A NEW APPROACH TO THE THIRD GENERATION CURRENCY CRISIS MODELS: AN APPLICATION FOR TURKEY

TUFAN BAYRAK

BOĞAZİÇİ UNIVERSITY

2022

A NEW APPROACH TO THE THIRD GENERATION CURRENCY CRISIS MODELS: AN APPLICATION FOR TURKEY

Thesis submitted to the
Institute for Graduate Studies in Social Sciences
in partial fulfillment of the requirements for the degree of

Master of Arts
in
Economics

by
Tufan Bayrak

Boğaziçi University
2022

DECLARATION OF ORIGINALITY

I, Tufan Bayrak, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution;
- this thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
- this is a true copy of the thesis approved by my advisor and thesis committee at Boğaziçi University, including final revisions required by them.

Signature: .....

Date: .....

ABSTRACT

A New Approach to the Third Generation Currency Crisis Models: An Application for Turkey

Since the 1980s, three currency crisis models have emerged to explain the formation of currency crises and define the appropriate policies. The purpose of this study is to summarize the first and second generation crisis models and then expand the third generation crisis models by proposing an original model incorporating export, imported intermediate goods, and risk premium variables to the model of Philippe Aghion, Philippe Bacchetta and Abhijit Banerjee (2001), which is one of the most critical studies in the literature. In this context, the model allows for the effects of changes in exchange rates on exports, importation of intermediate goods, short-term external debt, and the risk premium. The obtained results imply that a decrease in interest rate would be optimal in the case of high level and/or elasticity of exports. However, an economy with a high level of intermediate goods importation and/or foreign debt should implement a higher interest rate policy. An empirical analysis conducted by using the related data of the Turkish economy to test the effectiveness of the model and the recommended policies. The regression results show that the created model is not very suitable for the data of Turkey between 1994-2019.

ÖZET

Üçüncü Jenerasyon Döviz Krizi Modellerine Yeni Bir Yaklaşım: Türkiye Uygulaması

1980'lerden bu yana, döviz krizlerinin oluşumunu açıklamak ve uygun politikaları tanımlamak için üç döviz krizi modeli ortaya çıkmıştır. Bu çalışmanın amacı, birinci ve ikinci nesil döviz kriz modellerini özetlemek ve ardından literatürdeki en kritik çalışmalardan biri olan Philippe Aghion, Philippe Bacchetta ve Abhijit Banerjee (2001) modeline ihracat, ithal ara malı ve risk primi değişkenlerini içeren özgün bir model önererek üçüncü nesil kriz modellerini genişletmektir. Bu bağlamda model, döviz kurundaki değişimlerin ihracat, ara malı ithalatı, kısa vadeli dış borç ve risk primi üzerindeki etkilerine izin vermektedir. Elde edilen sonuçlar, yüksek ihracat seviyesi ve/veya esnekliği durumunda faiz oranındaki düşüşün optimal olacağını göstermektedir. Ancak, ara malı ithalatı ve/veya dış borcu yüksek olan bir ekonomi daha yüksek faiz politikası uygulamalıdır. Modelin ve önerilen politikaların etkinliğini test etmek için Türkiye ekonomisinin ilgili verileri kullanılarak ampirik bir analiz yapılmıştır. Regresyon sonuçları oluşturulan modelin Türkiye'nin 1994-2019 yılları arasındaki verilerine çok uygun olmadığını göstermektedir.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincere gratitude to my advisor, Tolga Umut Kuzubaş, who has always guided me in my work and helped me find solutions to move forward. It was an honor and an invaluable opportunity for me to do my thesis under his guidance. Also, with the honor of being a graduate of Boğaziçi University, I would like to thank all my professors who allowed me to acquire theoretical and practical knowledge during my studies. I am also grateful to my committee members, Murat Koyuncu and Mehmet Oğuz Karahan, for accepting to participate in my thesis defense and for their insightful comments.

Next, I would like to thank my parents, Ömür and İsmet, and my bother Çağdaş, for being behind me at every moment of my life and always supporting me under all circumstances.

A special thanks go to Ayşe Arpa, who supported me throughout this work and facilitated this process. The importance of her support is more than I can express in words. Additionally, endless thanks to Emre Kösemen and Defne Sandıkcıoğlu, who made my work easier with their knowledge and support whenever I fell into difficulties. Lastly, I would also like to thank Ezgi Öziş and Emirhan Aldinç, who listened to me without getting bored, for their patience.

I would like to thank the Scientific and Technological Research Council of Turkey (TÜBİTAK) BİDEB for their financial support via the 2211 Master's Scholarship Program.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

When we look at the historical course of economic crises, we can go back to the 17th century. Although we know that there have been crises before, these were usually agricultural crises caused by climate and transport conditions. From the nineteenth century, the world economy began to globalize, and as a result, a crisis in one country started to affect other countries. In particular, many countries that have adopted a fixed exchange rate regime have been attacked against national currencies. In this context, many studies have been conducted to reveal preventive and solvent policies.

Due to the crises of the European Monetary System (1992-1993), the Mexican economy (1994), the Asian economies (1997), the Turkish economy (2001), and many other economic crises at different times, the analysis of currency crises have become a crucial subject. Studies that analyzed the causes of crises and their processes as a phenomenon, which suddenly emerges and leads to great negativity in economies, have made significant progress alongside contributions made over time. The resulting full scans have been bundled into themselves. Thus, the first, second, and third generation crisis models have been developed.

Studies on monetary crises began with Krugman (1979) and P.Flood and M.Garber (1984). These studies are now known as first generation models. In these studies, which describe the Latin American crises of the 1970s and early 1980s, the scenario is very similar: to fill the budget deficit, reserves are depleted and the fixed exchange rate system collapses.

The first generation crises occur due to the inconsistency between the applied policies and the fixed exchange rate system. Unlike the first generation models, the second generation models focus on investors' expectations in the presence of monetary and fiscal policies compatible with a fixed exchange rate. If the idea of an increase in the exchange rate in the near future has started to spread in the society,

people will start converting their money into foreign currencies, which will put pressure on the Central Bank. In this case, self-fulfilling crises occur.

Since the first and second generation models could not explain or predict the crisis in Southeast Asia, the third generation crisis models were needed. Financial crisis models developed as a result of the Southeast Asian crisis consist of real and basic financial imbalance models.

The definition of currency crisis is one of the essential differences among works. While some studies describe the depreciation of the domestic currency above a certain level as a currency crisis, the others state that this approach is insufficient, so it is more appropriate to use an index that is a combination of the exchange rate, interest rate and foreign reserve amount. Thus, the use of the second method can also describe the pressure prevented by interest rate policies and reserve selling interventions as a currency crisis.

This work is an extension of third generation crisis models in order to study the causes of the crisis and the monetary policies that should be applied. The first part of this work takes into account the share of the export sector, the amount of imported intermediate goods, the level of the risk premium, and the cost of external borrowing. In the second part of the study, an empirical study will be conducted using the data of the Turkish economy between 1994 and 2019. The explanatory power of the model for the exchange rate movements in Turkey will be analyzed.

