FINANCIAL CRISES AND PRESSURE INDICES: CASE OF TURKEY

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Abstract

This study employs pressure indices in order to foresee the possible crises. Using monthly data obtained from the data distribution system of the Central Bank of Turkey between 1990-2009, the prevailing financial pressure indices have been estimated. This study deals with the anticipation of crises, especially in the field of banking, through an early warning system rather than pointing out what are the indicators of financial crises. Therefore, this study aims at establishing assumptions regarding financial crises using pressure indices for monthly data of Turkish economy between the period of 1999.01-2009.12.

Key Words: *Currency Crisis, Financial Risk, Pressure Index*

JEL Classification: E4, F32, F34, C41, C43

1. INTRODUCTION

Explanation of financial crisis is that they are caused by excesses-frequently monetary excesses-which lead to boom and an inevitable bust. Generally financial crisises were began in industrialized countries quickly spread to emerging market and developing economies. The term 'financial crisis' is used too loosely, often to denote either a banking crisis, or a debt crisis, or a foreign exchange market crisis.

Two main functions of the models intended for constructing a theory concerning financial crises are worth mentioning. These are designed to build an early warning system which will make a contribution to revealing what the indications of financial crises are and taking them under control before they occur. Even though it is uncertain what kind of change various macroeconomic magnitudes undergo before crises, it is possible that they can be determined through econometric models. Nonetheless, it is possible to use pressure indices based on basic economic indicators together with such economic models as logit and probit in order to anticipate crises.

2. THE ANALYSIS OF THE PREDICTABILITY OF FINANCIAL CRISES WITH PRESSURE INDICES: AN APPLICATION TO TURKEY (1990-2009)

2.1. Methodology and Data

2.1.1. Financial Pressure Indices in Predicting Financial Crises

Among the indices used to measure the degree of the pressure on financial markets and to anticipate crises are Speculative Pressure Index, Index of Currency Market Turbulence, Banking Sector Fragility Index and Excessive Risk Index. (Eichengreen, Rose and Wyplosz, 1997; Kaminsky and Reinhart, 1999; Kibritçioğlu, 2003; Ural and Balaylar, 2007). This indices are formed within a month or within three months in empirical studies.

In general terms, it is expressed that a crisis occurs or will occur when index values pass the thresold value. (Joosten, 2004). The Standard deviation of the index can be used for boundary values apart from the previously calculated values.

Speculative Pressure Index (SPI) known as Exchange Market Pressure Index or Financial Pressure Index is calculated based on the changes in Exchange rates (ER), interest rates (IR) and reserves. This index includes nominal exchange rate, interest rates and changes in reserves. Positive changes (increase) in exchange and interest rates or negative changes (decrease) in reserves indicate that the pressure on exchange markets increases.

In other words, it is obvious that both loss of value in exchange and interest rates as well as decrease in reserves increase the speculative pressure index when we observe that changes in exchange and interest rates as well as those in reserves have a negative tendency. Therefore changes in reserves are marked negative in pressure indices (Eichengreen, Rose and Wyplosz 1996).

In theory, the calculation of an index is done by focusing differently on each of the three variables. SPI is shown as belows (Ural and Balaylar, 2007):

$$SPI = [((\%\Delta K_t - \mu_k) / \sigma_k) + ((\%\Delta F_t - \mu_f) / \sigma_f) - ((\%\Delta R_t - \mu_r) / \sigma_r)] \quad \text{(Equation-1)}$$

SPI formulated above in equation-1 is used to create the decision criterion of the financial crisis explained. Under what circumstances and when an SPI denotes a financial crisis is defined in accordance with the predefined threshold value. Whenever the index value exceeds the predefined threshold value, it denotes the emergence of a crisis.

$$SPI \geq \mu + 1{,}5\,\sigma \quad \text{(Equation-2)}$$

Kaminsky & Reinhart (1999) and Kaminsky, Lizondo & Reinhart (1998) maintain that the index to be used as an indicator of a financial crises must consist of the nominal foreign Exchange rate and reserves adding that both variables must show due equal variability in the calculation of index.

