the countries statuse in the euro chrisis state and USA.

For this reason many cauntries economical policies and factors are affected on the credit scoring by the credit scoring agencies. In this study is used parametric and semiparametric logit models to compare the credit scoring degree differences and the giving score probability with the economical factors .using the best semiparametric logit models also shows the why the cauntries credit notes are changing or not.

The credit score analysis when the credit score takes the binay level so that we use type of logit models as the best fitting nonparametric and semiparametric logit models. In this study using Turkey credit scores are considered by credit score agencies which are Stadart and Poors,Fitch and Moody's for the 2000-2015. The country's credit notes are determined notes as adetermining factor with ,inflation ,current account balance, foreign borrowing, gross dometric product changement (GDP).

For this purpose we determined the some variables are taken first parametricly then we used variable as a smoothing parameter to show the significance and how changing the results on credit scores .

İn our study we evaluated the three credit scoring agencies S&P,Fitch and Moody's as giving their credit notes for Turkey.

The rest of the paper is organized as follows: The following section includes the introduction. Section 2 introduces the nonparametric and semi-parametric regression models. Sections 3 credit scoring agencies as we used and 4 present data and empirical models and graphs results, respectively. The final section provides conclusions how the credit scoring is determined with parametric and semiparametric logit models and to show the best scoring probability will be seen by fitting model as semiparametric models.

2. Non Parametric and Semiparametric Logit Models

The logit model remains the most widely used parametric method for the estimation of binary dependent

variable. This model depends on two assumptions: a known index which is assumed to influence choice, and a known parametric form for a distribution function which is assumed to yield choice probabilities. A Binary Dependent variable model has been used in this study. This class of models, dependent variable, may take on only two values zero and one. The binary logit model remains the most widely used parametric method for the estimation of binary choice models. The traditional parametric logit model approach to modelling binary choice is as follows:

$$\text{logit}\,(p_i) = \log(\frac{p_i}{1-p_i}) = \alpha + \beta x_i \quad (i=1,....,n) \tag{1}$$

The general form of the nonparametric regression regression is as follows,

$$y_t = f(x_{t1}, \ldots\ldots, x_{tk}) + \varepsilon_t \quad t=1,2,\ldots,n \tag{2}$$

F is the unknown regression function.The errors εt are identically and independently distributed. In the analysis of nonparametric regressions,the functional form will be constant and estimation of the density functions is absolutely necessary for he estimation of the unknown. An alternative approach to the nonparametric regression models is developed by the additive models. However, the alternative approach is only valid fort the models with more than one independent variable. Thus,the approach facilitates the accepttability of such models easier. Parallel with additive regression models and linear models the average value of the dependent variable is defined by the addition of the separate terms of each additional variable. Thus,the general form of the additive regression model is as follows:

$$y_i = \alpha + f_1(x_{t1}) + f_2(x_{t2}) + \cdots \ldots\ldots + f_k(x_{tk}) + \varepsilon_t \quad n=1,2,\ldots,n \tag{3}$$

The additive terms in the previous form will be the smoothing functions of x and will be calculated separately for each independent variable in smoothing additive models. The relationship between variables might not be necessarrily parametric and nonparametric regularly. The regression models of which one half of the relationship between variables is parametric and the other half is nonparametric are called the semiparametric regression models and their related form is:

$$y_i = \alpha + \beta_1 z_{t1} + f_1(x_{t1}) + \cdots + f_k(x_{tk}) + \varepsilon_t \quad t=1,2,\ldots,n \tag{4}$$

The parametric binary logit model as,

$$P(Y=1/X)=E(Y/X)=F(B^TX) \tag{5}$$

and

$$F(.)=(\frac{1}{1+e^{-yi}}) \tag{6}$$

The Cumulative Distribution Function .

In the above form, the errors are independent and normally distributed with a constant variance. In the estimation of parametric part of semiparametric regression models, the effect on the dependent variable of the parametric and nonparametric parts are separetely examined. This examination is done by adding the conditional expected value and the conditional expected value of the semiparametric regression model according to the nonparametric variables z will be:

$$E(y_i/z_i)=E(E(y_i/z_i)'\beta + f(x_i) + \varepsilon_i \tag{7}$$

There exist rich and very impressive variety of aproaches towards the semiparametric estimation of binary response models including that Coslett (1983), Ichimura (1986), Manski (1986), Rudd (1986), Ichimura and Lee (1991), Coslett (1991), Klein and Spady (1993), Lee (1995), Chen and Randall (1997), Picone and Buttler (2000), Ichimura and Thompson (1998) among others. Pagan and Ullah (1999), Härdle and Horowitz (1996) also give a recent survey of semiparametric approaches to the estimation of binary response models.