Export plays an essential role in the national economy. When increased exporting occurs, factor productivity in the economy increases, gains from economies of scale and positive externalities rise, and production costs decrease in the export sector. Therefore, the increase in total exports in the country along with the increase in the amount of labor and capital in the country has an effect on the economic growth of a country. If the share of export earnings in a country's GDP is large, any fluctuation in export earnings will greatly affect the total output. Due to this export effect, changes in the export sector also gain importance during times of currency crises.

On the other hand, the ratio of imported goods that are used in the production process is another aspect of the topic since the most of emerging economies are dependent on foreign goods as a common feature. In such cases, the gain provided by the depreciation of the domestic currency through exports may decrease or even disappear completely. For these reasons, both the quantity and flexibility of foreign trade actors should be included in crisis modeling studies.

Moreover, risk premia also provide information on the adequacy of credit used by the country, companies, or institutions to pay creditors. As a country's risk increases, risk premiums generally increase. Risk premiums provide information that can change daily depending on market conditions. The exchange rate is also a macroeconomic indicator offering variable information on a daily basis. As a result of research, the volatility of the value of the national currency is an effective factor for the country's risk premia. Changes in the risk premium will drive the inflow or outflow of capital and effectively contribute to improving the economic situation or worsening the crisis. Because of these reasons, exportation, imported intermediate goods, and risk premium factors must be added to the third generation crisis models.

The rest of the paper is organized as follows: Section 2 presents the studies in the literature, while Section 3 examines the new structure of the model and proposes appropriate monetary policy recommendations. In Section 4, the validity of the created model will be questioned for the Turkish economy by looking at the data from 1994 to 2019.

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical studies

Currency crises, as nightmares of both developed and developing countries for decades, have attracted many relevant researchers' attention. Since these periods of crises might have devastating effects on economies, many studies have been created with different approaches. These studies have provided extensive literature on the causes, timing, and consequences of crises. In this context, it must be talked over the existence of three generations of models of currency crises - first, second and third - in the literature.

The arguments of the first two generation models, which are totally focused on the crisis economies that have fixed or heavily managed exchange rate regimes, fundamentally come from the impossible trinity idea which is also called as the holy trinity or trilemma. As represented in Figure 1, this principle points out that it is not possible for any economy to have free capital mobility, monetary autonomy, and a fixed exchange rate regime synchronously. If an economy has fixed exchange rate regime and does not have any intervention on capital market, there would be no monetary independence for it. Similarly, if this economy tries to manage the exchange rate and wants to have monetary autonomy, free capital mobility is not an achievable economic goal. Finally, if the economic authorities aim to have monetary autonomy and free capital market, they would have to let the exchange rate float. Since the third generation currency crisis models allow a floating exchange rate regime, it is not possible to talk about the existence of the holy trinity.

The remaining part of this section briefly introduces these types of crises and then gives related examples for each one in history.

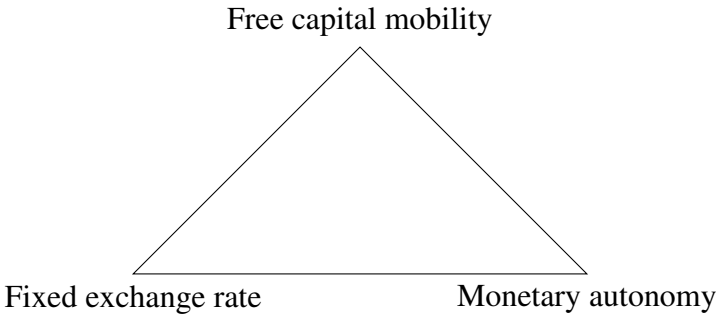


Figure 1. The impossible trinity

2.1.1 First generation currency crisis models

The first generation models (also known as canonical crisis models), pioneered by Krugman (1979) and exemplified thanks to much cleaner paper by P.Flood and M.Garber (1984), put forward an idea which implies that the reason behind the emergence of a currency crisis is the incompatibility between internal and external economic policies. At this point, internal economic policies indicate fiscal deficit, growth, and inflation; whereas, external policies refer to policies related to current account balance and exchange rate.

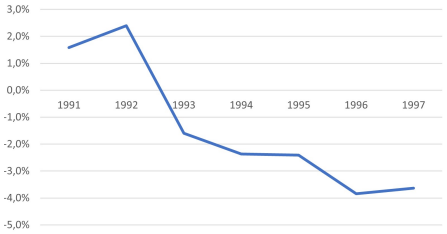
A fixed exchange rate regime forces the authorities to adopt a money supply path in accordance with a rule that satisfies the sustainability of the regime which has been implementing. However, this practice does not leave much policy space for governments with substantial budget deficits. Since depleting reserves and borrowing are not permanent solutions, if the problems cannot be solved with these short-run recipes, governments have to start creating money to close this deficit.[1] The participation of the rational individuals, who observe that exchange rate and money supply policies are inconsistent, accelerates exhaustion of reserves by buying foreign currency and increasing the pressure on domestic currency even more. This process leads to a collapse of the fixed exchange rate regime. Therefore, it is necessary to underline the fact that the monetary authorities' contradictory economic policies are

[1] Despite the fixed exchange rate regime; the budget deficit, which generally exceeds 8-10% of GDP, is financed by the increase in domestic credit which results in the gradual decline of reserves (Saxena, 2004).

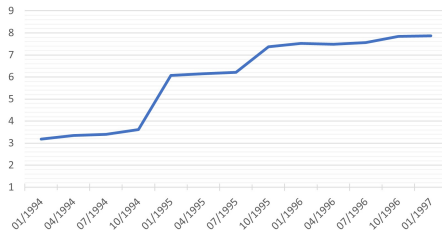
the main factor in the abandonment of the fixed exchange rate regime and thus in the formation of the first generation currency crisis models. One of the most important property of the models that are created with this approach is that, since the main problem of these periods is the incapableness of some principal variables, they give an opportunity to make an inference about the timing of the crisis thanks to the observation of the mentioned macroeconomic data. Government budget deficit, money demand, exit rule from fixed exchange rate regime, and purchasing power parity (PPP) are the main critical variables used in the first generation crisis modeling and thus in timing estimation.