In other words, it is maintained that index should be formed in accordance with the weighted average changes in rates and reserves. This index formed by Kaminsky and Reinhart (1999) has been named Index of Currency Market Turbulence (Demarmels and Fischer, 2003). Index of Currency Market Turbulence (ICMT) whose changes in foreign exchange rates are positive and those in reserves are negative can be formed as belows (Kaminsky, 2006):

$$ICMT = \Delta\%K_t - [(\sigma_k / \sigma_r) \times \Delta\%R_t] \quad \text{(Equation-3)}$$

Below is given the time when the Index of Currency Market Turbulence shows a signal of crisis.

$$\mathbf{ICMT \geq \mu + 2{,}5\sigma} \quad \textbf{(Equation-4)}$$

According to the equation-4, a crisis index is formed in case ICMT exceeds the 2.5 standard deviation and the emergence of a crisis can be assumed accordingly. Berg and Pattilo (1999) take 3 instead of 2.5 as the threshold value. Namely, they do not multiply the standard deviation by 2.5 adding the result to the mean. They multiply the standard deviation by 3 adding the result to the mean instead.

Another index used through pressure indices in order to anticipate financial crises is the Banking Sector Fragility Index (BSFI) suggested by Kibritçioğlu (2003). Kibritçioğlu (2003) suggests that this index be created by the mean of the bank deposits (BD), credits given to private sector (CGPS) and non-bank liabilities (NBL).

Therefore, BSFI which has been created in this way can be considered as a direct indicator of the risk of the credit, foreign exchange and liquidity in banking sector. BSFI can be formulated as shown below with the standardized expression of the series (Kibritçioğlu, 2002; Shen and Chen, 2008):

$$\mathbf{BSFI = [((BD- \mu_{bm})/ \sigma_{bm})+ ((CGPS- \mu_{\ddot{o}svk})/ \sigma_{\ddot{o}svk})+ ((NBL- \mu_{bdy})/ \sigma_{bdy})] /3} \quad \textbf{(Equation-5)}$$

Bank deposits, credits given to private sector and non-bank liabilities are marked as positive in the index. The index is calculated by having the mean of the standardized values of these series.

Whenever the index value gets a value between 0.5 and 0, it is assumed that the banking sector of that country has a moderate structure of fragility while it is assumed it has a higher structure of fragility if it gets a value of -0.5 or lower. (Shen and Chen, 2008).

If it is -0.5 < BSFI < 0 moderate structure of fragility**,** **(Equation-6)**

If it is -0.5 ≥ BSFI higher structure of fragility**,**

There are many pressure indices bearing similar structures in literature. When we take a closer look at these indices, we realize that the same variables have been used. When we examine the structure of the financial crises in Turkey, it can almost be said that these crises emerge in the triangle of rather exchange rate, interest and liquidity.

Concluding from this notion, Ural and Balaylar (2007) suggest the Excessive Risk Index (ERI) which is similar to BSFI. ERI therefore consists of bank deposits (BD), credits given to private sector (CGPS) and non-bank liabilities (NBL), bank securities (BS) and bank deposits (BD).

CGPS variable denotes credit risk of banks, NBL variable indicates exchange rate, NBL variable denotes currency risk, BS variable indicates interest risk and lastly BD variable denotes liability risk.

ERI can be calculated as below:

$$\mathbf{ERI = [((CGPS- \mu_{cgps})/ \sigma_{cgps}) + ((NBL- \mu_{nbl})/ \sigma_{nbl})}$$
$$\mathbf{+ ((BS- \mu_{bs})/ \sigma_{bs}) ((BD- \mu_{bd})/ \sigma_{bd})] /4} \quad \textbf{(Equation-7)}$$

2.1.2. Data Set

All of the variables used in the calculations of this study which accounts for the financial crises with pressure indices have been obtained from the Electronic Data Distribution System of the Central Bank of the Republic of Turkey (EDD).

The samples employed in the study cover the years 1990-2010 and consist of 233 monthly observation values. The nature of the study has led us to use monthly data rather than annual ones.

The variables used throughout the study are; Nominal Exchange Rate (NER), Interest Rate (IR), Reserves (R), Credits Given to the Private Sector (CGPS), Bank Deposits (BD), Non-bank Liabilities (NBL), Bank Securities (BS).

3. EMPIRICAL RESULTS

The chart of SPI designed to anticipate financial crises is shown below on chart-1.

