

Financial Crises in Retrospect of Turkish economy: Evidence from a probit model 1970-2018

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Abstract

This study empirically investigates the determinants of financial crisis which occurred in the Turkish economy in 1994, the late 1997 and 2007 respectively. A probit model is conducted by the main tool to identify the leading indicators of financial crisis using a sample of annual data covering the period 1970-2018. The evidence found in this paper indicates that terms of trade shock (TT), per capita income growth (CAPG) and M2 Reserve (M2R) are the best indicators, which determine financial crisis in the Turkish economy. Besides, real exchange misalignment (RER), current account balance (CABR) and annual reserve money to GDP (ARM) were not found significant in favour of the financial crisis. Based on our estimated results, (i) Turkish financial system may need a new law and regulation framework to improve the strength of the Turkish financial system. (ii) In the Turkish economy, human sources and facilities such as electronic communication have to be used efficiently. (iii) Macroeconomic stability and political soundness are the keys to the solution of the dilemma.

Keywords: financial crisis, probit analysis, Turkish economy.

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1. Introduction

The global financial crisis of 2007 started in the US but rapidly spread across borders and affected many countries with strong as well as weak economies. This has raised significant concerns about the possibility of a contagion effect of financial crises. The global financial crisis and its painful effects also increased the interest of academic researchers and policymakers to investigate the financial crisis, its painful impact and determinants. The well-functioning financial sector is a key component of an economy facilitating the exchange of goods and services, mobilizing savings, allocating resources, helping to diversify risks and technological advances and make the international financial community highly sophisticated as well as efficient. So, the problems which involve a large external deficit, inflated property and stock market values, the maintenance of relatively fixed exchange rates, an over-dependence on short term capital flows, lacking an effective infrastructure, etc may cause problems in the economy and lead to the financial crisis. Turkey has experienced severe financial crises and fallen into a significant recession since the 1980s. Turkey is a historical gateway from the ancient Silk Road to new markets. It is becoming a powerful local point as a cultural and a political intermediary as well as a trade centre of growing importance. Turkey is bound to become an important commercial and financial centre in the region and is one of the most industrialised nations outside of the US, Western Europe and Japan. Turkey's economy (in terms of GDP) is now the 18th largest in the world. It has a rapid growing free-market economy and its strategic location provides an excellent base for economic activities throughout Central and Eastern Europe. Thus, it is very important to understand what may cause the financial crisis. The most common view is that the crisis reflects fundamental macroeconomic and microeconomic weaknesses in the most affected economies.

Our own work presented in this paper has been stimulated both by this so-called contagious nature of crisis all over the world and the increased frequency and severity of the crisis in Turkish economy experienced particularly in post capital account liberalization era. The empirical methodology that we adopt in this paper is that of estimation of probit type of model to determine the statistically significant indicators of the financial crisis that we define based on an index that we call "Market Pressure Index". An important aspect of this index is that it is made up of not only the changes in the exchange rate of domestic currency but also those in interest rates and (non-gold) reserves of the central bank. The estimation results of our model for the sample period 1970-2018 suggested that contrary to conventional wisdom and findings of some of the previous researches, overvaluation of the real exchange rate and the increase in the respective ratios of "current account deficit" and (annual amount of) "reserve money" to GDP has not been significant determinants of financial crisis. Our results showed that the significant determinants of the financial crisis have been

“terms of trade shocks”, “per capita income growth” and “the ratio of M2 (Broad measure of Money Supply) to GDP”. The paper is organised as follow: Section 2 represents a review of the theory on the financial crisis and describes the previous studies in light of the financial crisis. Section 3 explains data, model and methodology. Section 4 presents the empirical results and section 5 provides some concluding remarks.

2. Literature Review

Crises have happened in different periods of time and there is a large volume of literature about the causes and impacts of the various balance of payment crises. There is a very wide and growing literature on the theoretical³ and empirical⁴ aspects of currency crises. Countries around the world have come under pressure or faced a crisis at different points in time. There have been numerous currency crises in international financial markets. The important crises ones were in Mexico in 1976 and Argentina, Brazil, Peru and Mexico in the early and mid-80s, and in Chile and Argentina in the 1980s. In 1992 the European Exchange Rate Mechanism (ERM) suffered a crisis, as did Mexico in 1995. However, the East Asia financial crises in the late 1997 and early 1998 have the greatest impact on world economic development. The last one is the global financial crisis of 2007 which started in the US but rapidly spread across borders and affected many countries.

2.1 Models in financial crisis

The first-generation model is based on the balance of a payment crisis and contemporary theoretical work on this issue was initiated by Krugman (1979).). Krugman argued that crisis occurs when a continuous deterioration in the economic fundamentals becomes inconsistent with an attempt to fix the exchange rate. The Krugman model and its extensions represent what has become known as first-generation models of a balance-of-payments crisis⁵ (Salant and Henderson (1978)). The main insight of these models is that a crisis arises as a result of an inconsistency between an excessive public sector deficit that becomes monetized and the exchange rate system. The import of this is that a crisis is both unavoidable and predictable in an economy with a constant deterioration of its economic fundamentals.