The Mexican crisis in 1994-1995 can be considered as the most obvious example that can be explained by the first generation crisis models. 1994 was a politically turbulent year for Mexico due to the peasant insurgency and the murder of the incumbent party's Presidential candidate (Babić & Žigman, 2001). This chaotic environment is followed by an opportunistic political business cycle before the general election.[2] In order to impress short-sided voters, the Mexican government decided to implement expansionary monetary and fiscal policies. The graphical representations of some economic variables in Figure 2 display the situation in the Mexican economy before, during and after the political and economic deteriorations. Firstly, Figure 2(a) demonstrates the effect of increased government expenditures on fiscal deficit. The fiscal surplus of the early 90s turns into a fiscal deficit as of 1993 due to expansionary government spending. In addition, all these events caused a fall in capital inflows and thus a sharp decrease in reserves. Since the process was not sustainable anymore, the authorities declared 15% devaluation of the Mexican peso against the dollar right after the election. As we can see from Figure 2(b), this relatively small depreciation provoked a lack of confidence in the Mexican economy; thus, dollar-peso parity doubled in the first quarter of 1995. In response to this sharp depreciation of the domestic currency, the Mexican government increased the interest rate, which had been floating between 10% and 20% for a while, to almost 75% in a

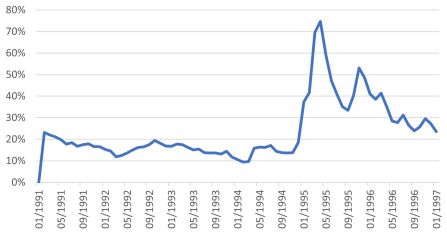
[2]For a detailed explanation of political business cycles, see Nordhaus (1975).



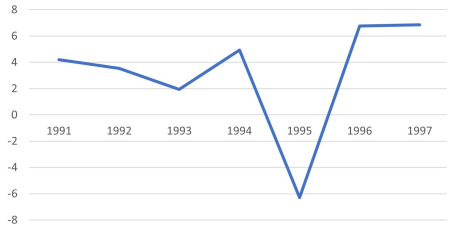
(a) Mexico's fiscal deficit between 1991 and 1997



(b) Increase of US dollar-Mexican peso parity from 1994 to 1997



(c) Mexico Interest Rate



(d) GDP growth of Mexico

Figure 2. Mexican economy before, during and after the 1994-1995 crisis

short time. Figure 2(c) shows this sudden rise and then the fluctuating decrease of interest rate over the years. As a result, all these processes caused a decline in real GDP by 7% in 1995. The problems were overcome with the assistance of the United States, and 1996 was a year of growth again for the Mexican economy. Figure 2(d) shows the growth trend of the Mexican economy, which had a V-shaped recovery in the mid-90s, shrank by more than 6% in 1995 but started to grow again from the following year.

2.1.2 Second generation currency crisis models

The crises that occurred in Chile and Argentina in the 1980s and the 1992 European Monetary System crisis were beyond the predictions of the first generation models. These crisis economies had enough reserve levels to combat pressure contrary to the requirement of previous works. Thus, the desire to explain these crises and put them on a basis led to the creation of second generation crisis models which is best represented by Obstfeld (1996).

It cannot be said that these economies were neither weak as cases that were explained by the first generation models nor strong enough to withstand the speculative attack. Even though there are no contradictions between economic policies, changes in expectations about the future of exchange rates may cause a speculative attack and trigger a crisis. This is why these are also called as "self-fulfilling" crises. The crux of these approaches is that the central bank has to make a maximization based on a benefit-cost comparison of exchange rate policy continuity and if the social cost exceeds the benefit, the exchange rate target cannot be sustainable anymore. Obstfeld (1996) tries to explain this situation by handling the central bank's problem as minimizing its quadratic loss function and he indicates that if unemployment and recession have a significant share in the economy, the policymakers will declare the devaluation or abandonment of the fixed exchange rate policy. The key factor suggested by this approach is that agents' suspicion about the central bank's decision may create multiple equilibria, making the economy vulnerable to speculative attacks even if economic policies have the power to ensure the sustainability of the exchange rate regime. Therefore, the interaction between central bank and investors is the focal point for the second generation currency crisis models.

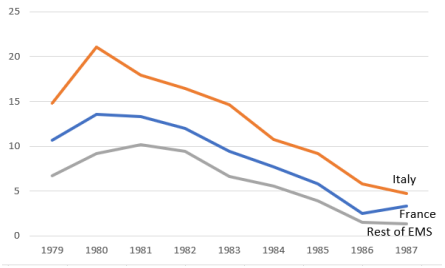
As the best example, we can observe what happened in European Monetary System (henceforth it will be referred as EMS) in 1992. Up to this date, there were only the first generation models that explain the reasons and the process of the crises, but this was different since the problems demonstrated by previous models were not observed. EMS was established[3] in 1979 to regulate exchange rates, high inflation, and unemployment rates among European countries. Thus, it consists of 3 steps:

- As the objective, the convergence of economic performance and cooperation on monetary and budgetary policies plus the elimination of all restrictions on the movement of capital were aimed.

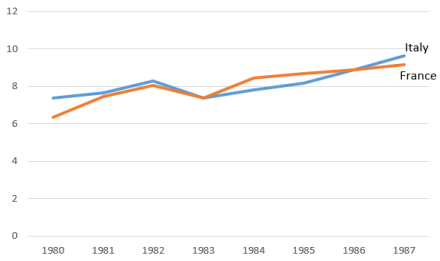
[3]The founding members of EMS are France, Denmark, Belgium, Luxembourg, Ireland, Netherlands, Germany and Italy. England joined the system in 1990, but left in 1992 due to problems caused by the crisis.

- Maastricht criteria,[4] which must be fulfilled by member countries, were determined.
- It was aimed to establish the European Central Bank and monetary union no later than 1999.

The volatility band of 2.25% against the dollar was given for the currencies of the countries affiliated with this system. In addition, they created a currency called the European currency unit (ecu), which was never used in real life, only as a means of payment between central banks. In this way, it was aimed to determine the exchange rate and the reserve amount of the member countries. They planned to reduce the exchange rate volatility and ensure monetary stability thanks to the exchange rate mechanism established. As shown in Figure 3(a), the crucial problem between 1979 and 1987 was higher inflation in France and Italy compared to the rest of the member countries. During this period, the low inflation rate in Germany caused high unemployment rates in the aforementioned countries. Figure 3(b) also represents high unemployment rates accompanied by high inflation for these two European economies.



(a) Inflation rates of EMS countries between 1979 and 1987

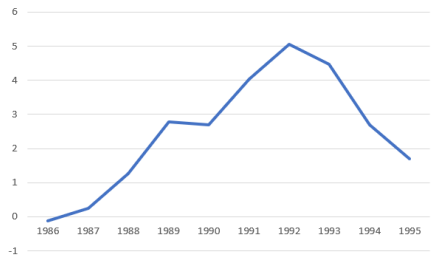


(b) Unemployment rates in France and Italy between 1979 and 1987

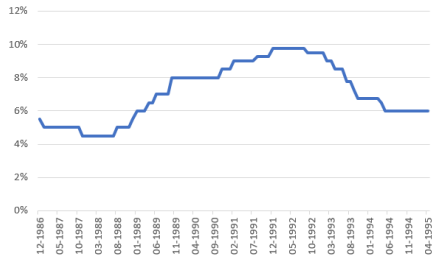
Figure 3. Economic problems for France and Italy between 1979 and 1987

[4]There were mainly four requirements: Low inflation (the inflation rate must not be more than 1.5% higher than the average of the three best performing member countries), low interest rates (the long-term interest rate must not be more than 2% above that of the three best performing member countries), stability of exchange rates (for at least two years, there must not be any devaluation on domestic currency against any member's currency) and sound public finance (the government deficit must not exceed 3% of GDP and the public debt must not exceed 60% of GDP).