The threshold values characterized as a warning of a crisis are highlighted parallel to the horizontal axis on SPI chart. The same rule applies for other index charts.

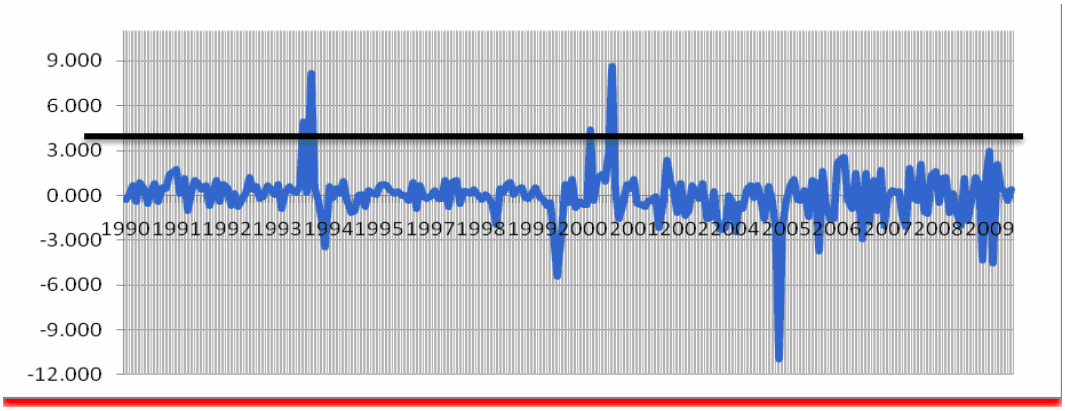

Chart-1: SPI, **1990:01-2009:12**

In order to anticipate a crisis in Turkey, the threshold value obtained from equation-3 and SPI obtained from equation-2 has been calculated as 3.441407. Hence, 1994, 2000 and 2001 are the years when this threshold value is exceeded and therefore they are the years to be evaluated as crisis years. The Speculative Pressure Index could considerably anticipate the crises in 1994 and 2001. As for both crises, when we examine the period of index, it becomes observable that there is a gradual tendency towards a crisis in 1994. On the other hand, one can say that the crisis in 2001 came up in the form of a sudden shock as a result of the stand-by agreement implemented in 1999.

As a matter of fact, the index had negative values in 1999. During the financial crisis in the world in 2008, the Speculative Pressure Index of Turkey had rather a positive outlook in comparison with other countries where the crisis was felt most. In other words, one can say that there was much more pressure on the financial systems of countries where the crisis was felt most while the pressure was relatively lesser in Turkey.

ICMT is another index which is related to the analysis. The chart of this index the threshold value of which has been determined as 3.048802 is shown on chart-2.

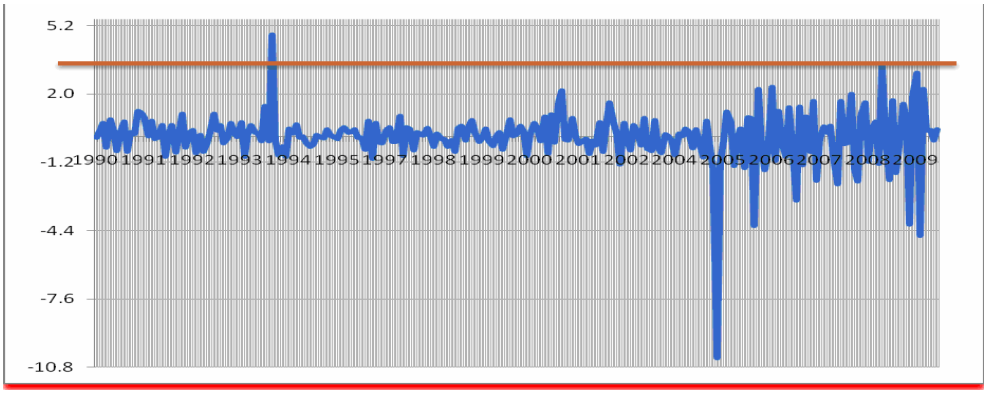

Chart-2: ICMT**, 1990:01-2009:12**

According to the ICMT chart, one can notice that the threshold value surpassed in the crises of 1994 and 2008. The pressure index was able to anticipate the crisis in 1994 similar to SPI while it fell short in anticipating the global crisis in 2008.

