

## Leading Financial Crises Indicators in Turkey<sup>1</sup>

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### Abstract

After financial liberalization, financial crises have often been characterized by concurrent currency and banking crises which is called as "twin crises" by Kaminsky and Reinhart (1998). The reciprocal interaction of problems of national currency and banking sector are the key triggers of extreme vulnerability and deteriorate the bank balance sheets. Insolvency, currency and maturity mismatches and non-performing loans are the main causes of financial vulnerability. When these vulnerabilities meet with internal and/or external shocks, banking crises erupts that are the central component of financial crises.

The objective of this study is to identify the leading macroeconomic and financial indicators in Turkey's financial crises over the quarterly period of 1989-2002, using the logit model. Among eight specifications and fifteen indicators, only an increase in "Commercial Banks' Foreign Liabilities/GDP" ratio and a decline in "International Reserves" are shown to be more associated with full-blown currency and banking crises. Surprisingly, domestic credit to the private sector/GDP has a negative effect on the probability of financial crises while reel exchange rate has a positive.

### Özet

Finansal serbestleşme sonrası, finansal krizler, Kaminsky ve Reinhart'ın (1998) "ikiz krizler" olarak adlandırdıkları eş zamanlı para ve bankacılık krizleri ile şekillenmektedir. Ulusal para birimi ile bankacılık sektöründeki problemlerin karşılıklı etkileşimi, finansal zayıflığı tetiklemekte ve banka bilançolarını bozmaktadır. Bankaların ödeme gücünü çekmesi, para birimi ve vade uyumsuzlukları ve geri dönmeyen krediler ise finansal zayıflığın temel nedenleridir. Bu zayıflıklar iç ve/veya dış şoklar ile karşılaştığı zaman, finansal krizlerin merkezi parçası olan bankacılık krizleri meydana gelmektedir.

Bu çalışmanın amacı, 1989-2002 çeyrek dönemi için Türkiye'de öncü niteliğindeki makroekonomik ve finansal göstergeleri lojistik model kullanarak belirlemektir. Belirlenen sekiz spesifikasyon ve onbeş değişken arasında, sadece "Ticaret Bankaları Dış Yükümlülükler/GSYİH" oranında artış ile "Uluslararası Rezervler"de düşüş, tam anlamıyla para ve bankacılık krizlerinin varlığına işaret etmektedir. Beklenenin aksine, Bankacılık Sektörü Yurtiçi Kredi Hacmi Toplamı/GSYİH oranı finansal kriz olasılığını olumsuz etkilerken, reel döviz kuru pozitif etkide bulunmaktadır.

**Keywords:** *Twin crises, financial crises indicators, financial vulnerability.*

## I. Introduction

The concept of globalization, developing since the 1980's has accompanied with a series of changes. Financial liberalization process was one of the most important feature of this period of change. International trade and capital movements are liberalized, spread, accelerated and increased in volume and new investment opportuni-

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ties are developed. Finally, using the advantages of liberalization and unrestricted world trade, growing capital haunts for short-term profits and rents. Therefore, another prominent issue arised with globalization is financial crises. The common feature of these crises is based on the fixed exchange regime applications, such as pegged, currency board and exchange rate stabilization program that lead overvaluation of national currency [1-2]. On the other hand, either current account or budget deficits are financed with short-term capital inflows under the intermediation of domestic financial system [3-4]. These inflows incline to consumption boom in some countries (1994 Mexico<sup>2</sup>) and speculative investments in others (1997 Asia<sup>3</sup>). A sudden reversal of funds that leads a panic in the exchange market is the most important factor in the eruption of currency crises which immediately affects the financial system in emerging economies[5].

One of the latest distressed country is Turkey in 2001 that rekindled the debate on the importance of twin crisis which is characterized by concurrent currency and banking crises. More precisely, a twin crisis is the reciprocal interaction of overvaluation of national currency and problems in banking sector which is financed by unhedged foreign liabilities[6]. Problems, such as insolvency, currency and maturity mismatches and non-performing loans are the key triggers of extreme vulnerability and deteriorate the bank balance sheets. When these vulnerabilities meet with internal and/or external shocks, banking crisis erupts that is the central component of financial crises.