³ Cartapanis (1994, 1996, 1997), Dooley (1997), Flood and Garber (1984), Flood and Marion (1998), Krugman (1979, 1996), Masson (1998), Obstfeld (1994, 1996).

⁴ Atkeson and Rios-Rull (1996), Blanco and Garber (1986), Calvo and Mendoza (1996), Cole and Kehoe (1996), Dornbusch, Goldfajn and Valdes (1995), Eichengreen, Rose and Wyplosz (1995), International Monetary Fund (1998a), J. P. Morgan (1998), Kaminsky and Reinhart (1996), Kaminsky, Lizondo and Reinhart (1997), Sachs, Tornell and Velasco (1996a,b,c).

⁵ Extensions to the Krugman model have been developed by Flood and Garber (1984) and Cornolly and Taylor (1984). More recently, Krugman (1991) extended the analysis to a target zone model. Flood and Garber and Kremer (1996) incorporate the role of sterilization into the analysis.

Several authors latterly have refined Krugman's work. Flood and Garber (1984) constructed a simplified linear model, introducing a stochastic component. Connolly, Michael, Dean Taylor (1984) analysed a crawling peg regime and stressed the behaviour of the relative prices of traded goods preceding the collapse of the exchange rate regime. In their analysis, the real exchange rate appreciates, and the current account deteriorates prior to the collapse. The related contents, Edwards and Sebastian (1989) have mentioned the importance of currency overvaluation and current account deterioration that tend to precede devaluation (Calvo and Guillermo, 1987). European countries faced severe speculative attacks on their currencies during 1992 and 1993 while maintaining their fixed exchange rates. Member countries of the European Monetary System allowed more flexibility in their currencies, permitting their currencies to move within a band of 15 percent instead of 22.5 percent for most Exchange Rate Mechanism (ERM) rates in August 1993⁶. Currency crises can arise when economies have sound macroeconomic fundamentals. But these countries do not have the features that are described by the first-generation models⁷.

The second-generation model demonstrates that a currency crisis can also occur without the financing of a fiscal deficit through domestic credit creation. The second-generation models of currency crisis are initiated under the impetus of Obstfeld (1996)⁸. In other second-generation models, crises are not affected by the position of the fundamentals and may simply be the result of pure speculation against a currency (Froot et al. 1992). Contagion effects, on the other hand, emphasize that groups of countries belonging to the same region may be perceived as sharing common policy characteristics or objectives. In this framework, when one country falls into crisis, investors may perceive a higher risk of a crisis in neighbouring countries (Drazen, 1998).

2.2 Studies in the recent crisis

Numerous unexpected economic developments have been occurring both in the international arena and in Turkey. Besides the normal succession of political changes and events, the ongoing process of "globalisation" is bringing more permanent changes and adding new dimensions. Financial crises affect world economies without distinguishing between developed and developing economies through different transmission channels. Ireland was called Celtic Tiger between 1997 and 2007 but hit by the banking crisis in 2008, which was a dramatic downturn. The Asian crisis, on the other hand, emerged suddenly at the end of 1997 when the world economies were performing well.

⁶ Klein, Michael W. and Nancy P. Marion (1997), "Explaining the Duration of Exchange Rate Pegs", *Journal of Development Economics*, 54(2), 387-404.

⁷ Obstfeld, M. (1996), "Models of Currency Crisis with Self-Fulling Features", *European Economic Review*, 40, 1037-1047

⁸ Calvo and Mendoza (1997), Cole and Kehoe (1996), Drosy (1998), Dornbusch, Goldfajn and Voldés (1995), Krugman (1996), Sachs, Tornell and Velasco (1996).

Jemovic and Marinkovic (2019) discuss determinants of financial crises and say the financial crises are diverse and may or may not have common determinants. For example, the East Asian Crisis showed that it is the structural weaknesses of domestic financial systems and foreign perceptions of those weaknesses that trigger a crisis in an economy. Yurdakul (2014) applied the probit model to find the determinants of the financial crisis in Turkey. The author found that the stock index in Turkey is closely associated with crises in Turkey. In a similar vein, Karabulut et al. (2010) found the real exchange rate, deposit interest rates, credit/deposit are significant determinants of crises in Turkey. Gu and Huang (2014) showed rising inequality as a strong determinant of financial crises in Anglo-Saxon economies and other similar economies. Unlike Gu and Huan (2014), Denk and Cournede (2015) showed there is no significant relationship between banking crisis crises and income inequality in 33 OECD countries during 1970–2011. Therefore, unexpected developments suddenly can change the positive expectations for the world economy into expectations of crisis and the need for crisis policies.

Comert and Yeldan (2018) argue that Turkey dramatically suffered from 1994, 2001 and 2008-2009 global financial crises by experiencing a significant decline in employment and GDP. It is argued that 1994 and 2001 crises have many things in common and both were deemed to be finance-driven with a substantial impact on the real sector. At the beginning of 1994, the Turkish economy found itself in a very severe financial crisis. The Central Bank heavily intervened in the foreign exchange market, and as a result, lost more than half of its international reserves. Turkish crisis was mainly the result of gross policy mistakes in the public debt domain. Specifically, Ozatay (1996) argues that, when government debt is rapidly rising, of short maturity, and on an “unsustainable” path, politically motivated attempts to control interest rates and monetization of debt are sure to backfire and eventually lead to a crisis. The Turkish crisis appears to contain elements from both the first-generation and second-generation models of currency crises⁹. Excessive money creation is arising from fiscal imbalances. It appeared to be the driving force behind the attack on the currency. However, agents saw that the government would refrain from defending the currency by raising interest rates.