In contrast to SPI, the crisis in 1994 broke out all of a sudden while the crisis in 2008 appeared in the aftermath of a speculative bulge. Naturally, It can be observed on the chart that there was a hectic activity on the basis of index in 2007-2009 period. However, the index was not as efficient as SPI in anticipating the crisis in 2000 and 2001. Moreover, both these crises never gave a warning.

Ural and Balaylar (2007) suggest that the disinflation policies executed at that period are responsible for this case. The main variable is, as it is known, the exchange rates and the changes occurring thereafter. Therefore, the role of the exchange rates fixed within the framework of the policies which political authorities followed have been played down. Finally, the continuation of the influence of the index presuming the crisis in 2008 by 2009 indicates that the speculative bulge went on in these periods as well.

Another pressure index suggested by Kibritçioğlu (2003) in presuming financial crises is BSFI. The chart of this pressure index which includes the period between 1990-2009 is shown on chart-3.

When we take a look at the BSFI chart, we can see that the increase in indices suggests that the banks generally took an excessive amount of risk while the decrease shows they avoided taking risks (the existing risk upon them). The decrease of index value beneath -0,5 can be explained as an indicator of sector's falling into the higher fragility period. On the whole, one can say that 1990-2009 period had a medium fragile structure. The banks generally showed a tendency towards avoiding risks between 1995- 1999.

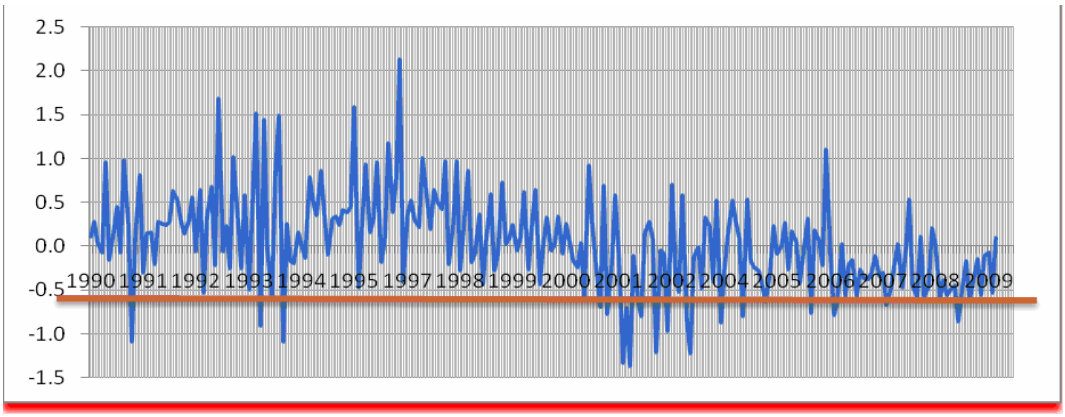

Chart-3: BSFI**, 1990:01-2009:12**

According to this index, the years 1991, 1993, 1994, 2001, 2002 ve 2004, 2006, 2007, late 2008 and early 2009 are interpreted as crisis years (-0.5<BSFI<0).

The index could only anticipate the crisis years of 1994, 2001 and late 2008. The speculative bulge in 2001 went on in 2002 and 2003, which means that the factors that triggered the crisis in 2001 partly made their presence felt in the years to come. It failed to anticipate the financial crisis in 2000. However, it was a highly important crisis period for the banking sector. The index issued false alarms in some years even though there occured no crises. This study deals finally with the Excessive Risk Index designed to analyse the 1990-2009 period. ERI chart is illustrated on the chart-4.