When there is more than one nonparametric independent in semiparametric models, the estimation can be realized by additive models. The coefficients of the parametric variables are analysed by the chi square test. For the model goodness of logit model, alternatives of binomial distribution are chosen and logit models are considered (Dunn and K., 1996; Goegebeur, 2008; Härdle and Horowitz, 1996).

3. Credit Scoring Agencies

Credit ratings play an important role in capital markets. Under the New Basel Capital Accord (Basel II), credit ratings will play an even more central role than they have so far. There are two basic types of credit ratings will play an even more central role than they have so far.There are two basic types of credit ratings,the bond rating and issuer credit rating.While the former mesaures the likelihood of the default or payment of a bond issue,the latter is an overall assesment of the creditworthiness of a campany .Currently ,there are many widely recognized credit rating

agencies, such as Moody's Investors Servise and Standart and Poor's Ratings Services(S&P's),Fitch ,etc.They routinely provide credit ratings for bonds and companies.

Meaning of the S&P ' s credit notes AAA shows that the most capacity for the fullfil commitment financial responsibility ,AA defines that the high capacity ,A defines the having high capacity for the fullfil commitment financial responsibility but can be affected economical positions. BBB defines the having high capacities and probability of affecting the economic conditions. CC defines fullfilling commitment so weak for financial subject in the recent condition. C defines that high weakness to fullfil commitment for financial and other dutuies.D defines that is default. The meaning of the Moody's credit notes Aaa shows that very high quality but having very little invesment risk. A defines that high degree and wholesome structure.A shows that the wholesome and trusttfull structure but can be effected from economic conditions.Baa defines middle degree but having risk on the period of the long term .Ba defines that having speculative experience and uncertanity .B defines the probability of not to obey the paying dept.Caa defines that having high risk even in a short time.Ca defines that wholly speculative and pay back is not possible almost. C defines that having very low quality and the most big risk.D defines that is default. The meaing of the Fitch Ratings AAA shows the default risk most low and having high capasity to fullfill the financial commitment. AA shows that having very little default risk and having strong capasity for predictible difficulties.A shows that low default risk.BBB defines that low default risk but having high probability of effecting on economical conditions. BB defines that having high sensibility to the default risk in the string economical attached.B defines that default risk in the recent term and probability of default risk will be continue in the continues time .CCC define that having high probability to fall dawn in a big default.CC shows that default possibility will set off. C defines that imperious default .D defines that default conditions.

Finally in the literature the credit scoring agencies generally pointed that on the macro economics shows AAA,AA+,AA...,BB,...,D .The credit scoring agency Standart& Poor's use BBB- and the above levels show invesment grade level for the country .The BB+ and the more below levels non-invesment grade and speculatifly wholly default. The credit agency Fitch determines the BBB- and above levels as invesment grade .BB+ level shows that the invesment can't be done on this country. The Moody's agency use the Baa3 and above shows invesment grade . The Ba1 and below levels show that the speculatifly non- invesment grade and wholly default.parameters while the sometimes these parameters could be changed .

In the literature we can find the defining factors the credit scoring and the country risk with GDP, inflation, and external dept. The credit numbers also could be change in the chrisis term. The high credit notes descriptives must be real growth rate and low inflation, minimum total dept of local self goverment.

4. Data

All the data used in this study are provided IMF World Economic Outlook Database and IMF Article IV countries and FED Reserve Bank for the country over the period of 2014-2015.

We used the dependet variable for the credit agencies notes and we used as a dependent variable for parametric and semiparametric logit model and we prepared the dependent variable with determining the 'changement' for the '0' and there is 'no changement' for '1' . Finally we can find the probability of changement or no changement on S&P,Fitch and Moody's credit notes for the country .

In this study the logit model dependent variable the changement probabability of credit notes of S&P ,Fitch and Moody's.Using the parametric and semiparrametric logit model for the changement '0' and no changement '1' as defined.

Table 1 below shows that the describes the variables descriptions and the short name of the variables and the many variables continues variables and the credit scores dummy variables for the agencies.We determined dependent variables coded are including the the credit scoring changement or credit changement or not. The credit changement for the Standart &Poors is capacity for the fullfil commitment financial responsibility but can be affected economical positions. The Moody's shows that very high quality invesment grade or invesment risk. The Fitch rating shows that default risk or not high capasity for the fullfil financial commitment. The other dependent variable the GDP and İnflation rates , Current Account Balance ,Foreign Borrowing are continues variables .The explanatory variables has been explained in the Table 1.

