The European Journal of Comparative Economics
Vol. 5, n. 1, pp. 107-124
ISSN 1722-4667

Twin Crises in Turkey:

A Comparison of Currency Crisis Models [1]

Hakan Yilmazkuday [2]
Vanderbilt University

Abstract

This paper analyzes the twin crises in Turkey experienced in 2000 and 2001. After a detailed survey of currency crisis models, together with a brief descriptive overview of the crises in Turkey, the similarities among the twin crises in Turkey and the models that have been developed to explain preceding crises in the world are investigated. It is found that the Turkish twin crises cannot be explained by using any individual generation of models, namely first generation models, second generation models or third generation models. Instead, a combination of these models is more appropriate to explain the details of the twin crises.

JEL Classification: E44, E52, E62

Keywords: Currency Crisis, Speculative Attack, Exchange Rate Targeting, Turkey

1. Introduction

The twin crises in Turkey consist of a banking crisis in November 2000 and currency crisis that followed in February 2001.[3] The crises were experienced due to a sudden increase in the demand for the dollar, which, in turn, caused the level of reserves to decrease swiftly. The Turkish government handled the crisis of November 2000, but it was not completely successful in handling the one in February 2001. So, the government had to abandon the fixed exchange rate regime and began to conduct a floating exchange rate regime. After this critical decision, the Turkish lira continued to devaluate against the US dollar.[4]

This paper analyzes these twin crises in Turkey. Following Akay (2004), we first perform a detailed literature survey on currency crisis models. After that, we create a brief descriptive overview of the crises in Turkey through which we attempt to find out the similarities between the twin crises in Turkey and the models that have been developed in order to explain preceding crises in the world. We hope that our detailed survey will serve as a reference for future research articles. Our main finding is that the Turkish twin crises cannot be explained by using any individual generation of models, namely first generation models (FGM), second generation models (SGM) or third generation models (TGM). Instead, a combination of these models is more appropriate to explain the details of the twin crises.

[1] The author would like to thank Koray Akay and Giovanni Battista Ramello for their helpful comments and suggestions. All remaining errors are the author's responsibility.
[2] Department of Economics, Vanderbilt University, Nashville, TN, 37235, USA;
Tel: +1-615-343-2472; fax: +1-615-343-8495; e-mail: hakan.yilmazkuday@vanderbilt.edu
[3] The twin crises refer to the association between the banking crises and balance-of-payments crises, and vice versa. In particular, according to Kaminsky and Reinhart (1999), the term "twin crises" is described as episodes in which the beginning of a banking crisis is followed within 48 months by a balance-of-payment crisis.
[4] See Akay and Yilmazkuday (2008) for an analysis of the Turkish economy during the period 1980-2001.

The Turkish twin crises are typical cases of crises known as *currency crises* or *balance of payment* crises. A currency crisis is an occurrence experienced in various economies all over the world. The crises that have been analyzed by the economists consist of the crisis in Latin America in the 1970s, the crisis in Europe in the early 1990s, and the crisis in Asia experienced in the late 1990s.

In general, currency crises are experienced when the government cannot fulfill its obligations (Calvo and Vegh, 1999). A typical case occurs in the case of a fixed exchange rate regime when the central bank cannot cover the increased demand for dollars coming from the individuals and institutions in the economy. As a result, the central bank is forced to let the exchange rate float. However, when we analyze the underlying reason for this scenario, we realize that this swift increase in demand is experienced because speculators, who foresee the devaluation of the currency, want to make a profit. This case is known as a speculative attack in the literature.

Most of the currency crises have been experienced in the countries in which governments are not seen as capable of continuing a fixed exchange rate regime. However, since all of the crises are experienced after speculative attacks, such governments have defended themselves, by accusing the speculators of such crises, and stating that the timing of the speculative attacks cannot be anticipated.

This timing problem has drawn the attention of economists toward speculative attacks. First, Krugman (1979) tried to explain the Latin American currency crises by introducing his model, which is accepted as the leader of FGM. FGM claims that the crises are a result of worsening economic fundamentals. After the crises experienced in the early 1990s, SGM have been developed, which not only take into account the worsening economic fundamentals, but, in addition to FGM, also focus on the expectations of the economy. After the 1997-1998 East Asian financial and currency crises, TGM were introduced, which are models of financial sector crises rather than of speculative attacks or currency crises *per se*.[5]

The rest of this paper is organized as follows: In Section 2, we introduce FGM. After that, we introduce SGM and TGM in Sections 3 and 4. The examination that shows whether the twin crises in Turkey, experienced in 2000 and 2001, can be explained by using any of these models is the subject of Sections 5 and 6. Section 7 concludes.

2. First Generation Models (FGM)

The seminal model of FGM was introduced by Krugman (1979). It was further simplified and popularized by Flood and Garber (1984). This leading model shows that, in a small open economy with a fixed exchange regime, an excess creation of domestic credit relative to money demand growth may generate the conditions for a sudden speculative attack against the domestic currency, ultimately leading to the abandonment of the fixed exchange rate peg and a switch to a flexible exchange rate regime.

The Krugman-Flood-Garber model assumes a small open economy with only one good. The output is constant and the price of the good is determined by the purchasing power parity:

[5] For recent currency crisis models, some of which focus on contagion issues, see Burnside, Eichenbaum and Rebelo (2001a, 2001b, 2004), Neal and Weidenmeir (2002), Kodres and Pritsker (2002), Kaminsky, Reinhart and Vegh (2003), Lahiri and Vegh (2003), Caramazza, Ricci and Salgado (2004), Tai (2004), Leila and Kestens (2006), Corsetti and Mackowiak (2006), Pesaran and Pick (2007), Pasquariello (2007).

$$P_t = E_t P_t^* \qquad [1]$$

where P_t is the domestic price level, P_t^* is the foreign price level, and E_t is the nominal exchange rate. For simplicity, it is assumed that the foreign price level is constant and equal to one ($P_t^* = 1$). Hence, the price level becomes equal to the nominal exchange rate, further implying that the domestic inflation rate is identical to the devaluation rate, ε_t.