2.3 Macroeconomic indicators in the recent crisis

One of the most noteworthy developments in the international economy since the 1990s is the sharp increase in capital flows to emerging market economies. These inflows, while hailed as a major step toward increased globalisation, enhanced certain risks for individual economies, as evidenced by the 1994 crisis in Mexico and crisis in South East Asia. It is recognized that the crises in both

⁹ The distinction between the two models, which have been the first- and second-generation models in the literature, is discussed in section 2.

Mexican and the South East Asian countries, SEA, stemmed from incorrect macroeconomic policies and structural imbalances. Exchange rate policies combined with irresponsible fiscal policies and put enormous strains on the balance of payments. Weak domestic financial systems and the rapid expansion of domestic credit, combined with pegged exchange rate regimes, deepened the economies' dependence on short-term external borrowing.

The first real sobering experience was the Mexican crisis of December 1994. Ucer et. al. (1999) argue that, at around the time of the crisis, it seemed that Mexico was well-positioned for better times. Significant reforms had been undertaken since the 1988 stabilization program, inflation had come down to fairly low levels and integration with North America offered great prospects. The current account deficit had begun to widen and capital inflows, in the form of short-term capital, had slowed down to an extent that reserves had begun to wear away. As a way of stimulating inflows, the Mexican government began to issue at an increasing rate, dollar-indexed instruments and had accumulated a large short-term debt. "Mexican problems lay largely in an overvalued real exchange rate," (Dornbusch & Werner, 1994). Mexico, in an effort to pull inflation further down to US levels, had used the exchange rate as an anchor too aggressively and for too long. As prices turned out to be stickier than envisaged, the real exchange rate appreciated, and a growing current account deficit was financed, increasingly, by short-term foreign inflows and reserves of the central bank.

Some analysis's argued that the growth of short-term debt was the critical factor in precipitating the crisis (Calvo & Mendoza, 1996 a, b; and Calvo, 1996). The large current account deficit was caused by a real exchange rate overvaluation. If you compared official reserves, you would make the economy vulnerable to a speculative attack. Investors would know that, in the event of an attack, the central bank would not be able to defend the currency because it would not have enough reserves. Hence, an attack would be self-fulfilling. Financial factors account for multiple self-fulfilling equilibria¹⁰. If the Mexican crisis was unexpected and proved quite a shock to the international community, the ongoing crisis in the SEA was even more so. The scale of the crisis was unpredictable to everyone, including, most notably, the IMF and the rating agencies. In Thailand, the devaluation of Thai bath in July began and spilled over into Malaysia, Indonesia and South Korea, causing a massive outflow of capital and forcing the collapse of the exchange rate pegs¹¹.

¹⁰ In addition, Calvo and Mendoza (1996b) develop a model whereby "herding" becomes the "optimal response" to a crisis under certain circumstances, lending further support to a self-fulfilling interpretation of crisis. Sachs et. al. (1996b) also emphasize the role of self-fulfilling panic in Mexican crisis.

¹¹ As it is well-known, China, Hong Kong, Singapore and Taiwan were also affected, but defended their pegs, without much need for large-scale intervention by the international community. Subsequently China's refraining from

In the South-East Asian countries, an improvement in the current account positions is expected a decline in imports because of competitive devaluations which were not made in Latin America countries to protect their export markets. Although the effect of crisis varies across countries, as mentioned financial crises do not distinguish between developed and developing countries. In this sense, Engle and Ruan (2019) attempt to develop the probability of crisis measure for 23 developed countries. They found that under capitalisation makes countries vulnerable to external shocks and therefore financial crises.

3. Model, Methodology and Data

3.1 A model of the financial crisis

In this section, we faithfully follow the previous studies on the topic to present our definition of a currency crisis. It is important to mention that we exclude unsuccessful speculative attacks from the definition of crisis¹², thus we consider that a currency crisis has occurred when at least one of the following conditions is met¹³ (Gerardo et al. 1999; Frankel and Rose 1995). Condition A: the accumulated three-month real exchange rate change is 15 percent or more, or condition B: The one-month change in the real exchange rate is higher than 2.54 times the country's specific standard deviation of the RER monthly growth rate, provided that it also exceeds 4 percent, i.e. $\Delta\varepsilon_{it} > 2.54\sigma_i^{\Delta\varepsilon}$ and $\Delta\varepsilon_{it} > 4\%$ where ε_{it} is the real exchange rate (RER) in-country i in period t , $\Delta\varepsilon_{it}$ is the one-month change in the RER and $\sigma_i^{\Delta\varepsilon}$ is the standard deviation of $\Delta\varepsilon_{it}$ in-country i over the whole period. Condition A guarantees that any large real depreciation is counted as a currency crisis. The threshold value of 15 percent is certainly somewhat arbitrary, but sensitivity analysis shows that the precise threshold is largely irrelevant for our results¹⁴. On the other hand, Condition B attempts to capture changes in the RER that are sufficiently large relative to the historical, country-specific, monthly changes of the RER¹⁵.

devaluation became an anchor that held the system together and still does. The sequence of events since July 1997 is documented in IMF (1997).