Recently, a great number of studies have analyzed various episodes of banking crises in an effort to determine the causes of banking crises which are the central component of financial crises[7]. Demirgüç-Kunt and Detragiache [8]. investigate 31 systemic banking crises (8 in developed countries and 23 in emerging economies) out of 546 episodes over the period 1980-94. The results indicate that banking crises tend to emerge when the macroeconomic environment is weak; in particular low GDP growth and high real interest rates. The presence of an explicit deposit insurance scheme<sup>4</sup> that introduces the moral hazard is significantly correlated with increased risk to the banking sector. The study of Hardy and Pazarbaşıoğlu [11] covers 50 countries, 38 of which suffered a total of 43 episodes of banking crisis or significant problems (23 instances of severe problems and 20 crises). The empirical findings suggest that banking distress is associated with a largely contemporaneous fall in real GDP growth, boom-bust cycles in inflation, credit expansion, capital inflows, rising real interest rates and a sharp decline in the real exchange rate. Kaminsky and Reinhart [12] examine 26 banking crises and 76 currency crises in the sample of 20 countries over the period 1970-95. They found that banking and currency crises are closely linked in the aftermath of financial liberalization. A decline in M2 multiplier, deposits and GDP growth rate and an increase in domestic credit-to-GDP ratio and lending-to-deposit interest rate are the facts on banking crises.

<sup>2</sup> Private consumption expenditures increased by % 30 over the period 1988-1994(Calvo and Mendoza, 1996; 3).

<sup>3</sup> Finance companies were at the forefront of real estate lending in Tayland and stock exchange investments in Malaysia(Mishkin, 2000; 10).

<sup>4</sup> A switch to no deposit insurance would have decreased the probability of a crisis by over 60 percent(Demirgüç-Kunt and Detragiache, 1998a, 100).

The determinants of financial crises are basically related with the macroeconomic imbalances, global financial conditions, domestic financial structure, exchange rate regime and problems in regulatory and supervisory environment. In this sense, expansionary policies that lead lending boom [13] high inflation associated with high real interest rates, budget and current account deficits, exchange rate volatility [14] and low GDP growth rate [8] are the basic macroeconomic imbalances. Deterioration in terms of trade-at least % 10 [15] and 8 months before the crisis and sudden changes in foreign interest rates [13] are the two global conditions that lead financial crisis. The benefits of financial liberalization may have to be weighed against the cost of increased financial fragility. Because, premature financial liberalization is associated with financial volatility. On the other hand, explicit and/or implicit deposit insurance that introduces a significant degree of moral hazard[8] and a dependent central bank [16] are the two basic domestic factors that accelerate financial crises. A fixed exchange regime that encourages foreign exchange risk[11] and problems in regulatory and supervisory environment, such as direct intervention of the credit allocation and pricing [13] and connected lending [17] are also associated with financial crises.

The loss in total output and the fiscal costs of restructuring bank balance sheets make the financial crises more important especially for the emerging economies. It takes three to six years to recover from a crisis and somewhat less in the developed countries. This is because their output loss is small and can be made up more quickly than that of the less developed countries. The loss in GDP changes between %4 -%8 in a currency crisis, is %11 in a banking crisis and %14 in a twin crisis [13]. While the loss in GDP in Turkey is %5,5 in 1994 and %9,5 in 2001, the fiscal costs or the restructuring costs of banking sector are %1 [15] and %31,9<sup>6</sup> [18] of crisis year's GDP respectively<sup>6</sup>.

## II. Empirical Methodology

This paper attempts to identify the link between leading macroeconomic and financial indicators and the likelihood of crises in Turkey. Using the data set for the quarterly period 1989-2002, we try to estimate the indicators that will be the best warning, by using the logit model.

Data on the explanatory variables are obtained from the Central Bank of Turkey and IMF-International Financial Statistics<sup>7</sup>.

The basic papers on financial crises used the logit model are, Domaç and Peria[1], Demirgüç-Kunt and Detragiache [8,19, 20], Hardy and Pazarbaşıoğlu [21, 11].

<sup>5</sup> %26,6 is the fiscal cost that covers the duty losses of state banks and banks in Saving Deposit Insurance Fund, while % 5,3 belongs to the private banks(BDDK, 2003: 7).

<sup>6</sup> 2001 Turkey crisis is a systemic one while 1994 crisis is a non-systemic(borderline or smaller). A systemic crisis is a situation in which significant segments of the banking sector become insolvent or illiquid and can not continue to operate without special assistance from the monetary or supervisory authorities (Demirgüç-Kunt and Detragiache, 2001: 8).

<sup>7</sup> only wholesale price indexes are taken from IFS in order to compute the real exchange rate index.

In binary regressand models, the dependent variable (financial crises) is obviously a dichotomous one. This dummy equals zero in years where there is no crisis and equals one during crisis periods (1994 and 2001 in Turkey).