The nominal money supply (monetary base) consists of domestic credits (D_t) and foreign exchange reserves (R_t):

$$M_t = D_t + R_t \qquad [2]$$

The real money demand is a negative function of the domestic interest rate, alone:[6]

$$L_t = L(i_t), \quad L' < 0 \qquad [3]$$

Under the assumption of perfect capital mobility (which is equivalent to the assumption of perfect substitution between domestic and foreign bonds), the nominal interest rate (i) is determined according to the interest rate parity:

$$i_t = i^* + \varepsilon_t^e \qquad [4]$$

where i^* is the constant foreign interest rate and ε_t^e is the expected devaluation rate. Under the assumption of perfect foresight, the expected devaluation rate equals the actual one ($\varepsilon_t^e = \varepsilon_t$). Thus, the monetary equilibrium condition can be formulated as:

$$\frac{1}{E_t} = (D_t + R_t) = L(i^* + \varepsilon_t) \qquad [5]$$

Suppose that at time $t = 0$ the central bank fixes the exchange rate at $E_t = \tilde{E}$. This implies that from then on, the real money demand becomes constant:

$$L_t = L(i^*) \qquad [6]$$

Moreover, suppose that the government is running a constant budget deficit, μ, financed by a continuous rise in the level of domestic credits:

$$\dot{D}_t = \mu \qquad [7]$$

[6] The inclusion of real income, which is assumed to be constant, into this function does not affect the analytical structure and the results of the model.

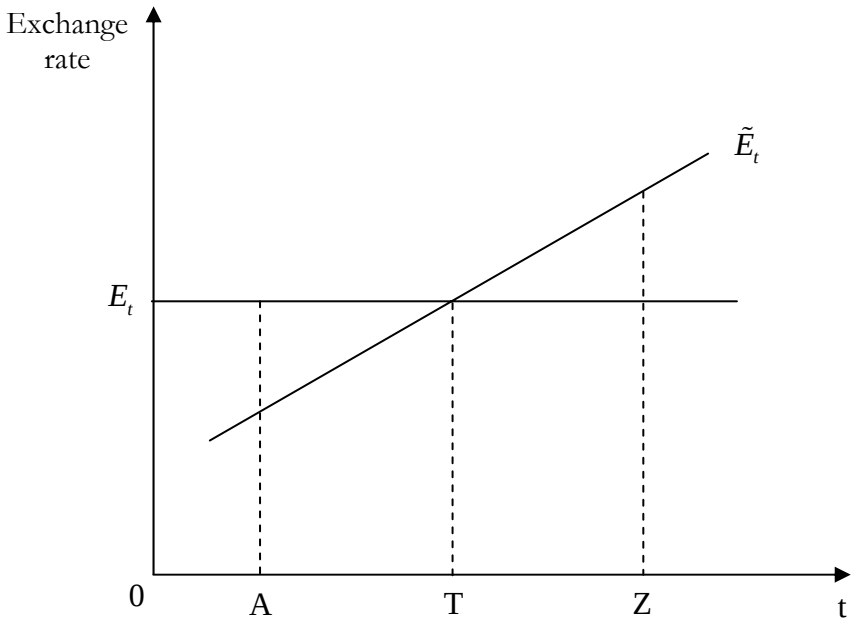
where $\dot{D}$, the derivative of D with respect to time, denotes the change in the domestic credits. The ensuing excess supply in the money market will be used to buy foreign bonds. As a result, the foreign exchange reserves of the central bank will decrease by an amount equal to the increase in the domestic credits:

$$\dot{R}_t = -\dot{D}_t = -\mu \qquad [8]$$

In other words, the increasing budget deficit will lead to a continuous fall in the foreign exchange reserves. Ultimately, the level of reserves will reach a critical value, which can safely be assumed to be zero ($R=0$). When the reserves fall to this critical level (say, at time $t=Z$) the government will have to abandon the fixed exchange rate regime and let the exchange rate float.

The assumption of perfect foresight implies that the individuals (speculators) are aware that, *ceteris paribus*, the exchange rate will be allowed to float at $t = Z$. Their reaction to this expectation can best be understood with the help of Figure 1. In this figure, $\tilde{E}_t$ denotes the shadow exchange rate, which is defined to be the rate that would have prevailed if the exchange rate had not been fixed at all.

Figure 1



According to Figure 1, the exchange rate is fixed at a rate above the shadow exchange rate at time t. However, because of the continuous increase in the domestic credits, the shadow exchange rate eventually exceeds the fixed rate. Two rates are equal at $t = T$. If the speculators attack at time $t = A$, they suffer a loss since the exchange rate falls. At first glance, one may think that the best time for the speculators to attack is just before $t = Z$. However, at that time the central bank would have very little reserves left, and thus, only very few speculators would be better off. So, the best strategy would be

to attack at an earlier time. So, inevitably, the competition among speculators, forces them to attack at $t = T$.

Thus, the main contribution of FGM to the literature is to show that speculative attacks are not arbitrary phenomena, but inevitable reactions necessary for the equilibrium of an economy with deteriorating economic fundamentals (an increasing budget deficit, in the above example).

Before the attack, the money supply is constant since the gradual fall in reserves is equal to the gradual rise in domestic credits. At the time of the switch, the drastic fall in reserves leads to a sharp decrease in money supply.

On the demand side, the positive devaluation rate at the time of the switch causes the nominal interest rate to rise (Eq. 4), leading to a fall in the money demand. Hence, the money market equilibrium is restored. The fall in the money demand must be equal to the fall in the foreign exchange reserves:

$$\Delta R = L(i^*) - L(i^* + \varepsilon_T) \qquad [9]$$

After the attack, the government can no longer finance its budget deficit by running down its reserves. So it returns to seigniorage financing. Domestic credit expansion causes the price level (the exchange rate) to rise continuously. The increase in inflation permits the government to finance its budget deficit by seigniorage. So, in the steady state:

$$\varepsilon_t L(i^* + \varepsilon_t) = \mu \qquad [10]$$

holds. The left hand side of Equation (10) is the seigniorage income.