Table-1. Explanotary Variables

Dependent Variable	**Short name**	**Description**
S&P Credit Note ,	YSP	No changement=0 Cchangement=1
Fitch Credit Note	YF	No changement=0 Changement=1
Moody's Credit Notes	YM	No changement 0 ,Changement=1
Independent Variable		
Gross Domestic Product	GDP	
Foreign Borrower	FB	
Inflation Rates	IR	
Current Account Balance	CAB	

5. Empirical Findings

In this paper we invastigated the effect of the credit scoring probability of credit scoring acencies on Turkey using the Semipararametric logit models. So we can see the best fit model parametric logit or semiparametric one.We used the criteria to find the fitted model and explain the effect of the credit scoring probability to the explanatory variables.

Table 2 below shows the parametric model and the all semiparametric models while adding nonparametric versus of models with variables and coefficients. The all coefficients are significant at level of %1. For the Moody's model I show the parametric logit model. The coefficient of grross dometric product, inflation rates, foreign borrowing, current account balance are statistically significant. Model II, model III, IV, V, VI are semiparametric logit models.Along these models the inflation, current account balance, forreign borrowing, are taken nonparametricly in Model II. Only GDP in Model III, only foreign borrows in Model IV, only inflation variable in Model V, only current account balance were estimated nonparametrically in Table 2 for Moody's. The coefficients of all the models in the table are statistically significant.

Table-2. Results of the Parametric and Semiparametric Regression Models (Moody's)

Variables	Model I Parametric Logit	Model II Semiparametric Logit (INF,FB,CAB Nonparametric)	Model III Semiparametric Logit(GDP Nonparametric)	Model IV SemiparametricLogit (FB Nonparametric)	Model V Semiparametric logit (INF Nonpparaetric)	Model VI Semiparametric Logit (CAB Nonparametric)
	Coefficient (standart error) (standard error)					
GDP	9.554946 (3.2177)	9.4796 (1.1802)	**7.2802 (5.8292)**	-	-	9.4750 (0.0036)*
INF	3.9650 (1.0078)	**4.2633 (0.8344)**	-	-	-	-4.5518 (1.8463)*
FB	5.6643 (2.0011)	**3.7045 (1.8455)**	5.6643 (1.6330)	-	-	5.5845 (1.8463)*
CAB	-1.7091 (0.0009)	**-1.0296 (0.00 17)**	-2.4951, (1.0558)	-	-	**1.7325 (0.4634)**
CONSTANT	-1.6663 (0.0066)	9.6853 (8.4749)	1.6087 (0.0007)	-	-	-
R^2	0.01322	0.3211	0.5512	-	-	0.7512
Adj R^2	56.4412	77.1721	0.6634	-	-	0.8711
F(parametrik)	44.1288	123.101	114.221	-	-	134.2217
F(nonparametrik)	-	147.181	127.245	-	-	159.5512
Residual Deviance	75.05106	101.896	83.11098	-	-	71.04884

Notes: Bold numbers refer to the smoothing parameter in the semiparametric logit model. All coefficients are significant at the level of 1%.

We can see for these four models the inflation variable is showed insignificant in the semiparametric regression model which gdp is taken non parametrically. The semi parametric regressions which financial borrowing and inflation nonparametrically are statistically significant so we didn't take.

The aim of this Table 2 for the Moody's to shows the best models combination for explaining the current account balance variable should take with nonparametric versus in the models so the semi parametric model showed us. For this purpose we used some criteria for defining the best models using R^2, adjR^2 , F statistics for parametric and nonparametric models and residual deviances. We can see best ferforming model which has the higher adj R^2(0.7512) and the high significant parametric F statistic (134.2217), nonparametric F statistic (159.5512) and least residual deviance (74.04884) is the best for defining the current account balance variable must be use nonparametric in the model.

In this table we may understand that the parametric models can give the wrong idea about the variables are parametric or nonparametric and we may think that this model is less reliable than semiparametric one. Thus the semiparametric models are more trustworthy than parametric versus. The current account balance variable is currently showing the nonparametric structure in most applying and studies and this variable's most significance is seemed in the semiparametric models .

Table 3 below shows the parametric model and the all semiparametric models for Standart &Poors and significant models can be seen except the semiparametric model which is only gross dommestic product nonparametrically is not significant so we did'nt approach this model**.** When we look at these model we can see current account balance variable is important and should take nonparametric for Standart&Poors credit scoring probability.