Given the logistic distribution, the probability of a banking crises in period  $t$  can be expressed as follows;

$$P_i = \text{Prob}(\text{crisis}_i=1/X_i) = \frac{1}{1 + e^{-Z_i}} = \frac{e^{Z_i}}{1 + e^{Z_i}} \quad (1)$$

Similarly, the probability of no crisis in period  $t$  is;

$$1-P_i = \text{Prob}(\text{crisis}_i=0/X_i) = \frac{1}{1 + e^{Z_i}} \quad (2)$$

The ratio of (1) over (2) is called "odds ratio in favor of a crisis";

$$\frac{P_i}{1-P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i} \quad (3)$$

Taking the (natural) logs of this ratio will give the "logit model".

$$\begin{aligned} L_i &= \ln\left(\frac{P_i}{1-P_i}\right) = Z_i \\ &= \beta_1 + \beta_2 X_i \end{aligned}$$

The parameters ( $\beta_i$ ) measure the change in the log-odds ratio for a unit change in  $X_i$ . Therefore, it is not possible to get the probabilities directly by using these parameters. But, the signs of the regression coefficients and their statistical significance is important in the logit model. On the other hand, to minimize simultaneity problem, all regressors in the model are lagged one period.

### III. Independent Variables

The independent variables are taken from the literature on the leading indicators of financial crises. In our estimation, we divide the variables into two types; macroeconomic and financial (Table 1).

Table 1. Independent Variables of the Estimated Model

<b>Macroeconomic Variables</b>	
Real interest rate <sup>8</sup>	
Real exchange rate <sup>9</sup>	
Consolidated budget net domestic and foreign borrowing/GNP	
Current account deficit	
Foreign exchange reserves	
<b>Financial Variables</b>	
Private domestic credit/GDP	
Growth of credit	
Short-term capital flows/GDP	
M2/Foreign exchange reserves	
Total domestic debt stock/M2Y	
Commercial bank reserves/Total assets	
Total national currency deposits	
Total foreign deposits	
Commercial banks' foreign liabilities/GDP	
Open positions in banking sector	

### III. 1. Macroeconomic Variables

High real interest rates point out liquidity problems and/or prevention of a speculative attack [22], so we expect it to have a positive effect on the likelihood of crises. An increase in the real exchange rate index shows the appreciation of Turkish Lira and increases the probability of a crisis. The third macroeconomic variable is used as a proxy of PSBR which is positively related with financial crises. We also expect a higher current account deficit<sup>10</sup> and declining international reserves to have a positive effect on financial crises.

<sup>8</sup> Real interest rate is calculated by the subtraction of 3-months TL deposit rate from the 3-months inflation rate reckoned with the wholesale price index.

<sup>9</sup> Real exchange rate is the TL value of foreign (here US) price level divided by the Turkey's price level,  $Q_{TL,US} = (EX_{TL,US} * P_{US}) / P_{TR}$ . In the construction-formation of the index, 1995 is chosen as the base year because of the year after 1994 crisis.

<sup>10</sup> A current account deficit equal to 4-5 percent of GDP is regarded as unsustainable and often leads to devaluation of national currency (Salvatore, 1999: 343).

### III. 2. Financial Variables

As banking crises are associated with lending booms [22], we include the first two financial variables in the logit model. Both capital inflows and outflows could precipitate the financial crises. A rise in capital inflows intermediated by the domestic financial system increases the supply of loanable funds, allowing banks to engineer a lending boom. Then, lending booms lead financial vulnerability by deteriorating the quality of banks' assets; in particular, increasing the share of non-performing loans. On the other hand, capital outflows deprive banks' foreign borrowing and increase the expectation of a meltdown, leading to bank runs. The ratio of M2 to foreign exchange reserves is used to measure banks vulnerability against bank runs associated with currency crises[1]. The pressure of domestic debt stock on financial system can be shown by the ratio total domestic debt stock to M2Y [24]. The most liquid bank asset is the reserves. The ratio is introduced to capture the ability of banks to deal with potential runs [1]. When a financial crisis erupts, national currency deposits fall [22] and foreign currency deposits tend to rise. The level of unhedged foreign liabilities can be seen by the ratio of commercial banks' foreign liabilities to GDP and it shows the extent of currency and maturity mismatches. The difference between commercial banks' foreign assets and foreign liabilities excluding the off-balance sheet activities shows banks' open positions[25]. It leads financial fragility by the way of mismatching problems.