2.1. Extensions to the Model

The most unrealistic assumption in the Krugman-Flood-Garber model concerns the passive role the government assumes before and during the currency crisis. Even though it is obvious that financing a permanent budget deficit by domestic credit expansion will lead to an inevitable crisis, the government does nothing either to prevent the crisis or to smooth out its negative effects. Accordingly, there have been several attempts to extend the model by incorporating more realistic features such as sterilization and domestic borrowing.

2.1.1. Sterilization

Flood et al., (1996) point out that, in practice, sterilization is commonly observed during currency crises. However, it is impossible to incorporate the practice of sterilization into the Krugman-Flood-Garber model due to its assumption of perfect substitution between domestic and foreign assets. Calvo and Vegh (1999) explain this with the following simple reasoning: Assume for a moment that during the attack, the government can prevent the fall in money supply by sterilizing the drastic fall in the reserves. The money market equilibrium then requires that the money demand does not change either. An unchanged money demand means no devaluation (Equation 9), which is clearly contradictory with the existence of a crisis. This obvious contradiction is eliminated only if the crisis takes place at t = 0.

By assuming imperfect substitution between domestic and foreign assets, Flood et al., (1996) modify the model to allow for sterilization. Under this assumption, Equation (4) becomes:

$$i_t = i^* + \varepsilon_t + \rho_t \qquad [11]$$

where, ρ_t denotes the risk premium that is defined as:

$$\rho_t = \beta(B_t - E_t B_t^*) \qquad [12]$$

Here, B_t and B_t^* denote domestic and foreign bonds held by the private sector, respectively and β is any positive constant. Thus, an increase in domestic borrowing (an increase in B_t), leads to an increase in the risk premium whereas accumulation of foreign assets held by the private sector (an increase in B_t^*) leads to a fall in the risk premium.

Once sterilization is allowed in the model, the sudden shifts in the money market are transferred completely to the bond market. Sterilization by the central bank (open market purchases of domestic bonds held by the private sector) leaves the money supply intact during the crisis, because the sudden drop in foreign reserves is met by an equivalent rise in the domestic assets held by the central bank.

This, of course, means a fall in B_t. As the speculators invest in foreign bonds, B_t^* increases. According to Equation (12), both of these changes cause the risk premium to decrease substantially.

Monetary equilibrium implies that the money demand is also constant during the crisis. Hence, according to Equation (11), the expected devaluation rate must be equal to the decrease in the risk premium. In other words, whilst the sterilization holds the money supply constant, the risk premium has to adjust to keep the money demand constant.

The above example shows that the original model is open to extensions. However, Flood and Marion (1998) also point out that the introduction of a stochastic risk premium into a perfect foresight model must be considered to be an anomaly.

2.1.2. Domestic Debt

In the Krugman-Flood-Garber model, it is the unrealistic assumption of seigniorage financing of the budget deficit that causes the fixed exchange rate regime to come to an end. Calvo (1996) analyzes the implications of the original model under the assumption of financing the budget deficit by domestic borrowing alone.

Assuming that the government debt is of instant maturity and that the government is ready to exchange bonds for cash on a par basis at any time, equation (7) is modified as:

$$\dot{B}_t = \mu + i^* B_t \qquad [13]$$

which is the modified budget constraint of the government. B_t denotes the domestic debt stock. According to this equation, the government finances both the

budget deficit and interest payments by domestic borrowing. Assuming that the initial level of domestic debt is equal to zero ($B_0 = 0$), it is clear that equation (13) cannot hold forever and that, in the end, the government will have to resort to seigniorage. Hence, as in the original model, the speculative attack is inevitable. However, as will be explained below, the timing and the results of the speculative attack are different.

Suppose that, in the event of the attack, the government stops issuing domestic debt and starts to finance the deficit by seigniorage. If we assume that the government pays all its debt to bondholders, who will try to avoid capital loss, there will be no interest payments to be made after the crisis. This means that equation (10) will continue to hold. Thus we can conclude that, in this model, the magnitude of the rise in inflation and the fall in the real money demand caused by the attack are the same as in the original model.

However, the amount of the reserves lost in this model is clearly greater than in the original model, since, in this model, there is no reserve loss before the attack. Finally, Calvo (1996) also shows that in the case of debt financing, the crisis takes place sooner than it does in the original model.

3. Second Generation Models (SGM)

FGM implicitly assumes that governments care for the continuation of their policies (even if they lead to deteriorating fundamentals) more than the preservation of the fixed exchange rate regime. However, as Flood *et al.*, (1996) point out, a government whose absolute priority is the maintenance of the fixed exchange rate regime can succeed at all costs. First, it may try to avoid policies inconsistent with the fixed exchange rate regime. Second, if the attack happens all the same, due to a foreign shock or the change in speculators' expectations, for example, it can drive back the attack by in any case. There is always an interest rate high enough to make the speculators give up the attack. The question is whether the government considers the pursuance of the fixed exchange rate regime to be more important than the output loss caused by the rising interest rates.

After the currency crises in the European Monetary System (EMS) in the early 1990s, it became clear that FGM were unable to explain many features of these crises. For example, in most of these countries the economic fundamentals were quite robust. Most ran modest budget deficits and some even had budget surpluses. Moreover, governments in countries with similar fundamentals reacted to the attacks differently. Some defended their exchange rate regimes by letting the interest rates increase sharply and/or by replacing their depleting reserves with foreign borrowing, but others gave in. These examples show that governments did not play a passive role during the crisis, as is the case in the FGM, but that they reacted to it in different ways reflecting their priorities.

3.1. An Illustrative Model: Unemployment and Currency Crises

Here we demonstrate the main idea behind SGM by an illustrative two-period model by Jeanne (1999). The government maintains the fixed parity in the first period, $E_1 = \overline{E}$, but may devalue in the second period. The unemployment rate in the economy is given by the expectations-augmented Phillips curve:

$$U_2 = \beta U_1 - \alpha(\pi - \pi^e) \quad [14]$$

where U_1 and U_2 are the deviations of the unemployment rate from its natural level in periods one and two, respectively, and π^e is the expected rate of inflation.