In 1990, upon the reunification of Germany, one East German mark was equaled to one West German mark. This equalization directed the people of West Germany, who had to keep their money in the bank for years, to spend very high levels, thus increased the price levels and inflation. The impacts of this new period on inflation and on interest rate are given graphically in Figure 4(a) and Figure 4(b), respectively.



(a) The effect of reunification on inflation in the German economy



(b) Interest rates in Germany before, during and after the reunification.

Figure 4. Inflation and interest rates in the German economy

The German government used high interest rate as a policy response to high inflation and started rate cuts until 1993, but decided not to make any further rate cuts since unemployment rates did not decrease. While all this was happening, France, which had low inflation and high unemployment rates, had to set high interest rates. The people, who thought that this system was not sustainable any more for France due to the benefit-cost comparison, were starting to sell French franc and buy German marks, and such speculative attacks were taking action. Briefly, like in the Mexico case, we observe the implication of impossible trinity in the first part of the 90s for some EMS countries.

2.1.3 Third generation currency crisis models

The 1997 Asian crisis is a crucial event for the literature because the economies that were affected by the crisis had neither any conflicting policies nor high unemployment rates which forced the authorities to make a comparison of benefits and costs of the exchange rate regime. Thus, it led to the development of another working area, namely the third generation crisis models, since the existing models did

not have the power to explain the reasons behind this crisis period. According to these new models, the main actors of some currency crises are the vulnerabilities and fragilities in the balance sheets of financial intermediaries and/or real sector rather than governments' behaviours. The effects of devaluations on balance sheets are tackled as the crucial points by them since firms and banks borrow in foreign currency whereas lending in domestic currency, especially in emerging economies. Within this context, they may also face liquidity shocks due to their mismatches caused by financing long-term projects with short-term borrowing. However, it is hard to consider the third generation models just as currency crises because exchange rate adjustments are caused by not distortions in exchange rate markets but financial instabilities in the economy (Cartapanis, 2004).

The years between 1960 and 1990 were as dream for some Asian countries in terms of an increase in their economic growths and living standards. The developments that they experienced during this period were so strong that some countries were mentioned as "Asian tigers"[5] in the economic literature. This period of three decades also was seen as the success of capitalism (Babić & Žigman, 2001). On the other hand, this dream made investors unable to see the weaknesses of the mentioned economies in the first part of the 1990s. During these years, almost all Asian economies had extremely high gross saving rates as a percentage of GDP, and this situation can be seen in Figure 5 as a comparison among themselves and with the United States and the average of OECD members. The ratios were more than one third of GDP for almost all Asian countries in the pre-crisis episode of the 1990s while this share of gross savings was around 20% for the USA and OECD countries average. This situation became a problematical issue since the bulk of the savings was directed in domestic companies by banks and that makes the firms more vulnerable. Additively, IMF's and World Bank's advices for liberalisation and deregulation exposed these economies to a high level of capital inflow from Europe and Japan. When all these combined with the inadequateness of banking supervision,

[5]This term mainly refers to Taiwan, Singapore, Hong Kong and South Korea but also implies some other Asian economies.

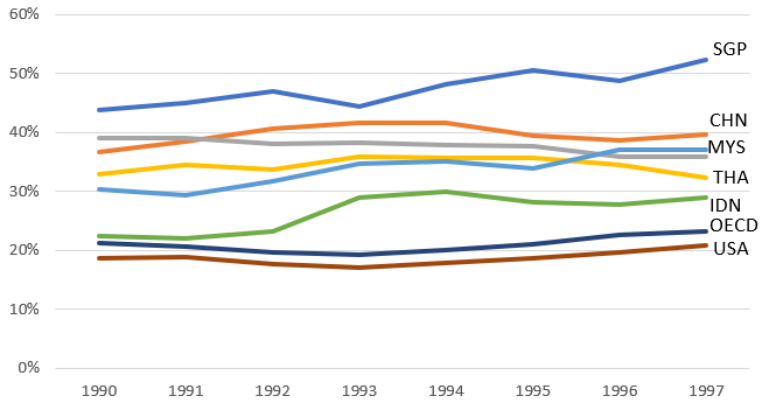
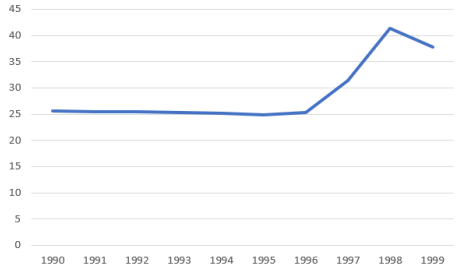


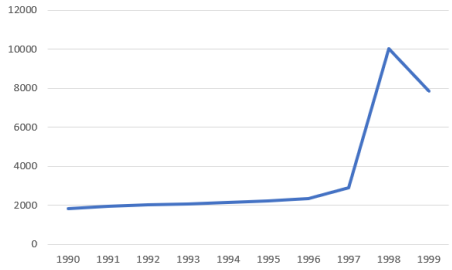
Figure 5. Gross saving rates as percentage of GDP

they jointly gave birth to the Asian crisis in 1997. Thailand became the starting point by devaluating the domestic currency (Thai baht) against the dollar when the companies had hard times in terms of paying their debts due to the slowing growth rate. Even though IMF warned about the contagion effect, the devaluation in Thailand was followed by Indonesia and South Korea. As it was shown in Figure 6, the devaluations of Thai baht, Indonesian rupiah and Korean won against the dollar between 1996 and 1998 were around 63%, 327% and 74%, respectively. Consequently, Thailand, Indonesia and South Korea economies shrank by 7.63%, 13.12% and 5.12%, respectively whereas GDP growth rates were 4.48% for the United States, 3.19% for the European Union and 2.8% for OECD members average in 1998. To sum it up, the fragilities in the banking and financial sectors were the primary causes of the crisis. This explains why the third generation currency crisis models examine the role of these sectors as priority.