Table 2. Logit Estimations for Financial Crises in Turkey<sup>11</sup>

	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)	(1.7)	(1.8)
Private domestic credit/GDP <sub>t-1</sub>	-4.1636 (-1.33)	-4.9899* (-1.63)		-2.6286 (-0.83)	-3.5702 (-1.17)	-4.4900 (-1.60)	-4.4820* (-1.83)	-1.9713 (-0.75)
Growth of credit <sub>t</sub>	0.0158 (0.55)	0.0229 (0.86)		0.0071 (0.24)	0.0191 (0.68)	0.0200 (0.75)	0.0166 (0.61)	
Short-term capital flows/GDP <sub>t-1</sub>	-6.2100 (-0.90)		-129.3162** (-2.00)	-9.8096 (-1.39)	-5.7885 (-0.86)	-4.7179 (-0.82)	-5.6298 (-0.90)	
Real interest rate <sub>t</sub>	-0.0314 (-0.70)	-0.0180 (-0.39)	-0.2913 (-0.82)	-0.0463 (-1.07)	-0.0338 (-0.77)	-0.0243 (-0.55)	-0.0276 (-0.57)	0.0011 (0.02)
Real exchange rate <sub>t</sub>	0.0429 (1.11)	0.0628** (1.95)	-0.0623 (-0.27)	0.0257 (0.63)	0.0358 (0.94)	0.0512* (1.69)	0.0474 (1.30)	0.0761*** (2.66)
M2/Foreign exchange reserves <sub>t-1</sub>	-0.3421 (-0.39)	0.1248 (0.15)	-13.3098** (-2.35)	-0.6401 (-0.75)	-0.3691 (-0.42)		-0.2194 (-0.37)	0.6919 (1.09)
Total domestic debt stock/M2Y <sub>t-1</sub>			29.5255 (1.54)					
Consolidated budget net domestic and foreign borrowing/GNP <sub>t-1</sub>	-6.9489* (-1.86)	-7.7177** (-2.21)	-35.8515*** (-2.49)		-6.7811* (-1.77)	-7.2515** (-1.96)	-6.9922* (-1.90)	
Current account deficit <sub>t-1</sub>	-0.0667 (-0.56)	-0.0603 (-0.51)	-0.1085 (-0.63)	-0.0533 (-0.44)		-0.0655 (-0.55)	-0.0703 (-0.57)	
Foreign exchange reserves <sub>t-1</sub>		-4.65E-08 (-1.07)					-3.56E-08 (-1.58)	-7.59E-08* (-1.64)
Total national currency deposits <sub>t-1</sub>	-1.03E-08 (-0.65)			-8.11E-09 (-0.48)	-7.52E-09 (-0.45)			
Total foreign deposits <sub>t-1</sub>						-2.65E-08 (-1.03)		
Commercial bank reserves/Total assets <sub>t-1</sub>	30.8016 (1.52)	26.0832 (1.26)	209.9791*** (3.83)	42.3890** (2.41)	27.5365 (1.40)	27.7184 (1.50)	29.7241 (1.56)	
Open positions in banking sector <sub>t-1</sub>	-1.21E-07 (-0.27)	1.19E-07 (0.26)	-6.33E-06* (-1.83)	-3.08E-07 (-0.73)	-1.82E-07 (-0.38)	2.01E-08 (0.06)		8.76E-08 (0.20)
Commercial banks' foreign liabilities/GDP <sub>t-1</sub>	13.3733* (1.62)	15.8530** (1.97)	26.9437*** (3.20)	9.9026 (1.16)	12.1093 (1.45)	14.3892** (2.01)	14.3847*** (2.54)	6.3963 (0.86)
Number of observations	55	55	55	55	55	55	55	55
McFadden R <sup>2</sup>	0.3921	0.3889	0.7535	0.3468	0.3814	0.3854	0.3960	0.2659

<sup>11</sup> This table presents the coefficients and z-statistics (in parentheses) for the logit estimations of the probability of financial crises. \*, \*\* and \*\*\* denote significance at %10, %5 and %1, respectively.