Suppose that the government decides whether or not to devalue by minimizing the following loss function:

$$L = (U_2)^2 + \delta C \quad [15]$$

where δ is a dummy variable indicating the policymaker's decision (equal to one if he or she devalues, zero if not), and C is the opting-out cost. The opting-out cost comprises the loss of the advantage of the fixed exchange rate regime and the credibility loss.

The private agents form their expectations of devaluation with either probability zero or probability one. Suppose that the private agents do not expect any devaluation in the second period ($\pi^e = 0$). Then, if the government devalues the currency, the loss function gives:

$$L^D = (\beta U_1 - \alpha\pi)^2 + C \quad [16]$$

If the government does not devalue the currency, the loss function gives:

$$L^F = (\beta U_1)^2 \quad [17]$$

The government decides whether or not to devalue by considering equations (16) and (17). Obviously, the government will choose the case with the minimum loss.

$$L^F > L^D \Rightarrow \frac{C}{\alpha\pi} - 2\beta U_1 < -\alpha\pi \Rightarrow \text{Devaluation is preferred}$$

$$L^D > L^F \Rightarrow \frac{C}{\alpha\pi} - 2\beta U_1 > -\alpha\pi \Rightarrow \text{Fixed exchange rate is preferred}$$

Now suppose that the private agents expect a devaluation in the second period. The loss under devaluation is now:

$$L^D = (\beta U_1)^2 + C \quad (1)$$

and the loss under the fixed exchange rate regime is:

$$L^F = (\beta U_1 + \alpha\pi^e)^2 \quad (2)$$

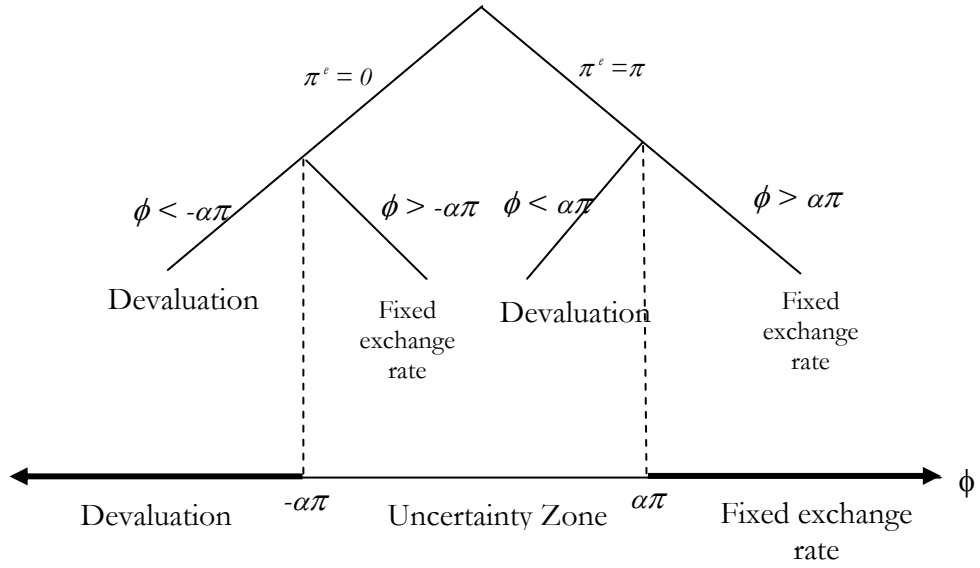
In sum, the decision in the case of the expected devaluation is given by:

$$L^F > L^D \Rightarrow \frac{C}{\alpha\pi} - 2\beta U_1 < \alpha\pi \Rightarrow \text{Devaluation is preferred}$$

$$L^D > L^F \Rightarrow \frac{C}{\alpha\pi} - 2\beta U_1 > \alpha\pi \Rightarrow \text{Fixed exchange rate is preferred}$$

Let us define $\phi = \frac{C}{\alpha\pi} - 2\beta U_1$ and call it the "fundamental variable" of the model. We can summarize the whole model by the help of a tree diagram presented in Figure 2.

Figure 2



As the figure shows, if $\phi < -\alpha\pi$, the government will devalue regardless of the expectations of the private agents. Similarly, whenever $\phi > \alpha\pi$, the government will keep the exchange rate fixed whatever the expectations of the private agents are.

However, in the interval ($-\alpha\pi < \phi < \alpha\pi$), the result depends completely on the expectations of private agents. If the agents expect a devaluation ($\pi^e = \pi$), there will be a speculative attack, and the government will have to devalue; if agents expect no devaluation ($\pi^e = 0$), there will be no speculative attack, and the exchange rate will continue to remain constant. Thus, there are multiple equilibria in this interval.

It is important to note that whether or not the outcome will depend on expectations, depends solely on the value assumed by the fundamental variable ϕ, which plays a similar role as the concept of economic fundamentals plays in the FGM.[7] The condition $\phi > \alpha\pi$ implies that either the cost of abandoning the fixed exchange rate regime (C) is too high and/or the unemployment in the first period (U_1) is very low. Even if the agents expect a devaluation and attack, the government will resist because it is more profitable to keep the exchange rate fixed. In the opposite case where $\phi < -\alpha\pi$, the government will find it to be more profitable to devaluate because either the low opting-out cost is very low and/or the unemployment rate is very high.

[7] Note that the definition of economic fundamentals here is more general than it is in FGM because it comprises even factors like opting-out cost, which are difficult to measure. Jeanne (1999) considers this as an advantage and points out that it enhances the explanatory power of SGM compared to FGM.

If the economy is in the uncertainty zone, a continuos rise in unemployment and/or a continuous fall in opting-out cost (thus, a continuous decrease in ϕ) will cause the economy to enter into the devaluation zone and a currency crisis will occur. Therefore, even in the uncertainity zone, economic fundamentals may play an important role in the dynamics of the crisis.