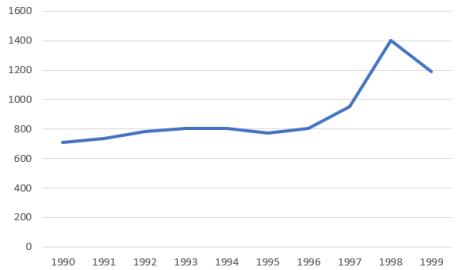
The Asian crisis enabled the emergence of an important literature about the causes and effects of the currency crises. There are various types of models that show what type of distortions may result in a currency crisis. It is possible to group the related theoretical works under two different subheadings. One part of these studies focus on the deterioration of banks' balance sheets caused by currency and maturity mismatches whereas the other part involves currency mismatch in the real sector. Thanks to unique concepts, assumptions and functions, they all present different



(a) US dollar - Thai baht parity from 1990 to 1999



(b) US dollar - Indonesian rupiah parity from 1990 to 1999



(c) US dollar - South Korean won parity from 1990 to 1999

Figure 6. Exchange rate movements of countries affected by the Asian crisis

scenarios from each other that divert the story behind the crises in another direction.

One of the approaches related to the third generation models indicates that financial liberalization and government guarantees to the banking system may lead to a currency crisis through the banking crisis. In this context, Flood and Marion (2002) show that profit-oriented behaviours of the banks, which cause excessive external borrowing, are seen as the main reason of the crises. Since many countries cannot borrow from overseas in terms of domestic currency,[6] this situation is strongly linked to the currency crises. Buch and Heinrich (1999) remark that exchange rate expectation determines the market value of banks and thus their external borrowing capacity. Therefore, their study underlines the relationship between banking and currency crises. McKinnon and Pill (1997) have a different argument in terms of that banks may prefer extreme credit expansion because of financial liberalization, and this makes banking system more vulnerable. Furthermore, the danger of government

[6]This is commonly called as “Original Sin” and see Eichengreen, Hausmann, and Panizza (2007) for more.

guarantees to the banking system is highlighted by Dooley (2001) and Burnside, Eichenbaum, and Rebelo (2004). These studies evince the possible negative impact of aforesaid warrants on banks' external borrowing behaviour. According to Corsetti, Pesenti, and Roubini (1999), and also as suggested by Krugman (1998), financial intermediaries would have an incentive to increase risky investment as a result of government guarantees. Bleaney (2008) approaches the subject from another perspective and submits that if some depositors withdraw their deposits from banks and convert them into foreign currencies, both banking and foreign exchange crises may occur simultaneously. In the work of Chang and Velasco (2001), the banking and currency crises may jointly arise in the case of maturity mismatch with short term borrowing and long term financing.

The other type of the third generation models mainly investigates the weight of the real sector in the currency crisis. The deterioration in the liabilities of the firms, as well as banks, might be the initial point of the crisis. In this regard, many studies that examined the effects of real sector behaviour in an economy have been conducted, and also a major part of them offer a monetary policy recommendation.

According to Aghion, Bacchetta, and Banerjee (2001) (hereafter ABB), productivity shocks may worsen the firms' balance sheets. If the credit constraint and high foreign denominated debt are the cases for the firms, the destruction of the whole economy by a currency crisis is a possible scenario. Their work concludes with a policy recommendation which implies that an increase of the interest rate is the monetary policy that should be followed as a response to the shock. In a similar pattern, Caballero and Krishnamurthy (2001) moot that international and domestic constraints might be explanatory situations which can trigger a currency crisis. Bergman and Hassan (2008) show that if the uncovered interest parity assumption does not hold, a lower interest rate might be an optimal policy response contrary to what ABB suggested. Nakatani (2017b) based on the ABB model, but he included exportation since earnings in foreign currency would have a positive impact as a result of domestic currency depreciation. This approach was also used by Dhillon,

Garcia-Fronti, Ghosal, and Miller (2006) before but they preferred to add export as an external fixed variable; thus, it does not depend on exchange rate fluctuations. Zeyneloglu (2018) analyzed the role of imported intermediate goods and concluded that the depreciated domestic currency could shake the economies even more heavily if the production process depends on the foreign intermediate goods.

The assumption of the uncovered interest parity is a controversial topic in the literature. Many studies show that even though it is a strong assumption for the long run,[7] it does not hold in the short-run. Flood and Rose (2002), by observing 21 currencies, display that this assumption holds only for seven cases in the regression and just three of them are statistically significant. Bouvatier (2004) criticized the assumption of risk premium as zero in the ABB model and mentioned how important role it plays in the process of the determination of interest rate. Céspedes, Chang, and Velasco (2004) show that increased risk premium due to an external shock in the international financial markets causes the deterioration in the balance sheets of firms, and this explains the reason of the currency crisis in an economy.

As well as the causes of the crisis, the monetary policies that should be implemented have also been a remarkable and discussed issue. Some studies on this subject show that tight monetary policies should be followed in order to prevent or overcome the crisis, while others state that loose monetary policies would be more optimal and successful. Aghion et al. (2001) and Krugman (1999) propose that domestic currency should be evaluated by a tight monetary policy as a policy response to a currency crisis. On the contrary, a loose monetary policy is an optimal policy for Furman and Stiglitz (1998), Bergman and Hassan (2008) and Céspedes et al. (2004). Bergman and Jellingsø (2010) examined the medium-term effects of the interest rate policy applied and stated that even if the interest rate increased in the short term, it would not be effective in the medium term because an increase in interest rates would reduce inflation in the medium term and that the fall in inflation will increase the real interest rate and thus the burden of the domestic debt of the

[7] See Chinn and Meredith (2004) for the related results.

companies. Goderis and Ioannidou (2008) found that if a country has a low debt burden, the increase of interest rate would might be a solution for the short term but if this is not the case, it can have an adverse effect. Krugman (1999), by looking from a different perspective, affirms that the firms should be discouraged from borrowing in foreign currency in order to reduce the risks but the question of how to succeed it is not answered clearly.

2.2 Empirical studies

The literature is full of many empirical studies that try to explain the mechanism behind the currency crises. Most of them reach different results since they use different periods, country sample sets, definitions of variables that are focused on, and techniques. The researchers mainly prefer to use parametric techniques which include linear regression models, logit/probit models and the Markov regime switching models but there are also many studies that are based on non-parametric techniques such as the signaling approach and on qualitative comparisons that use graphical differences. According to Berg and Pattillo (1999), the choice of methods would change the power of the model and the significance of the independent variables. Even though it is not possible to declare that one of these methods is always better than the others, since the predictive powers of them change in the history, some researchers aimed to compare the forecast powers of different methods. For instance, Comelli (2014) and Berg and Pattillo (1999) showed that the discrete choice models are better than the signal approach.

Signaling approach, which is a non-parametric method, uses binary variables for each explanatory variable where the value equals one if the level of regressor is higher than a threshold, and zero, otherwise. In this technique, the signals are obtained from the abnormal movements of the variables. These signals are placed in four different categories, depending on whether they signal a crisis or not. If a crisis happens following a signal, then this signal is categorized as a good signal. A false signal indicates that the signaled crisis did not occur. Similarly, a good no signal

means that no crisis takes place in the stated period. These categories can be shown as given by Table 1.