¹² Some of the papers that prefer to include these events in their definition of crisis are Eichengreen, Rose and Wyplosz (1995), Kaminsky and Reinhart (1999), and Sachs, Tornell and Velasco (1996).

¹³ Gerardo Esquivel, Felipe Larrin B. (1999), "Currency Crisis: Is Central America Different?", CID Working Paper No.26 September

¹⁴ Other authors have also thresholds in their definition of crisis. Frankel and Rose (1996), for example, use a 25 percent nominal exchange rate change as a threshold value. Eichengreen, Rose and Wyplosz (1995), Goldfajn and Voldes (1998) and Kaminsky, Lizondo and Reinhart (1998) have instead used a definition that is closer to our Condition B.

¹⁵ Assuming that changes in the RER are normally distributed, Condition B is defined as the capture changes in the RER that lie in the upper 0.5 percent of the distribution for each country.

3.2 Methodology

Following Esquiel and Larraine (1999) and Fethi and Fethi, (2000), we construct a probit model as Griffiths et al. (1999: 740) describe, “The probit model is a non-linear (in the parameters) statistical model that achieves the objective of relating the choice probability p_i to explanatory factors in such a way that the probability remains in the $[0,1]$ interval”. It is consistent when the dependent variable y_t , ($t=1,2,\dots,n$) takes the value of 1 or 0. Economic agents are faced with two alternatives when such models arise in econometrics. Their choice depends on a set of k explanatory variables or factors. The models are also referred to as ‘qualitative’ or ‘limited dependent’. The variable to be explained (y_{it}) is dichotomous and takes the value of 1 if a currency crisis occurred during year t and 0 otherwise. We estimate a probit model of the form:

Financial Crisis Proxy (FCP) = VEC of Explanatory Variables

$$\text{Prob} (crisis_{it}) = \text{Prob} (y_{it}) = \Phi(\beta\chi_{it-1})$$

where χ_{it-1} is a vector of explanatory variables for the country i in the period $t-1$, β is a vector of coefficients to be estimated and Φ is the normal cumulative distribution function. Note that in our estimation we are implicitly assuming the existence of an unobservable or latent variable (y_{it}^*), which is described by

$$y_{it}^* = \beta' \chi_{it-1} + u_{it}$$

where χ_{it-1} and β are as before, u_{it} is a normally distributed error term with zero mean and unit variance and the observed variable y_{it} behaves according to $y_{it} = 1$ if $y_{it}^* > 0$ and $y_{it} = 0$ otherwise. It is worth stressing that the discrete (or dichotomous) dependent variable under this study is constructed in the following form rather than using the standard procedure in the literature giving 1 for crisis years and 0 otherwise.

$$Y_{MPI} = 1 \text{ if } MPI > \mu_{MPI} + 1.5\sigma_{MPI}$$

where μ denotes the mean, σ stands for the standard deviation. We, therefore, construct a measure of exchange rate pressure, termed the Market Pressure Index (MPI), which is formed as follows:

$$MPI = \frac{\Delta e_t}{\sigma_{\Delta e_t}} + \frac{\Delta i_t}{\sigma_{\Delta i_t}} - \frac{\Delta r_t}{\sigma_{\Delta r_t}}$$

where e is the exchange rate defined as domestic currency/US\$, i is the interest rate, r is non-gold international reserves weighed by their respective standard deviation¹⁶, and Δ denotes changes. This index is high when there is pressure on the currency and low otherwise. The perception is that, if there is an attack on the currency, the exchange rate would depreciate. The interest rate would be raised to defend against the attack, or the central bank would sell foreign currency to support the exchange rate. In a probit model, it is important to remember that the sign of β is very important. If $\beta_t > 0$ then an increase in χ_{it} increases the probability that $y_{it} = 1$; and if $\beta < 0$ then an increase in χ_{it} reduces the probability that $y_{it} = 1$.

3.3 Data

Annual data¹⁷ for Turkey were collected over the period between 1970 and 2018. There are six explanatory variables used in the analysis including Seignorage (ARM- annual reserve money as a percentage of GDP), Real Exchange Rate Misalignment (RER), Current Account Balance (CABR), Per Capita Income Growth (CAPG), Terms of Trade Stock (TT) and M2/Reserves (M2R)¹⁸. Market Pressure Index (MPI) is the (dichotomous) dependent variable.