The analysis so far clearly demonstrates that, contrary to some critiques (e.g., Krugman, 1996), SGM do not ignore or underestimate the role of economic fundamentals during the crisis, but they introduce an additional explanatory factor which is missing in FGM, namely, the expectations held by the agents. If the economy is in the uncertainty zone, a currency crisis can take place even if the economic fundamentals (the value of ϕ) are intact. In this case, it is not the deteriorating economic fundamentals but the shifts in the expectations of the agents (or "animal spirits") that cause the crisis.

3.2. Other Second Generation Models

In the heart of SGM, lies the assumption that governments perform optimizations subject to some constraints. Hence, the models in this genre differ from each other mainly in their specification of loss functions and constraints.

In the previous section, we used an example in which the government's main concern was a rise in the rate of unemployment. In that model, it was the level of unemployment that forced the government to devalue (to increase inflation). Obviously, there can be several other factors that may force the government to give up the fixed exchange rate regime. One such factor is the real domestic debt. Governments may choose to devalue in order to decrease the real value of domestic debt. In this case, the decision of the government is reduced to an optimal taxation problem based on a choice between taxation and seigniorage. De Kock and Grilli (1993), Obsfeld (1994), and Velasco (1996) have considered such an approach. A high level of real domestic debt (just like the high level of unemployment in the above example) leads definitely to a currency crisis. If the level of the domestic debt is in a specific interval, (uncertainty zone) then self-fulfilling attacks and multiple equilibria may occur. Cole and Kehoe (1996) develop a similar model in which the factor affecting the decision of the government is not only the level of domestic debt but also its maturity structure.

Obstfeld (1994) defines the devaluation rate (ε) as an endogenous variable determined by the relationship between inflation and unemployment. This small change in the illustrative model explained in the previous section leads to an interesting result. Remember that, in FGM, the ideal condition for a speculative attack to take place was that the shadow exchange rate exceeds the fixed exchange rate. However, in SGM, this condition is no longer ideal. This is because if the difference between the two rates is sufficiently small, the benefit of devaluation may fall short of the opting-out cost.

In another model, Drazen and Masson (1994) analyze the case in which the private agents do not know the level of the opting-out cost (C). Remember that the greater this cost is, the more resistant the government will be to a speculative attack. If this parameter is known by the private agents, whether or not the economy is in the uncertainty zone, is also known. But, if the private agents do not know this parameter, things get a little more complicated. To see how, consider an increase in the rate of unemployment. This reduces the credibility of the fixed exchange rate regime, because it is known that a higher unemployment rate makes the government more vulnerable. On

the other hand, if the government perseveres in its commitment to the fixed exchange rate regime, this gives the message that the cost of opting-out is too high, and this message will raise the credibility of the fixed exchange rate regime. In such a case, the dominant effect on the credibility of the regime will depend on the parameters of the model.

4. Third Generation Models (TGM)

The crises that took place in the late 1990s in Asia rekindled interest in the currency crises one more time. But, in these crises, two factors that have not been mentioned in FGM and SGM came into the picture: The role of the banking sector and the contagion of crises.

Goldfajn and Valdes (1997) explain the link between the banking crises and the currency crises as follows: Deposits at domestic banks constitute an important part of the domestic assets that investors will attempt to convert into foreign assets in a currency crisis. Thus, a run on the currency is typically associated with a run on the banking system. This relationship makes it clear why the banking system will have a crisis when there is a currency crisis. However, according to Saxena and Wong (1999), during the Asian crisis, the causality ran in the opposite direction; the crisis in the banking sector led to a currency crisis.

Burnside, Eichenbaum, and Rebelo (2001a) support this view. In their model, the government undertakes the possible costs of the banking system implicitly by insuring the deposits at commercial banks. In this setup, an imminent banking sector crisis will signal a huge budget deficit in the future even if the economic fundamentals are currently strong. If the government does not want to increase taxes or reduce its expenditure, there are two ways left to finance the budget deficit: to decrease the level of real domestic debt by inflation (devaluation) or seigniorage. However, both of these policies contradict the fixed exchange rate regime. Under the assumption of perfect foresight, the agents will realize that the government is bound to abandon the fixed exchange rate regime. Thus, they carry out a speculative attack. This model is very similar to the FGM. However, it differs in that it allows the possibility of a crisis even when the economic fundamentals are strong. At the time when people realize that the banking sector will have a crisis, there may be neither a huge budget deficit, nor an increase in money supply. In a way, this model shows that FGM, too, is capable of explaining crises in economies without deteriorating fundamentals.

History has shown that currency crises can be contagious. It can quickly spread not only to neighbor economies but to others that are geographically far away. So, more recent models try to explain this phenomenon as well. The first explanation that comes to mind is that the countries in crisis have similar fundamental weaknesses and/or they are hit by the same foreign shock. Jeanne (1999), however, claims that this is not confirmed on empirical grounds.

Another approach places emphasis on the importance of foreign trade in the process of contagion. If a country devalues its currency due to a crisis, this forces the partners and rivals of that country to devalue their currencies as well. Jeanne (1999) points out that the level of foreign trade between countries does not seem to be high enough to be a primary cause of contagion.

Drazen (1998) provides a different explanation for contagion. A crisis in one of the emerging economies affects the expectations of the foreign investors concerning

other emerging economies in a negative way. This mechanism becomes clearer if the crisis takes place as a result of deterioration in some fundamentals that are difficult to observe or measure. As an example for such fundamentals, Drazen (1998) mentions the problems in the banking sectors of the Asian countries. Neither the nature of the relationship between the banks and the firms, nor the problem in the regulation of the banking system is easy to observe. Any crisis caused by such bad fundamentals may lead the foreign investors to expect similar problems in the fundamentals of similar countries. As one might guess, this approach is similar to SGM. Changes in the expectations of the investors lead to speculative attacks if the economic fundamentals of the economy are weak enough.

Kaminsky and Reinhart (1999) classify the models on the links between banking and currency crises into three groups. In the first group, the chain of causation runs from the balance of payments problems to the banking crisis. Under a fixed exchange rate regime, an external shock, such as an increase in foreign interest rates, will result in the loss of reserves leading to a credit crunch, increased bankruptcies, and financial crisis. As Mishkin (1996) points out, if devaluation occurs, the position of banks could be weakened further if a large share of their liabilities is denominated in foreign assets.