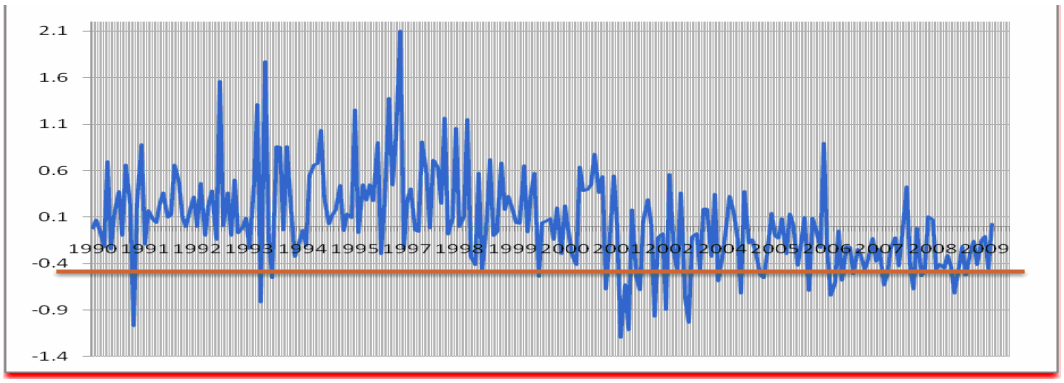

Chart-4: ERI, 1990:01-2009:12

According to the chart above, the Excessive Risk Index by Ural and Balaylar (2007) failed to anticipate the financial crises between 1994 and 2000 since it remained below the threshold value. It gives a warning of crisis every year between 2001-2009 since the index threshold value is exceeded. Even if the index gives a warning of crisis in these years, there occurred no crises except for the global credit crisis in 2008. We can see clearly that this index could measure the crises in 2000 and 2001. There occurred increase in the risks of the rates and credits of banks since the crises in November 2000 and February 2001 had rather a nature of banking crisis. In this sense, it

can be said that there occurred a decrease also in the bank securities which reflect the liquidity risk.

When we consider all of the pressure indices, we observe that all of the pressure indices except for ERI gave a warning of crisis for the crisis in 1994 as the threshold value was surpassed.

BSFI and ERI were the only ones to announce in advance the global credit risk in 2008. SPI pressure index was the only one to give a warning of the crisis in November, 2000. None of the other pressure index values surpassed the threshold value of the crisis in November 2000. However, all of the indices except for BSFI could predict the crisis in February 2001.

As one can see, the indices in question considered different financial crises in different periods as a warning. The major reason for this case is results from the sensitivity of the variables used in creating indices. This leads us to conclude that financial indicators alone are not sufficient in predicting crises by means of early warning systems. However, the fact that the variables in indices overreact in accordance with the type of crisis play a crucial role in predicting the emergence of a crisis. Another point that should be taken into consideration is the fact that there emerges the problem of determining the weights of variables since the macroeconomic factors that underlie a crisis are unknown. Therefore, one should notice that the standardization process applied to the variables in order to avoid this problem might cause an important amount of information loss.

4. OVERALL ASSESSMENT AND CONCLUSION

There have occurred recently serious financial crises both in developing and developed countries. It is estimated that these crises have occurred mainly due to macroeconomic indicators. It can be said that the financial structures operate in high-risk environment and they have a fragile structure. There emerge financial crises especially in such developing markets as those in Turkey due to the wrong policies on rates, national and international financial shocks, the weak structure of the national banking system, liberalization, disorder in financial policies or lack of tight financial policies. It is necessary that the competent authorities take a series of measures in order to get rid of these disorders or to alleviate their effects. However, taking these preventive measures justifies the necessity of early warning systems. It will be possible to minimize the costs the crises will impose on the economic system of countries by means of early warning models. In this sense, the study deals with the significant pressure index models designed to predict a possible financial crisis and to take necessary measures in the face of an imminent crisis.

This study carries out analyses as to how useful pressure indices might be which are prevalently used in literature in predicting financial crises. For this purpose, the period between 1990: 01 and 2009: 12 period of Turkish economy has been analysed in 4 indices within the scope of 7 explanatory variables. Therefore, the pressure indices are expected to give a warning of financial crisis.

The findings obtained within the scope of this study partly justify the expectation stated above. However, it has been observed that the indices could not always give a warning of crisis and some fell short in predicting a crisis. It would be challenging to state that an index which could predict a crisis will be capable of predicting other crises.

One should bear in mind that it would be a hastily taken decision to state that an economy is away from a financial crisis judging from only the success of indices in the prediction of crises. Finally,

one can conclude that financial crises cannot be explained merely by financial indicators. It is known today that a financial crisis is the result of the interaction among social events, political conflicts and many international factors. Therefore, it is clear that monitoring one or more than one index as an early warning indicator will not be sufficient in the prediction of crises.

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