4. Empirical Results¹⁹.

4.1 Correlation matrix

By referring to Table 1²⁰, we notice that, between the periods of 1970 to 2018, there is a low correlation of -0.39 between RER and MPI. This means that during this period, the RER may not be as good an indicator as others for the prediction function. The correlation between MPI and other independent variables is acceptable. When checking the multicollinearity among the independent variables, we found a high correlation of -0.65 CAPG and M2R and -0.81 between RER and TT which implies that some of them might be poor signal variables. However, as can be seen in Table 2, the Probit model results are not badly affected by a high correlation between the explanatory

¹⁶ See e.g. Eichengreen, Rose and Wyplosz (1996), Sachs, Tornell and Velasco (1996), Frankel and Rose (1996) and Kaminsky, Lizondo and Reinhart (1997) for similar construction of exchange rate pressure.

¹⁷ The data used in this study were obtained from International Monetary Fund (IMF): <https://data.imf.org/>

¹⁸ Other authors have suggested using the short-term debt/Reserves ratio to capture this effect (see, for example Sachs and Radelet, 1998). However, cross-country information for this variable is available only starting in 1986. We therefore prefer the M2/Reserves variable.

¹⁹ All our empirical tests have been carried out by Microfit 4.1 (Peseran and Peseran, 1997)

²⁰ Due to the multicollionarty problem, we expect to get a high correlation between MPI and other independent variables, but a low correlation among the independent variables (see also Waters, 1997: 257).

variables²¹. We are in a situation to conclude that the correlations among the variables do not suffer from multicollinearity problem since our estimated results are acceptable from the statistical point of view.

Table 1: Estimated Correlation Matrix of Variables

	MPI	AMR	RER	CAPG	CABR	TT	M2R
MPI	1.00						
ARM	0.74	1.00					
RER	-0.39	0.46	1.00				
CAPG	0.53	0.55	0.42	1.00			
CABR	-0.47	-0.17	-0.21	-0.16	1.00		
TT	-0.64	-0.41	-0.81	0.25	-0.37	1.00	
M2R	-0.51	0.27	0.07	-0.65	-0.09	0.22	1.00

Source: Results are from the calculation by using software-Microfit 4.1.

4.2 Probit model

The results presented in Table 2 are estimated by applying the Probit model. The table indicates four different models in which the best model was estimated after the insignificant variables were dropped sequentially from the model.

Table 2: Determinants of Financial Crisis
Regression of Coefficients (t-statistics)

Variables	Model(1)	Model(2)	Model(3)	Model(4)
ARM	1.13 (0.80)			
RER	0.03 (1.04)	0.23 (1.13)		
CABR	-0.15 (-1.47)	-0.14 (-1.39)	-0.11 (-1.18)	
CAPG	-0.26 (-1.62)	-0.28 (-1.93) **	-0.32 (-2.02) **	-0.31 (-2.08) *
TT	-0.11 (-2.11) *	-0.09 (-2.04) *	-0.05 (-2.15) *	-0.05 (-2.12) *
M2R	0.14 (1.98)**	0.12 (2.02)**	0.15 (1.85)**	0.09 (2.05)*
Log Likelihood	-14.7422	-15.0639	-15.6748	-16.4034
Goodness of Fit	0.76	0.73	0.66	0.59
Pseudo-R ²	0.27	0.26	0.23	0.19

Source: Results are from the calculation by using software-Microfit 4.0

Note: * indicates statistically significant at a 5%, ** indicates significant at a 10% and the others are not statistically significant at conventional levels.

²¹ This kind of data are either regrouping data or contain similar trend (see also Jalilian and odedokun, 2000).

Having obtained these results, we conducted individual t-tests for independent variables within four steps. In each step, we dropped the most insignificant variables to obtain a parsimonious specification of the model. In other words, we selected the most significant t-values until we reached the best model to explain the financial crisis in the Turkish economy. Column (1) in Table 2 shows most of the variables to be insignificant. The results tell us that TT and M2R determine the level of financial crisis whereas ARM, RER, CABR and CAPG are insignificant in the test. This means that they do not affect the probability of the financial crisis. In the same Column, the goodness of fit was found quite high with a value of 0.76. The equation can explain 27% of the total variation in the dependent variables since the Pseudo-R² is equal to 0.27. In the next step, we dropped the independent variable ARM, which was the most insignificant variable in Equation 1 and carried out Test 2. Column (2) illustrates that the variables are significant except RER and CABR in which CAPG, TT and M2R determine the level of the financial crisis. This indicates that these indicators do not influence the probability of the financial crisis. The ratio of the goodness of fit indicates 0.73 whereas the equation can explain 26% of the total variation in the dependent variable since the Pseudo-R² is equal to 0.26. In order to make the equation reflect the real situation, we dropped the independent variable, RER and carried out Test 3. Column (3) in the relevant table shows that CABR is the only variable insignificant. This means that CAPG, TT and M2R determine the level of the financial crisis whilst the goodness of fit and Pseudo-R² were found 0.66 and 0.23 respectively. Finally, we dropped CABR and carried out Test 4. Column (4) in the table displays all the variables were significant. This implies that CAPG, TT and M2R determine the probability of the financial crisis, so we assume that this equation could properly reflect the real situation of the Turkish economy. We found the ratio of the goodness of fit; 0.59 and the Pseudo-R²; 0.19 which are not as high as others.