The second group of models point to a causal direction in the opposite way. When central banks finance the bailout of troubled financial institutions by printing money, we return to the basic FGM story of a currency crisis caused by excessive money creation.

The third group asserts that currency and banking crises have common causes. They stress the fact that exchange rate based stabilization programs have well-defined dynamics. Because inflation converges to international levels only gradually, the real exchange rate appreciates considerably. The appreciating currency and the economic boom in the early stages of the program cause the current account deficit to widen. This undermines the credibility of the program and causes an attack against the domestic currency. Since the boom is usually financed by a surge in bank credit, as banks borrow abroad, the resulting capital outflows lead to a collapse of the banking system.

The models summarized in this section can be classified as TGM. Jeanne (1999) points out, however, that these models should be considered only as extensions to FGM and SGM because they do not offer a new approach but try to explain the recent developments using the same theoretical framework.

5. A Brief Overview of the Twin Crises

Inflation has been the main issue in the Turkish economy starting in the 1980s, so several disinflation programs supported by the International Monetary Fund (IMF) have been employed accordingly.[8] After many disappointments, a pre-announced crawling peg exchange rate policy was adopted starting in December 1999. It was called pre-announced, because according to this disinflation program, the timing and the degree of the exchange rate widening would be pre-announced. This pre-announcement was seen as the most important strength of the program.[9]

In order to support the disinflation program, several reforms have also been achieved in the banking sector. This, together with the borrowing strategy of the government from abroad, led interest rates to fall significantly. In other words, the

[8] See Akay and Yilmazkuday (2008).

[9] See Akyuz and Boratav (2002), Ozatay and Sak (2002).

following mechanism was in effect as the Central Bank was committed not to engage in sterilization:

$$R_{DOLLAR} < R_{TL} \quad \rightarrow \quad \text{capital inflow} \quad \rightarrow \quad S_{DOLLAR} \uparrow \quad \underset{CB}{\rightarrow} \quad M^S \uparrow \quad \rightarrow \quad i \downarrow$$

After some time, the Turkish economy became dependent on the capital inflows. So, everything should have been perfect as long as the foreign capital was kept in the economy. However, the problems in the banking sector didn't let this happen. Despite the regulatory reforms in the banking sector, there were still two more sources of the problem: 1) The private banks had been financed from abroad, thus they were open to exchange rate risks; 2) The state banks had high duty loss values, so they were open to interest rate risk. For instance, Demirbank, which was one of the private banks in Turkey, had an extremely risky position in that it had a substantial government securities portfolio, financed through short-term borrowing from international money markets. When Demirbank had liquidity problems, in order to not exceed the IMF ceilings on net domestic assets, the Central Bank did not lend to Demirbank. Since Demirbank could not borrow from the market or the Central Bank, it started selling government bonds at lower prices, thus at higher interest rates. This, in turn, gave rise to capital outflows and thus a decrease in the Central Bank reserves. This process continued with enormous interest rates, such as 800 percent on December 2000, and ended up with having and an additional 7.5 billion dollars of IMF loans to support the on-going program.

Although the short-lived crisis at the end of 2000 was eliminated, dependency on the short-term capital flows and the vulnerability of the banking sector signaled the possibility of a new crisis. Unless the foreign direct investment would enter the Turkish economy, the disinflation program would fail as before. The realization of this scenario was inevitable, especially after the political crisis between the Prime Minister and the President in February 2001. This political crisis hit the market in a devastating way. First of all, the liquidity problem came into the picture. Second, the official reserves of the Central Bank fell down dramatically. As a result, the interest rates were up to around 4000 percent in annual terms.[10] The only remaining policy for the authorities was to abandon the fixed exchange rate in this economic environment. The government acted accordingly, which resulted in forty percent devaluation against the U.S. dollar. This whole process caused inflation to reach above one hundred percent (in annual terms) in both March and April 2001.

6. Analysis of the Twin Crises

The novelty of the exchange rate regime that was launched in December 1999 was that both the exit strategy and the date of exit were publicly known at the very beginning of the program. It was announced that after eighteen months, the exchange rate would be allowed to fluctuate in a continuously widening band. What caused a sky-high overnight rate, as much as 6200 percent in uncompounded terms, and a huge decline [11] in foreign exchange reserves of the Central Bank on February 23, 2001, just four months before the exit day, and the exchange rate system to collapse and the Central Bank to declare that it would allow the exchange rate to float freely? We gave a brief answer to this question; but now, we will analyze the characteristics of the crises,

[10] See Ertugrul and Selcuk (2001).

[11] As a result of the attack, the Central Bank lost almost 20 percent of its foreign exchange reserves while the average overnight rate jumped to 873 percent again in uncompounded terms.

and investigate whether or not they can be explained by using any of the currency crisis models that we introduced earlier.

First, we will investigate whether the twin crises can be explained by using first generation models (FGM). It is shown by Ozatay and Sak (2002), the budget deficit was not financed by the Central Bank resources in the period preceding the crisis. That is, the central element of the first generation models was not on the stage. Moreover, just two days before the burst of the turmoil, which was on November 17, 2000, the reserve level was 24.4 billion dollars. Hence, in the periods preceding the crisis, prerequisites of the FGM were absent. Namely, public sector borrowing requirements were never met through the Central Bank resources and there is no evidence that the crisis had been expected long before its occurrence.

We showed that the twin crises in Turkey cannot be explained by FGM. But, what about the extensions of FGM? Remember in the original model of FGM, the cause of the crisis was the critical amount of the reserves. However, in Calvo's (1996) model, the reserves are constant during the fixed exchange regime. Here, continuously increasing domestic debt makes the individuals question whether the debt will be paid back by the government. Realizing that the paying back is possible only in the case of seigniorage, the individuals begin to expect inflation (thus devaluation), and as in the original model, the speculative attack starts.