Table 1. Signal Approach Table

	Crisis within N months	No crisis within N months
Signal	A	B
No signal	C	D

As it can be seen in the table, the perfect indicators are A and D. In order to rank the indicators, a signal to noise ratio (SNR) is calculated by the following formula: SNR = [A/(A + C)]/[B/(B + D)]. The threshold values for signals are selected to maximize SNR (Kaminsky, Lizondo, & Reinhart, 1998). The advantages and disadvantages of this method are given by Zhang (2001) and Abiad (2003), respectively. While Zhang (2001) says that the researchers can easily check the abnormal behaviors of the variables, Abiad (2003) indicates that the marginal contributions and multicollinearity can not be examined in this technique.

Limited dependent regression models are other popular approaches that were used in the empirical literature. The advantage of these methods is that all the variables are considered together and marginal contributions of each one can be observed. On the other hand, as indicated by Castillo (2006), there exist some drawbacks to these models. These works, similar to signaling approach, require priori crisis dates and the use of binary dependent variables causes the loss of such information. In addition, logit models are less preferred than probit ones because the interpretation of coefficients is not an easy task since they do not represent the probabilities.

In addition to methodology, the authors also have different views on currency crisis definition. According to some (such as Frankel and Rose (1996)), in case of a devaluation of domestic currency above a certain threshold, a currency crisis can be mentioned whereas the rest (such as Eichengreen, Rose, and Wyplosz (1996)) submit that a high appreciation of nominal exchange rate is not sufficient to consider it as a

currency crisis. The latter group generally proposes to investigate the alterations in an index which is a weighted average of changes in exchange rate, interest rate and foreign reserve. This index is also called as exchange market pressure (EMP) or index of speculative pressure (ISP) and the most important feature that distinguishes the two different definitions is that unsuccessful attacks, which are defended by local authorities by selling foreign reserves and/or altering the nominal interest rate, are also treated as a currency crisis situation. The index and crisis definition used by Eichengreen, Rose, and Wyplosz (1994) can be shown as:

$$EMP_{i,t} = \alpha\%\Delta e_{i,t} + \beta.\Delta(i_{i,t} - i_{G,t}) + \gamma.(\%\Delta r_{i,t} - \%\Delta r_{G,t})$$

where

$$Crisis_{i,t} = \begin{cases} 1, & \text{if } EMP_{i,t} > 1.5 * \sigma_{EMP} + \mu_{EMP} \\ 0, & \text{otherwise} \end{cases}$$

In the index formula, e is the nominal exchange rate, i is the interest rate and r is the amount of reserves in an economy. In this work, the German economy was chosen as the base economy, which is why the authors care about interest rate and reserves changes in Germany. The weights of the components in the equation of EMP are generally the inverse of their standard deviations (σ). However, there are also models that weight ingredients equally or according to their level of variance (σ^2). The importance of the weights is that they would prevent the dominating effect of a change in one of the factors. Similar to former definition, if EMP exceeds a certain value which was determined by researchers, it would be understood that the mentioned economy is in a currency crisis position. The threshold value is another crucial point since the selection of a high value declines the predictive power of the model (Type I errors) while a low threshold value causes false alarms (Type II errors). Unlike Eichengreen et al. (1994), Kaminsky et al. (1998) and Edison (2000) multiplied the standard deviation by 3 and 2.5, respectively. Therefore, applying different thresholds may also explain the different results of empirical works. These works on the literature are called as “Early Warning System” and they let the

governments to take action against the impending crisis. The independent variables differ depending on theoretical background and some use simultaneous variables while others include lagged regressors.

Due to the differences in methods and definitions, studies in the literature have emphasized the importance of various variables. Frankel and Rose (1996) use annual data from 1971 to 1992 for 105 countries by regressing a probit model. Their dependent variable is a currency crash that was defined as at least 25% depreciation of the nominal exchange rate which was also a 10% rising over the previous period. The last requirement aims to eliminate the effect of high inflation periods. This study concludes that output growth, increase in domestic credit, rise in foreign interest rates and real exchange rate are some of the determinants of a currency crisis. The part that does not overlap with the literature is that they find negative coefficients for current account and fiscal balances. Fontaine (2005) analyzed 21 developed and 16 emerging economies by using a logit model in order to expose the determinants of a currency crisis. One of the most distinctive feature of this study is that the political environment and contagion effect are captured as explanatory variables. He finds that contemporaneous current account balance ratio to GDP, contagion and budget deficit over GDP are statistically significant at 5% level and have negative impact. These variables are also significant with same sign of coefficient when their one year lagged variables are included. In addition, the positive relationship between political risk and probability of a currency crisis is also found. The comparison between developed and developing economies also shows some statistical differences in terms of the power of explanatory variables. Aziz, Caramazza, and Salgado (2000) focus on 20 industrial and three developing economies between 1975 and 1997 by using EMPI. They find that an overheated economy with overvalued currency and high inflation is the general situation before the currency crisis periods. They also compare the number of currency crises, average recovery time and cumulative loss of output per crisis between industrial and emerging economies and they show that currency crises

are more common in developing countries whereas these economies recover more quickly with more loss of output in terms of percentage.

Nakatani (2017a) is another empirical study related to the dynamics of exchange rates in the literature. He added the shocks as independent variables and analyzed their impact on currency crises. The changes in the exchange rate are considered dependent variables thus the main goal of the work is to explain exchange rate dynamics rather than calculating the probability of a currency crisis by an Early Warning System. According to the results that come from panel data on 51 emerging countries between 1980 and 2011, changes in both production efficiency and risk premium of countries have explanatory power over the exchange rate dynamics. However, their effects change for different crisis periods. In his following study, Nakatani (2018) used a probit model to make a calculation of currency crisis possibility and found that even though the coefficients of the aforementioned types of shocks are statistically significant, productivity shocks have more importance in terms of explaining severe currency crises. He explains that the shocks should be considered as independent variables because if productivity shocks are the main reasons for the crises, then macroeconomic policies should be regulated while financial shocks while financial shocks require emphasis on financial measures. He also adds that if the floating exchange rate regime has been adopted rather than pegged ones, the impacts of these shocks are larger.

The role of financial liberalization was investigated by Weller (2001). The paper concludes that economies are in a more crisis-prone position after financial liberalization and the probability of having a crisis following a currency overvaluation increases compared to before financial liberalization.

Esquivel and Larrain (1998) focus on 30 economies from 1975 to 1996 by using annual dataset. As a dependent variable they use the collapse of the exchange rate regime and find that seignorage, current account, foreign exchange reserves, trade shocks and growth rate are statistically significant determinants of currency crises. According to the results of Milesi-Ferretti and Razin (1998); low reserves,

appreciated real exchange rate and the situation of industrial economies, such as high interest rates and low GDP growths, are the main reasons behind the currency crises.

Glick and Moreno (1999) analyze East Asian and Latin American economies for 25 years from 1972 to 1997 by defining currency crises if exchange rate depreciation in percent exceeds the sum of the mean and two standard deviations. The authors conclude that money, credit, trade and competitiveness are statistically explanatory variables for currency crisis periods.