5. Conclusion and policy implication

5.1 Conclusion

This study empirically investigated the determinants of the financial crisis, which occurred in the Turkish economy in 1991, 1994, late 1997 and 2007. Looking at key macroeconomic variables is a good starting point to assess the current conditions in a country and to identify its potential vulnerabilities. We conduct a probit model as the main tool to identify the indicators of a currency crisis using a sample of annual data covering the period 1970-2018.

From the analysis of the results, we found that terms of trade shock (TT), per capita income growth (CAPG) and M2 Reserve (M2R) are the best indicators for determining the probability of the financial crisis in the Turkish economy. Turning to the significant variables, per capita income growth (CAPG) suggest that an increase in per capita growth leads to an increase of probability for the financial crisis. Terms of trade shock (TT) variable also illustrate that high changes in the relative price of exports and imports or a decline in the terms of trade are associated with a high probability of the financial crisis. The result for the ratio of M2 to Reserve advice that unnecessary demand for reserve money stimulates the financial crisis due to a balance of payment problem in the Turkish economy.

It is worth emphasising that real exchange misalignment (RER) was not found significant at conventional levels in the favour of the financial crisis, although RER misalignment has worked best in the empirical analysis of the determinants of crisis²². The reason behind that may stem from heavy protection against the value of Turkish monetary currency. This finding suggests that a sharp rise in exchange rate appreciation often impeding a financial crisis. Current account balance (CABR) was also found insignificant that reflects a high import demand in the Turkish economy. This situation is related to a sharp rise in the current account balance, which prevent the probability of a financial crisis. Apart from these two variables, annual reserve money (ARM) was found insignificant that a decrease in this variable is followed by a decrease in the probability of a financial crisis. These variables were not found significant in the recent empirical literature. This may stem from the way used in conjunction with the other explanatory variables. These three useful independent variables could signal the financial crisis in Turkey and they could provide the quantitative measurement about the financial risk that Turkey may face. In fact, different variables may take importance at different times.

A general survey of the worldwide financial crisis from 1970 to 2002 reveals that they take one of the two forms; the banking crisis and the foreign exchange crisis. They are like twins and when they arrive in an economy together, there are certainties to be significant costs. Turkey has great opportunities in the region, and it is one of the fastest-growing markets in the world, which increases its attractiveness and productivity for foreign capital. Other factors include Turkey's favourable relations with neighbouring markets, decreased government regulations, well-developed infrastructure and human resources, and cheapness of labour and technology. Starting from 1980, financial liberalisation process was realised gradually through some new regulations such as determining the exchange rates by Central Bank, setting interest rates free, permitting to residents to hold foreign exchange deposits, establishing the interbank money market and Istanbul Stock

²² See, for example Kaminsky, G., Lizondo, S. and Reinhart, C. M. (1998).

Exchange and starting to use indirect monetary policy instruments in policy implementation. However, the recent financial crisis would deteriorate Turkey's favourable conditions and brought a liquidity crisis for the Turkish economy due to the combination of weak reserves and a weak financial sector.

5.2 Policy implication

Recent and ongoing increases in petroleum crisis might potentially increase the likelihood of a currency crisis through its adverse effects on Turkish terms of trade. Policies that foster long-run economic growth and therefore positively affect per income growth are likely to lower the chances of a currency crisis. (i.e., policies enhance saving investment rate, human capital accumulation, TFP growth, trade openness, financial development, macroeconomic and political stability etc.). It is worth to mention that negative correlation between per capita income growth and the probability of currency crisis can be partly rationalized by Ballassa- Samuelson theorem: This theorem predicts that as per capita income grows TFP in the tradeable sector will rise more rapidly. This, in turn, will increase the relative output supply of tradeable which may lower the risk of crisis.

One possible reason for CABR to be an insignificant determinant of currency crisis may lie in the fact that usually, it is the increased availability of foreign savings (through a higher rate of net inflows of foreign capital) that makes possible financing of higher current account deficits. And rationally these foreign capital inflows must be responding to improved risk-return possibilities which are likely to be associated with lower probability of currency crisis. Finally, the fact that ratio of M2R to total reserves of the central bank is found to be a significant determinant of currency crisis suggests that the benefits of a policy of the Turkish Central Bank in terms of reserve build-up in recent years might more than offset its costs in the long-run.