Calvo's model shows that if the government finances its budget deficit by borrowing instead of printing money, the economy will experience the same level of inflation at an earlier time and the Central Bank will lose more reserves. Thus, the government can only mask the loss of reserves, but the individuals realize the possible results of this policy via perfect foresight. In the end, the government is the one that loses. Thus, we can conclude that the twin crises in Turkey can *partly* be explained by Calvo's model, which is an extension of the FGM. Since the expectation of inflation can be partly explained by second-generation models (SGM), which explains the crises by the expectation about it, we can also conclude that SGM are explanatory for the twin crises. But, can these models explain the banking crisis, which is the other part of the twin crises?

Partly explaining the twin crises by such models does not change the fact that the fiscal fundamentals in 2000 in isolation were indeed weak. Moreover, in the five-year period preceding the crisis, the macroeconomic fundamentals of the last two years were the worst. Furthermore, as we explained before, in the period preceding the crisis, an open foreign exchange position was a structural feature of the Turkish banking system. Maturity mismatch was another structural feature of the banking system in Turkey due to the inability of domestic banks to borrow long term in the domestic currency.

The banking sector problem in Turkey was basically a result of a mechanism chosen to finance a very high public sector borrowing requirement. First, this led to an increase in government debt instruments especially in balance sheets of private banks. Second, it caused a significant deterioration in state-owned banks by accumulating duty losses. Risk accumulation in bank balance sheets in order to carry the domestic debt stock, looks to be an important element to understand crisis dynamics. When due to excessive risks accumulated in the balance sheets, credit lines to some banks that were acting as market makers in the government debt instruments market were cut off, the banking sector problem turned into a debt rollover problem increasing interest rates. The rise in interest rates turned the problem into a debt sustainability issue directly making rollover impossible. Based on the above discussion, we can say that the Turkish

financial system, which was dominated by banks, was vulnerable to a jump in both the exchange rate and interest rate that a sudden capital reversal could cause (Ozatay and Sak, 2002). Despite the similarities, the Turkish crises have some features that do not fit in the third-generation models. Most notable of them is the high budget deficit, which is mainly financed by domestic and foreign debt.

Nevertheless, we can find more similarities between the Turkish crises and one of the TGM classifications of Kaminsky and Reinhart (1999). According to their definition, exchange rate based stabilization programs have well-defined dynamics. Because inflation converges to international levels only gradually, there is a marked cumulative real exchange rate appreciation. Also, at the early stages of the plan there is a boom in imports and economic activity, financed by borrowing abroad. As the current account deficit continues to widen, financial markets become convinced that the stabilization program is unsustainable, fueling an attack against the domestic currency. Since the boom is usually financed by a surge in bank credit, as banks borrow abroad, when the capital inflows become outflows and asset markets crash, the banking system caves in. It is also modeled to how financial liberalization together with microeconomic distortions such as implicit deposit insurance can make boom-bust cycles even more pronounced by fueling the lending boom that leads to the eventual collapse of the banking system.

We can say that Kaminsky and Reinhart's (1999) definition of TGM almost exactly explains the twin crises in Turkey. However, in Turkey, in addition to their TGM definition, there occurred a political crisis between the president and the prime minister, which led to worsening economic expectations of the investors. Thus, there are also some clues that indicate the possibility of SGM. Moreover, remember that according to some economists, TGM are only extended combinations of FGM and SGM. We can clearly realize this fact by taking into account the factors that led to the crises in Turkey: high budget deficit, the role of expectations, and the banking sector. The first two of these factors play a crucial role in FGM and SGM, but they are also the key features of TGM. Thus, we can conclude that the twin crises in Turkey can be explained by using a combination of each of the three models, namely FGM, SGM, and TGM.

7. Conclusions

We attempted to summarize the recent theoretical models that try to explain the currency crises in the world. We first analyzed first generation models (FGM). These models were not only the first attempt to explain the currency crises, but also have shown that the main reason for the currency crises was the deteriorated economic fundamentals, opposed to the view that they occurred because of the changes in speculative expectations. Although FGM are old fashioned, most of the recent economists still use FGM in order to explain the dynamics of the currency crises.

After that, we analyzed both second generation models (SGM) and third generation models (TGM). As opposed to FGM that focuses on the deteriorated economic fundamentals, SGM gives more importance to the government that is responsible for giving the optimal decision under variable economic conditions. Through this new approach, SGM has shown that the currency crises were due not only to deteriorated economic fundamentals, but also to sudden shifts of the private agents. Thus, SGM is able to explain the currency crises that were not able to be explained by FGM. The point here is that SGM can shed light on the crises that occur even when there is nothing wrong with the economic fundamentals. However, the deficiency of

SGM is that they cannot include the expectations component into the model in a satisfactory way. Relating the currency crises to expectations of which reasons are not known means that the main motivations of crises are not known.

TGM are the final contributions to the theory. TGM, which emerged after Asian crises, are the models that try to model the relationship between banking and currency crises by using the concept of contagion. But since these models are so close to FGM and SGM in a general way, most economists claim that it is a mistake to call these models TGM. To conclude, the competition among FGM, SGM, and TGM still continues. Nevertheless, it is clear that the models, which can explain the currency crises that will be experienced in the future, will be the winner of this competition.

After reviewing theoretical literature, we analyzed the twin crises in Turkey (2000, 2001). We focused on the background and the occurrence of the crises. First, we presented a brief overview of the crises and mentioned the main characteristics of the Turkish economy during the crises. In this sense, we emphasized the importance of an exit strategy, the role of the interest rate as the main political tool, the liquidity crisis of the banking sector (both private and state-owned), the dependency on the short-term capital flows, and the political crisis between the president and the prime minister.

Following the overview of the crises, we attempted to find out the similarities between the twin crises in Turkey (2000, 2001) and the models that had been developed in order to explain preceding crises in the world. We concluded that the twin crises in Turkey cannot be explained by using any individual generation of models. Instead, a combination of three generations of models, namely FGM, SGM, and TGM, is more appropriate to explain the details of the twin crises.