When we look at the models fit we can see parametric model's R^2 and AdjR^2(0.013, 0.5644) , model II has R^2 and AdjR^2(0.3211, 0.7717) ,modelVI has R^2 and AdjR^2(0.7512, 0.8711) so we can say the best model is semiparametric model which is current account balance should take nonparametricly. We can also see the best fit looking at minimum residual deviance which Model VI has the minimum one (71.8739). Parametric and

nonpoarametric F statistics are significant for four model and the most big one which has Model VI shows that best fit . We can understand that in all these semiparametric models the current account balance variable most descriptive variable and should take nonparametric to explain the best relationship to explain the Standart &Poors credit scoring probability on Turkey.

Table-3. Results of the Parametric and Semiparametric Regression Models (Standart&Poors)

Variables	Model I Parametric Logit	Model II Semiparametric Logit (GDP,FB,CAB Nonparametric)	Model III Semiparametric Logit(GDP Nonparametric)	Model IV SemiparametricLogit (FB Nonparametric)	Model V Semiparametric logit (INF Nonpparaetric)	Model VI Semiparametric Logit (CAB Nonparametric)
	Coefficient (standart error) (standard error)					
GDP	-1.6696 (0.0029)	**1.7712 (0.2050)**	-	2.1112 (0.0031)	1.6696	1.8146 (0.0019)
INF	2.4655 (0.2546)	2.6543 (0.0022)	-	-	**2.4655 (0.2546)**	-1.2384 (0.0014)
FB	-7.4636 (1.1233)	**-5.1299 (1.2287)**	-	**-4.2212 (1.6621)**	-7.4636 (0.2004)	5.2305 (1.2278)
CAB	1.0771 (0.0003)	**2.1899 (0.0023)**	-	5.2211 (1.0011)	-1.0771 (0.2904)	**1.6929 (0.0008)**
CONSTANT	-	1.6275 (0.0004)	-	2.1222 (0.0032)	1.8977 (0.2050)	-
R^2	0.3312	0.4712	-	0.5518	0.4432	0.6189
Adj R^2	0.03822	0.5412	-	0.6119	0.4756	0.7731
F(parametrik)	-	120.122	-	133.456	126.324	197.222
F(nonparametrik)	45.1233	146.778	-	151.441	134.221	254.954
Residual Deviance	79.0936	66.1277	-	75.3396	80.9833	71.8739

Notes: Bold numbers refer to the smoothing parameter in the semiparametric logit model. All coefficients are significant at the level of 1%.

Table 4 shows that parametric and semiparametric logit models for he Fitch. Model II shows that the significant model structure is the semiparametric one which is foreign borrower ,GDP and current account balance variables are taken nonparametrically together .So the other variables are taken nonparametrically lonely.When we look at the models the inflation parameter is statistically insignificant for model I,II,III so we didn't take.For the Fitch credit probability we can say the best descriptive variable current account balance variable which is taken nonparametrically in the semiparametric regression .When we look at the models the best defining variables which are current account balance ,cross domestic product,foreign borrowing nonparametrically in the semiparametric model .The best model is semiparametric model which cross account balance is taken nonparametrically

Table-4. Results of the Parametric and Semiparametric Regression Models (Fitch)

Variables	Model I Parametric Logit	Model II Semiparametric Logit (FB,CAB,GDP Nonparametric)	Model III Semiparametric Logit(GDP Nonparametric)	Model IV SemiparametricLogit (FB Nonparametric)	Model V Semiparametric logit (INF Nonpparaetric)	Model VI Semiparametric Logit (CAB Nonparametric)
	Coefficient (standart error) (standard error)					
GDP	-1.8146 (0.0002)	**-1.4677 (0.0055)**	**-1.8146 (0.0007)**	-2.4421 (0.0054)	-	3.1288 (0.0012)
INF	-	-	-	1.2384 (0.0071)	**2.8845 (0.0008)**	3.1252 (0.1211)
FB	-5.2305 (0.0045)	**-4.2212 (0.0012)**	-3.0525 (0.0002)	**-6.7406 (1.2218)**	-3.9912 (0.02377)	-2.1930 (0.0012)
CAB	-	**1.1698 0.0037**	2.8812 (0.0066)	-	2.1939 (0.1003)	**1.3783 (0.0002)**
CONSTANT	-	-	-	1.7522 (0.0003)	-	-
R^2	0.0013	0.6719	0.5512	0.4512	0.3319	0.7116
Adj R^2	0.0122	0.6923	0.5777	0.5103	0.4112	0.7918
F(parametrik)	87.922	188.967	127.4421	132.1110	92.156	138.881
F(nonparametrik)	-	213.221	156.2212	138.3288	122.1609	304.189
Residual Deviance	77.8939	62.5788	71.1386	73.1222	83.2291	70.0056

Notes: Bold numbers refer to the smoothing parameter in the semiparametric logit model. All coefficients are significant at the level of 1%.