References

- Andres, J. and Hernando, I. (1997). Does inflation harm economic growth? Evidence for the OECD. Working Paper 6062, N.B.E.R., Cambridge, MA, U.S.A.
- Berg, A. and Pattillo, S. (1999) “are currency crisis predictable? a test”, IMF Staff Papers. vol.46, no.2, June.
- Bergsten, F. C. (1997) “The Asian monetary crisis: proposed remedies”, Institute for International Economics. November 13, available from the web (<http://www.iie.com/crisis.html>)
- Bergsten, F. C. (1998) “A new strategy for the global crisis”, international economics policy briefs, Institute for International Economics. September 20, available from the web (<http://www.iie.com/news98-7.htm>)
- Binay, S. and Salman, F. (1998) “New policy challenges and expectations for the near future”, Research Department, November, Ankara
- Calvo, G. (1987) “Balance of payments crisis in a cash-in-advance economy”, Journal of Money. Credit and Banking 19, February, 19-32.
- Calvo, G. and Mendoza, E. G. (1997) “Rational herd behaviour and the globalization of securities markets”, University of Maryland, November, Mimeo
- Celasun, O. (1998) “The 1994 currency crisis in Turkey”, Policy Research Working Paper. no:1913, April.
- Cerra, V. and Saxena, S. C. (2000) “Contagion, monsoons and domestic turmoil in Indonesia: a case study in the Asian currency crisis”, IMF Working Paper. wp/00/60.
- Cerra, V. and Saxena, S. C. (2000) “What caused the 1991 currency crisis in India?”, IMF Working Paper. wp/00/157.
- Çiftcioglu, S. (2006). Growth, Volatility and Sectoral Composition of Output before and after Capital Account Liberalization: Case of Turkey. In B. N. Gosh and A. Ghafoor (Eds.), Economic Development in Turkey: Some Contemporary Issues, Wisdom House, Leeds.
- Comert, H and Yeldan, E. (2018). A tale of three crises in Turkey: 1994, 2001, and 2008-09.
- Corsetti, G., Pesenti, P, Roubini, N. (1998) “What caused the Asian currency and financial crisis”, NYU, March 9, Mimeo, available from the web www.stern.nyu.edu/~roubini/asia/asiahomepage.html
- Denk, O. and B. Cournède (2015), “Finance and income inequality in OECD countries”, OECD Economics Department Working Papers, No. 1224, OECD Publishing, Paris.
- Dornbusch, R. (1997) “Expectations and exchange rate dynamics”, Journal of Political Economy. pp 1161-1176.
- Dornbusch, R. (1998) “Asian crisis themes”, Massachusetts institute of technology. February.
- Dornbusch, R., Goldfajn, I. and Valdes, r. (1995) “Currency crisis and collapses”, Brookings Papers on Economic Activity. pp 219-270.

- Eichengreen, B., Rose, A. and Wyplosz, C. (1996) "Contagious currency crisis: first test", *Scandinavian journal of economics*. no.4, pp463-484.
- Ekinci, K. N. and Ertürk, A. K. (2004). *Turkish Currency Crisis of 2000-1, Revisited*, Working Paper No: 2004-1, Department of Economics, University of Utah, Salt Lake City, U.S.A.
- Engle, R.F., Ruan, T., 2019. Measuring the probability of a financial crisis. *Proc. Natl. Acad. Sci. The USA*. 116, 18341–18346. <https://doi.org/10.1073/pnas.1903879116>
- Ercel, G. (1997) "Turkey: business, finance and investment", at Euromoney's conference, May 14, Istanbul, available from the web
<http://www.tcmb.gov.tr/yeni/evds/konusma/ing/1997/euromon.html>
- Ercel, G. (1998) "Lessons from the east Asian crisis for Turkish policymakers", *Mediterranean Development Forum*, World Bank Morocco, September 4, Marrakesh.
- Ercel, G. (1999) "Trends in the Turkish economy at the beginning of 1999", interview on HBB Tv Channel. February 16, Ankara.
- Ertugrul, A. and Selcuk, F. (2001) "A brief account of the Turkish economy, 1980-2000", February, from Nouriel Roubini's global macroeconomic and financial policy site.
- Esquivel, G. and Larrin, F. B. (1999) "Latin America confronting the Asian crisis", *Development Discussion Papers*. no.681, February, Harvard University.
- Esquivel, G. and Larrin, F. B. (1999) "Currency crisis is central America different?", *CID Working Paper*. no.26, September.
- Fethi, M. D and Fethi, S. (2000) "Heading off china's financial crisis: evidence from a probit model", *Management Centre*, University of Leicester, Mimeo.
- Fischer, S. (1997). *Capital Account Liberalization and the Role of the IMF*. Paper presented at the seminar 'Asia and IMF', Held in Honk Kong, China, on September 19, 1997, IMF, September 1997.
- Fischer, s. (1998), "Lessons from a crisis", *the economist*, October 3rd, available from the web
<http://www.imf.org/external/np/vc/1998/100398.htm>
- Flood, R., Garber, P. and Kramer, c. (1996) "Collapsing exchange rate regimes: another linear example", *Journal of International Economics*. November, pp223-234.
- Flood, R. and Marion, N. (1998), "Perspectives on the recent currency crisis literature", *NBER Working Paper*. no.6380, Cambridge, Massachusetts: National Bureau of Economic Research.
- Frankel, J. A. And Rose, A. K. (1995). *Currency Crashes in Emerging Market Economies: An Empirical Treatment*, *Journal of International Economics*, 41, 351-366.
- Goldfajn, I. and Valdes, R. (1997) "Are currency crisis predictable?", *IMF Working Papers*. wp/97/159.
- Goldstein, M. (1996) "Presumptive indicators/early warning signals of vulnerability to the financial crisis in emerging – market economies", *Institute for International Economics*. January.