There are also empirical studies that aim to explain currency crises in a single country. Ari and Cergibozan (2018) investigate the reasons behind the Turkish currency crises from 1990 to 2014. The selection of time period in this study depends on financial liberalization policies in Turkey. They use different methodologies and currency crisis definitions in order to make comparisons. According to the results of this study, macroeconomic imbalances and weak structure of the banking system in Turkish economy gave birth to the crises in 1994 and 2001 while external vulnerabilities are the main reasons of the pressures that occurred after 2001. Also they got that the selection of the threshold value is more important than the definition of currency crisis in examining crises in Turkey. In another study which was focused on Turkish economy, Ari (2012) declares that the combination of macroeconomic imbalances, vulnerabilities in the banking sector and shocks in trade leads to currency crises between 1990 and 2008. This work also shows that there is no order of importance for the three types of crisis models. Karabulut, Bilgin, and Danisoglu (2010) examined the period from 1991 to 2007 for Turkish economy. They use an ordered probit model with same intervals between categories and thus they could observe soft, mild and severe crises situations separately. The results imply that short term debt / GDP, real exchange rate, credit / deposit and foreign exchange reserves / imports are the determinants of currency crises in Turkey.

CHAPTER 3

MODEL

3.1 General framework

As previously stated, the model to be established in this study is based on ABB's work. We can simply list the advantages of the basic model as follows: Firstly, it shows how the currency crises combined with credit constrained firms might cause a decrease in production. Secondly, it allows observing the effect of the high level of foreign denominated borrowing in the real sector.[8] Thirdly, it contains smooth government spending and macroeconomic stability as the main difference of the third generation. Fourthly, it involves deviations from purchasing power parity as a result of domestic currency devaluations. Fifthly, it clearly shows the monetary side which makes it easier to see impacts of any possible monetary policy. Sixthly, even though I will mainly focus on the economies with flexible exchange rates, it is possible to examine the case of fixed exchange rate regime. Lastly, by adding the variables such as export, imported intermediate good and risk premium into the ABB model, we can also compare the costs and benefits of exchange rate fluctuations for an open economy.

To begin with, the general framework must be described evidently. I examine an infinite horizon small open economy but mainly focus on just two periods that are shock and next periods due to the assumption that everything will remain constant over the remaining periods. Thus, in this system, the economy will be hit by an unanticipated shock in the first period, and it will not experience any change from the second period. As an extension of the work of Obstfeld and Rogoff (1995), it was assumed that at the beginning of each period, good prices are set and remain unchanged. Equation (1) reflects that purchasing power parity (PPP) assumption holds *ex-ante* for each period where P_t and E_t^e are domestic price and expected nominal exchange rate, respectively. However, an unanticipated shock in the first

[8] Furman and Stiglitz (1998) emphasize the importance of this issue as follows: "the ability of this variable, by itself, to predict the crises of 1997 is remarkable".

period causes an *ex-post* deviation from this equality. This shock may be related to productivity or a shift in expectations. The processes and consequences of both types of shocks will be analyzed in the rest of the study. Indeed, the right hand side of the equation is multiplied with P_t^* as reflecting foreign price, but it equals to one all the time by assumption in order to simplify.

$$P_t = E_t^e \tag{1}$$

The model works on a standard production function with capital as the sole input as shown in Equation (2) where k_t is the working capital and σ is the productivity level. Since it does not change my results, full depreciation of capital is assumed to write equations more clearly. There is no restriction on capital mobility, and a representative firm produces only one type of goods again by assumption. As one of the distinctive features of this study from ABB, uncovered interest parity does not hold, and this will be detailed in the following parts of the study. The firms can borrow from both domestic and foreign financial intermediaries. The crucial point in this part is that the existence of a credit limit, which was shown by Bernanke and Gertler (1989), appears as an obstacle in front of firms' borrowings and productions.

$$y_t = \sigma.f(k_t) \tag{2}$$

As another difference from ABB, y_t (i.e. total production in period t) will be divided into three parts for the purpose of observing marginal effects of changes in the exchange rate. Therefore, Equation (3) means that y_t is equal to the quantity consumed by the domestic consumers (h_t) plus the volume exported to foreign markets (x_t) minus the quantity of imported intermediate goods (m_t). It is vital to notice that since $P_t^* = 1$ by assumption, the export level depends positively on the real exchange rate ($\frac{E_t}{P_t}$) and the foreign demand (y_t^*), while the amount of imported intermediate goods is a decreasing function of the real exchange rate. So, the depreciation of domestic currency (i.e. higher E_t/P_t) means higher exports and lower

intermediate good imports whereas an increase in foreign demand (i.e. higher y_t^*) results in a lower export level, and these facts are shown in equation (4).

$$y_t = h_t + x_t\left(\frac{E_t}{P_t}, y_t^*\right) - m_t\left(\frac{E_t}{P_t}\right) \tag{3}$$

$$\frac{dx_t}{d(E_t/P_t)} > 0, \qquad \frac{dx_t}{dy_t^*} > 0, \qquad \frac{dm_t}{d(E_t/P_t)} < 0 \tag{4}$$

It is possible to summarize the timing of the whole structure as follows: Initially, the price P_1 is preset and firms make their investment decisions. An unanticipated negative shock occurs in the first period and since the prices are rigid, the effects of this shock are absorbed by the nominal exchange rate. The monetary adjustment as a policy response determines the nominal interest rate i_1 and thus tries to limit the depreciation of the domestic currency. All of these events designate the output and profit levels of the companies. After the debt payments of the firm, say W_2, a part (α) of net earnings is distributed among dividends or consumed, and the remaining amount $(1-\alpha)$ is saved for investment in period two where $0 < \alpha < 1$. As it was indicated before, there is no shock or monetary adjustment in the economy starting from second period two; thus, all these periods are identical.

3.2 Wealth curve

Firstly, it is necessary to specify clearly the net profit equations of firms. In this context, Equation (5) gives us what is required. There are two kinds of mechanisms for companies to borrow money: In period $t-1$, they can choose to borrow in domestic currency at domestic interest rate i_{t-1} or in foreign currency at foreign interest rate, which is assumed constant and shown by i^*. Therefore, d_t and d_t^* indicate these borrowing amounts, respectively.

$$\pi_t = P_t y_t - d_t(1+i_{t-1})P_{t-1} - d_t^*(1+i^*)\frac{E_t P_{t-1}}{E_{t-1}} \tag{5}$$

If these entrepreneurs make positive profits, they would consume and/or distribute a certain part (at α ratio) of these profits and then save the remaining part as

investment in order to use in the production process in the next period. Hereby, by assuming a positive profit level, we can write the total net wealth that will be used in the following period as follow:

$$W_{t+1} = (1 - \alpha)\frac{\pi_t}{P_t} \tag{6}$$

In addition to the capital remaining from the previous period, firms have the opportunity to borrow at a constant rate of their capital. Equation (7) shows that a firm can borrow up to a certain percentage of its own wealth. Since the production is a positive function of capital, equation (7) holds with equality.