#### IV. Empirical Results

Table 2 presents logit estimations for financial crises in Turkey over the period 1989-2002. The estimated results suggest that some of the indicators have the expected sign and significance as a best warning. The first specification includes all the variables except total domestic debt stock/M2Y, foreign exchange reserves and total foreign deposits. Because, the correlation matrix between them and total national currency deposits is quite high (greater than %80). As a result, only commercial banks' foreign liabilities/GDP is statistically significant at 10 % level and has the expected sign. Between the second and eight specifications, we try to disentangle the effects of various variables on financial crises by replacing them from the regression. When we omit the role of short-term capital flows/GDP and private domestic credit/GDP and growth of credit in a financial crisis in the second and third specifications respectively, again commercial banks' foreign liabilities/GDP is statistically significant and has the expected sign. Omitting the effects of consolidated budget net domestic and foreign borrowing/GDP and current account deficit from the regression in the fourth and fifth equations respectively, indicates that none of the variables can be identified as the leading indicators. M2/Foreign exchange reserves which is one of the best currency crisis indicator and open positions in banking sector are taken out of the regression in the sixth and seventh equations respectively, only commercial banks' foreign liabilities/GDP is statistically significant and has the expected sign. In the last specification, the most important known financial crisis indicators (private domestic credit/GDP, real interest rate, real exchange rate, M2/Foreign exchange reserves, foreign exchange reserves, open positions in banking sector and commercial banks' foreign liabilities/GDP) are gathered. Surprisingly, private domestic credit/GDP and real exchange rate<sup>12</sup> do not have the expected signs. In other words, while the former has a negative effect on the probability of financial crises, the latter has a positive. But, only foreign exchange reserves is statistically significant and has the expected sign and can be used to explain the financial crises.

Among eight specifications, full-blown currency and banking crises are shown to be more associated with rising commercial banks' foreign liabilities/GDP and declining foreign exchange reserves. The first indicator shows the pitfall of heavy reliance on external funds in order to finance banking activities at the expense of foreign exchange risk and consequently, the hazardous role of the banking sector in Turkey's financial crises. The main reason that encourages banks to take great risks (moral hazard) is the overvalued exchange rate regimes that facilitates foreign borrowing [10, 1].

A rise in commercial banks' foreign liabilities/GDP points out three issues; First, short-term capital inflows and banks' open positions (associated with mismatching problems) also increase. Second, a greater increase in foreign liabilities than GDP growth shows that economic growth is financed by foreign borrowing. Third, it confirms that banking problems in Turkey mostly arise from the liability-side of bank balance sheets rather than asset-side like a collapse in real estate prices or increase in non-performing loans, as Kaminsky and Reinhart [12] emphasize.

<sup>12</sup> Kaminsky, Lizondo and Reinhart (1998, 12) and Goldstein (1997: 108) expect real exchange rate to be one of the best performing indicator before currency and banking crises.

A decline in foreign exchange reserves generally indicates a sudden speculative attack as a cost of a currency crisis. On the other hand, it also shows a decrease in central bank's foreign assets that is based on foreign exchange inflows and outflows. As monetary base<sup>13</sup> narrows, money supply<sup>14</sup> decreases. When money demand increases liquidity problems arise. High interest rates decrease the price of government securities held by banks and bank balance sheets tend to deteriorate. Consequently, this process goes on with financial fragility boosted with the existent mismatching problems and ends up with the break out of a twin crisis.

## V. Conclusion

2001 Turkish crisis has a number of features common to crises in emerging markets that implemented exchange rate based stabilization programs and shows how a fragile banking sector with currency and maturity mismatches and open positions is turned into a financial crisis.

In this paper, our aim was to identify the leading macroeconomic and financial indicators as a best warning in order to predict the timing of a financial crisis. To reach this aim, we determined fifteen indicators and used the logit model. After running eight specifications, an increase in commercial banks' foreign liabilities/GDP and a decline in foreign exchange reserves can be identified as the leading financial crisis indicators in Turkey for the period 1989-2002.

Concurrent macroeconomic and financial balance may be the key solutions to financial crises. In this sense, decreasing inflation, real interest rates and foreign exchange volatility, avoiding the twin deficits (current account and budget), purposing fiscal austerity, preventing fiscal dominance and decreasing public debt stock, keeping sufficient amount of foreign reserves and maintaining a "sustainable" growth are the ways of macroeconomic stability. On the other hand, strengthening the capital structure of the banking sector by following Bank for International Settlement (BIS) standards, preventing huge amount of foreign borrowing and establishing an efficient regulatory and supervisory environment under a transparent legal system are the ways of financial balance. The last solution can be considered in the political and institutional senses by applying a floating exchange regime, having an independent central bank, establishing an international lender of last resort and controlling short-term capital flows.

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<sup>13</sup> Monetary base is the sum of net domestic assets and net foreign assets.

<sup>14</sup> Money Supply=Monetary Base\*money multiplier

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