For this purpose we can see best ferforming model which has the higher adj R^2(0.7918) and the high significant parametric F statistic (138.881), nonparametric F statistic (304.189) and least residual deviance (70.0056) is the best for defining the current account balance variable must be use nonparametric in the model.

When we look at the all semiparametric logit models are taken seperately for the credit scoring agencies, it is seen that the the semiparametric logit model has the best performance among others. Coefficients are interpreted directly in the semiparametric logit modelsas in the parametric logit and odds ratios are calculated and comments are made according to these values. Odds ratio give the probability of the emergence of poverty coded as "1" in the dependent variable. Odds ratio are interpreted differently for continuous variables. The odds ratios of continuous variables are calculated by imposing quota or by making the variable dashed.

In the semi-parametric logit model which shows the best performance, the variables (income and number of workers in household) which form the non-parametric part are continuous variables. In this sense, the odds ratios were calculated differently compared with other variables .In this study the explonatory variables are continues variable but we don't have any cote for them just explaining the probability of changement is enough for .

The Table 2 shows that the best semiparametric model is themodel VI which the current account balance is taken nonparametrically. When we look at the models significant variable coefficient gdp as (9.4750) that 1 br of changing the gdp will increase the probability of the changement credit score as 9.47 of Moody's on Turkey .For the inflation rates variable the coefficient (-4.5518) that 1 br of changing on foreign borrowing will decrease the 4.55 br probability of changenment credit scor e. The foreign borrowing variable the coefficient (5.5845) that 1 br of changing on foreign borrowing will increase the 5.58 br probability of changenment credit score. The current account balance variable coefficient (1.7325) shows that the 1 br of changing on the current account balance will increase the 1.73 br probability of changement credit score of Moody's on Turkey. The Table 3 shows that the best semiparametric model is the Model VI which the current account balance is taken nonparametrically. When we look at the models significant variable coefficient gdp as (1.8146) that 1 br of changing the gdp will increase the probability of the changement credit score as 1.81 of Standart & Poors on Turkey. For the inflation rates variable the coefficient (-1.2384)) that 1 br of changing on foreign borrowing will decrease the 1.23 br probability of changenment credit score. The foreign borrowing variable the coefficient (5.2305) that 1 br of changing on foreign borrowing will increase the 5.23 br probability of changenment credit score. The current account balance variable coefficient (1.6929) shows that the 1 br of changing on the current account balance will increase the 1.69 br probability of changement credit score of Standart & Poors on Turkey. The Table 4 shows that the best fit model is model VI as semiparametric model that current account balance is taken nonparametrically for the Fitch's credit scoring.When we look at the coefficient gdp as (3.1288) one that 1 br of changing the gdp will increase the probability of the changement credit score as 3.12 br. The foreign borrowing variable the coefficient (-2.1930) that 1 br of changing on foreign borrowing will decrease the 2.19 br probability of changement credit score. The inflation rates variable the coefficient (3.1252)) that 1 br of changing on inflation rates will increase the 3.12 br probability of changement credit score. The current account balance variable coefficient (1.3783) shows that the 1 br of changing on the current account balance will increase the 1.37br probability of changement credit score of Fitch on Turkey.

6. Conclusion

The future of Turkey's credit profile depends on whether the country can now rebalance its economy, ratings agencies. Fitch Ratings shows that the current account balance and gdp is the defining factors on Turkish sovereign rating, which stands at an investment grade generally BBB-, could improve if the new government implements reforms that promote "durable" economic growth. Especially the current account balance factor more defining variable than others.

The advent of a stable majority government will remove the drag on economic growth depends on the gdp and current account balance caused by political uncertainty but it is not yet clear whether the election outcome will support structural reform and help resolve tensions among policy makers on how best to support growth, rebalance the economy, lower reliance on net capital inflows, and reduce inflation factor on Turkey by defined the Moody's. When we look at the gdp and current account balance changement the Fitch's more attention on these factors and support the forecasts suggested real gdp growth in Turkey would increase early in 2016.

Resolving policy uncertainty and unpredictability, and implementing reforms that promote durable economic growth and currrent account rebalancing that reduce external vulnerabilities, would be positive for the sovereign ratings.

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