- Gu, X. and B. Huang (2014), “Does inequality lead to a financial crisis? Revisited”, *Review of Development Economics*, 18(3), pp. 502-516.
- International Monetary Fund (1998a) “Currency and banking crisis: characteristics and indicators of vulnerability”, *World Economic Outlook*, pp110-142.
- Jemovic, M and Marinkovic S. (2019) Determinants of the financial crisis – an early warning system based on panel logit regression, *International Journal of Finance and Economics*, 10.1002/ijfe.1779.
- Jillian, H and Odedokun, M. (2000) “Equipment and non-equipment private investment: a generalized Solow model”, *Applied Economics*, 32, 289-296.
- Kaminsky, G. and Reinhart, C. M. (1996) “The twin crisis: the causes of banking and balance-of-payments problems”, *International Finance Discussion Paper*. no.544.
- Kaminsky, G., Lizando, S. and Reinhart, C. (1998). *Leading Indicators of Currency Crisis*. IMF Staff Papers 4s, 1-48.
- Karabulut, G., Bilgin, M. H., Danisoglu, A. C. (2010). Determinants of currency crises in Turkey: some empirical evidence. *Emerging Markets Finance and Trade*, 46 (sup1), 51-58.
- Khamis, M. and Leona, A. M. (1999) “Can currency demand be stable under a financial crisis? the case of Mexico”, *IMF Working Paper*. April, no.53
- Klein, M. W. and Marion, N. (1997), “explaining the duration of exchange rate pegs”, *Journal of Development Economics*. no.54, pp387-404.
- Krugman, p. (1979), “A model of balance of payments crisis”, *Journal of Money Credit and Banking*, no.11, pp311-325.
- Krugman, p. (1996) “Are currency crisis self-fulfilling?”, *NBER macroeconomics annual 1996*, National Bureau of Economic Research, pp345-407.
- Krugman, P. (1997b) “Currency crisis manuscript”, prepared for NBER Conference, October, available from the web (<http://www.mit.edu/krugman/crisis.html>)
- Krugman, p. (1998a) “What happened to Asia?”, available from the web (www.mit.edu/krugman/disinter.html)
- Lim, C. H. and Papi, L. (1997) “An econometric analysis of the determinants of inflation in Turkey”, *IMF Working Paper*. December, wp/97/170.
- Obstfeld, M. (1996) “models of currency crisis with self-fulfilling features”, *European Economic Review*. no.40, pp1037-1047.
- Özlale, Ü. and Özcan, K. (2007). An Alternative Method to Measure the Likelihood of a Financial Crisis in an Emerging Market Economy. *Physician A* 381, 329-337.
- Pesaran, h. and Pesaran, b. (1997) *Microfit 4.0.: an interaction econometric software package (user manual)*. Oxford University Press, Oxford.

Radalet, S. and Sachs, J. (1998) “The onset of the East Asian crisis”, Harvard University, March 30, forthcoming in NBER book, Mimeo, available from the web (www.hiid.harvard.edu/pub/other/asiacrisis.html)

Radalet, S. and Sachs, J. (1998b), “The East Asian financial crisis: diagnosis, remedies, prospect”, Harvard University, Mimeo, available from the web (www.hiid.harvard.edu/pub/other/asiacrisis.html)

Sachs, J., Tornell, A. and Velasco, A. (1996). Financial Crisis in Emerging Markets: The Lessons from 1995. Brookings Papers, Economic Activity 1, 147-215.

Sachs, J. and Radalet, S. (1998) “The onset of the East Asian financial crisis”, National Bureau of Economic Research Working Paper. no.6680.

Singh, A. (2003). Capital Account Liberalization Free Long-Term Capital Flows, Financial Crisis and Economic Development, Working Paper, Queen’s College, University of Cambridge, England.

SPO (1994). Main macroeconomic indicators, August 1994. T. R. Prime Ministry State Planning Organization, Ankara.

Taylor, L. (1983). Structuralist Macroeconomics. Basic Books, New York.

Ucer, M., Rijckeghem, C. V. and Yoladan, R. (1999) “Leading indicators of a currency crisis: a brief literature survey and an application to Turkey”, Yapi Kredi Yayinlari. pp3-22, Istanbul

Velasco, A. (1987) “Financial and balance of payments crisis”, Journal of Development Economics. vol 27, no.48, pp263-293.

Water, D. (1997) Quantitative models for business. Addison-Wesley, Essex

World Bank (1998) “East Asia's financial crisis: causes, evolution and prospects”, Global Development Finance. pp29-48.

Yellen, J. (1998) “Lessons from the Asian crisis”, Council of Foreign Relations. April 15, New York, available from the web <http://www1.whitehouse.gov/wh/oep/cea/html/19980415.html>

Yenturk, N. (1997) “The last fifteen years of the Turkish economy: destined to be in crisis”, available from the web <http://www.tusiad.org.tr/yayin/private/autumn97/html/yenturk.html>

Yılmazkuday, H. and Akay, K. (2007). An Analysis of Regime Shifts in the Turkish Economy. Economic Modeling (2008), doi: 10.1016/j.econmed.2007.11.013.

Yurdakul, F. (2014). Factors that trigger financial crises: The case of Turkey. Social and Behavioural Sciences, 109, 896 – 901.