References

Akay, K. (2004), 'Para Krizi Teorileri: Kusaklararasi Bir Karsilastirma', in Akgul H. and Aral F. (eds), *Gulten Kazgan'a Armagan*, Istanbul Bilgi Universitesi Yayinlari, 79, Istanbul.

Akay, K., Yilmazkuday, H. (2008), 'An Analysis of the Turkish Economy under Regime Shifts', *Economic Modelling*, forthcoming.

Akyuz, Y., Boratav, K. (2001). *The Making of the Turkish Financial Crisis*, mimeo.

Burnside, C., Eichenbaum, M., Rebelo, S. (2001a), 'Prospective Deficits and the Asian Currency Crisis,' *Journal of Political Economy*, 109: 1155-1198

Burnside, C., Eichenbaum, M., Rebelo, S. (2001b), 'Hedging and financial fragility in fixed exchange rate regimes', *European Economic Review*, 45: 1151–1193.

Burnside, C., Eichenbaum, M., Rebelo, S. (2004), 'Government guarantees and selffulfilling speculative attacks', *Journal of Economic Theory*, 119: 31–63

Calvo, G.A. (1996), *Varieties of Capital-Market Crises*, mimeo.

Calvo, G.A., Vegh, C.A. (1999), 'Inflation Stabilization and Bop Crises in Developing Countries,' *NBER Working Paper Series*, 6925

Caramazza, F., Ricci, L, Salgado, R. (2004) 'International financial contagion in currency crises', *Journal of International Money and Finance*, 23(1): 51-70

Cole, H.R., Kehoe, T.J. (1996), 'Self-fulfilling Debt Crises,' *Journal of International Economics*, 41: 309-30

Corsetti, G., Mackowiak, B. (2006), 'Fiscal imbalances and the dynamics of currency crises', *European Economic Review*, 50: 1317–1138

De Kock, G., Grilli, V. (1993), 'Fiscal Policies and the Choice of Exchange Rate Regime,' *The Economic Journal*, 103: 347-58.

Drazen, A. (1998), *Political Contagion in Currency Crises*, mimeo.

Drazen, A., Masson, P.R. (1994), 'Credibilities of Policies versus Credibilities of Policymakers,' *Quarterly Journal of Economics*, 109: 735-54.

Ertugrul, A., Selcuk, F. (2001). 'A Brief Account of the Turkish Economy: 1980-2000', *Russian and East European Finance and Trade*, 37, No.6.

Flood, R., Garber, P. (1984), 'Collapsing Exchange-Rate Regimes, Some Linear Examples,' *Journal of International Economics*, 17: 1-13.

Flood, R., Garber, P., Kramer, C. (1996), 'Collapsing Exchange Rate Regimes: Another Linear Example,' *Journal of International Economics*, 41: 223-34.

Flood, R., Marion, N.,.(1998), 'Perspectives on the Recent Currency Crises Literature,' *NBER Working Paper Series*, 6380.

Goldfajn, I., Valdes, R. (1997), 'Capital Flows and the Twin Crises: the Role of Liquidity,' *International Monetary Fund Working Paper* No. 97/87.

Graciela L. K., Reinhart, C.M., Carlos A. Vegh, (2003), 'The Unholy Trinity of Financial Contagion', *Journal of Economic Perspectives*, 17(4): 51–74

Jeanne, O. (1999), 'Currency Crises: A Perspective on Recent Theoretical Devlopments,' Centre for Economic Policy Research, *Discussion Paper* No.2170.

Kaminsky, G., Reinhart, C.M. (1999), 'The Twin Crises: The Causes of Banking and Balance of Payment Problems,' *American Economic Review*, 89(3): 473-500.

Kodres, L., Pritsker, M. (2002), 'A Rational Expectations Model of Financial Contagion.' *Journal of Finance*, 57(2): 769–800.

Krugman, P. (1979), 'A Model of Balance-of-Payments Crises,' *Journal of Money, Credit and Banking*, 11: 311-25.

Krugman, P. (1996), 'Are Currency Crises Self-fulfilling?,' *NBER Macroeconomics Annual* (Cambridge: MIT Press): 345-78.

Lahiri, A., Végh, C. (2003), 'Delaying the inevitable: interest rate defense and BOP crises', *Journal of Political Economy*, 111: 404–24.

Leila, A., Kestens, Y. (2006), 'Contagion and Crises Clusters: Toward a Regional Warning System?', *Journal Review of World Economics*, 142(4): 814-839.

Mishkin, F. S., (1996), 'Understanding Financial Crises: A Developing Country Perspective', *NBER Working Paper*, 5600

Neal, L., Weidenmeir, M. (2002), 'Crises in the Global Economy from Tulips to Today: Contagion and Consequences.' *NBER Working Paper*, 9147.

Obstfeld, M. (1994), 'The Logic of Currency Crises,' *Cahiers Economiques et Monetaires*, 43: 189-213

Ozatay, F., Sak, G. (2002). *The 2000-2001 Financial Crisis*, mimeo.

Pasquariello, P. (2007), 'Imperfect Competition, Information Heterogeneity, and Financial Contagion', *Review of Financial Studies*, 20(2): 391-426

Pesaran, M.H., Pick, A. (2007), 'Econometric issues in the analysis of contagion', *Journal of Economic Dynamics and Control*, 31(4): 1245-1277

Ozkan, F.G. (2003), 'Currency and Financial Crises in Turkey 2000-2001: Bad Fundamentals or Bad Luck?,' mimeo.

Saxena, S.C., Wond, K., (1999), *Currency Crises and Capital Controls: A Selective Survey*, mimeo.

Tai, Chu-Sheng (2004), 'Can bank be a source of contagion during the 1997 Asian crisis?', *Journal of Banking and Finance*, 28(2): 399-421

Uygur, E. (2001), 'Krizden Krize Turkiye: 2000 Kasım ve 2001 Subat Krizleri,' *Turkiye Ekonomi Kurumu, Tartısma Metni*, No: 2001/1.

Velasco, A. (1996), 'Fixed Exchange Rates: Credibility, Flexibility and Multiplicity,' *European Economic Review*, 40: 1023-35.