$$D_t \leq \mu.W_t \tag{7}$$

The summation of total debt and saving a fraction of current real wealth as investment creates the whole capital level to use in the following period.[9] That is to say, the next equation displays the amount of input as a combination of a part of real wealth and credit multiplier.

$$k_{t+1} = (1 + \mu).(1 - \alpha).\frac{\pi_t}{P_t} \tag{8}$$

The combination of all the equations I have obtained so far gives the equation that will determine the output level of the second period which is the period after the shock. Generally speaking, Equation (9) shows that total production in period two (since shock occurs in the first period by assumption) depends on productivity, credit multiplier and a fraction of previous current real wealth. The r_0 term indicates the real interest rate which can be defined as $1 + r_t = (1 + i_t)\frac{P_t}{P_{t+1}}$, and it is important to remember for the last term $E_0 = P_0$ but $E_1 \neq P_1$ since the purchasing power parity holds at t = 0 but there is a deviation at t = 1 due to the shock.

[9] It is worth recalling the assumption that capital is fully depreciated.

$$y_2 = \sigma.f\left((1+\mu).(1-\alpha).\left(h_1 + x_1.\frac{E_1}{P_1} - m_1.\frac{E_1}{P_1} - d_1.(1+r_0) - d_1^*.(1+i^*).\frac{E_1}{P_1}\right)\right) \quad (9)$$

The relationship between the current nominal exchange rate (E_1) and and the following period's output (y_2) is given by equation (9) and ABB (2001) denoted it as "wealth curve" (W-curve). Since this study has differences from ABB work due to the addition of export and import intermediate goods, the changes in the exchange rate would have an impact not only through foreign currency debt but also on the export level of firms and the share of imported intermediate goods in the production process. In ABB (2001), the W-curve is concave downward, and it is defined as the behavior of the firms. This fact is explained intuitively as the negative impact of the unanticipated negative shock on in order of output, profit, net wealth, investment and finally next period's output by ABB (2001). For the purpose of observing this relation in the new structure of this study, the derivative which is given by Equation (10) should be checked.

$$\frac{dE_1}{dy_2} = \frac{P_1}{f_{k_2}.\sigma.(1+\mu).(1-\alpha).[x_1.(1+\varepsilon_x) - m_1.(1+\varepsilon_m) - d_1^*(1+i^*)]} \quad (10)$$

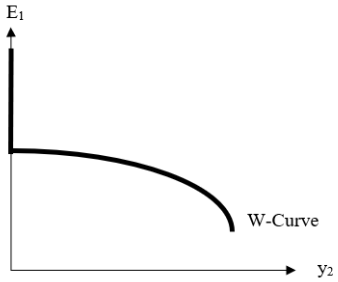
Before starting to interpret, it is needed to be mentioned that ε_x and ε_m are the exchange rate elasticities of exports and intermediate good imports, respectively. The term in the squared bracket in equation (10) is the only determinant of the sign of the slope since P_1, f_{k_2}, σ, $(1+\mu)$ and $(1-\alpha)$ have positive values. Thus, the results can be summarized as follows: if the cost of domestic currency depreciation is larger than the benefit (i.e., $x_1.(1+\varepsilon_x) < m_1.(1+\varepsilon_m) + d_1^*(1+i^*)$) the sign of the slope would be negative. In other words, the negative relationship between the current nominal exchange rate and the next period's output ($\frac{dE_1}{dy_2} < 0$) is observed and this would be the case when the economy has a large foreign debt burden, high use of imported intermediate goods in the production process or high values for the elasticity of intermediate good imports. However, on the contrary, if the share of exports or its

elasticity is large enough to turn the exchange rate increase into a positive change; then, it would ensure the rise of output in the next period after the shock. That is to say, the production level changes in the same direction as the exchange rate ($\frac{dE_1}{dy_2} > 0$). The intuition behind the difference between the signs of the slopes is pretty straightforward. When the foreign currency appreciation is harmful and decreases the firms' profits, the entrepreneurs' investments will be less and thus following period's outputs will reduce. However, in the exact opposite situation, increasing profits thanks to augmented nominal exchange rate will increase investments and also future outputs.

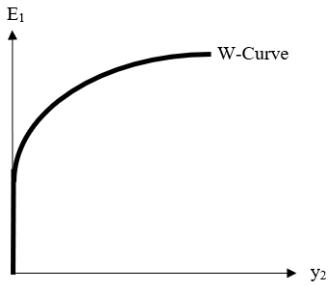
Figure 7 displays the graphical representation of the W-curve in accordance with the roles of determinants. The first thing to talk about is the shape of the W-curve. By following the standard assumption about the production which is an increasing function of capital but at a decreasing rate ($f'(k) > 0$ and $f''(k) < 0$), we would have $f''(k_2) < 0$ and thus W-curve would have a concave structure. The other point that should be noticed is that in a scenario where there is no crisis and PPP holds, W-curve would be a vertical line in the same plane since the equality between E_1 and P_1 converts Equation (9) into the case where the production is independent of the exchange rate value. And lastly, W-curve has a piece in E_1 axis because as it can be seen from Equation (5), high level of currency depreciation may cause zero or negative profit and this would force the firms not to produce. These segments on the vertical axis will play a crucial role in the part where we examine the equilibrium points and crisis possibilities in an open economy.

3.3 IPLM curve

The monetary sector is the other side of the analysis, and ABB (2001) tries to underline the importance of the interest rate parity (IP) and the money market equilibrium (LM) as the interaction between the Central Bank, foreign investors and consumers. This study will provide a deeper insight into these equations. ABB (2001) assumes that the uncovered interest parity condition, which defines the



(a) Large intermediate good imports or high foreign debt cases



(b) Large exports case

Figure 7. W-curve depending on the character of the economy

nominal interest rates difference between two economies as the changes in the foreign exchange rate, holds. As the main difference from them, I will relax this assumption and add the risk premium into the interest parity condition. This structural change has two crucial properties in terms of discussing the impacts of unanticipated expectation shocks and contagion. Thus, the interest parity condition that reflects investors' arbitrages between local and foreign currency bonds can be expressed as:

$$1 + i_t = (1 + i^*)\frac{E^e_{t+1}}{E_t} + \rho_t \qquad (11)$$

where ρ_t is the foreign exchange risk premium that must be paid at period t because of the rise in uncertainty about the future exchange rate and E^e_{t+1} is the exchange rate expectation for the next period. As shown by Bergman and Jellingsø (2008), a constant and exogenous risk premium may cause a crisis to occur without changing the distribution of domestic and foreign currency debt. Although the addition of a new variable does not make a difference in shape from ABB (2001), it shifts the curve and this has a crucial role in the possibility of a crisis.

Money market equilibrium, which is a relation between money supply and money demand, gives us LM condition and it is given by Equation (12) where M^s_t and M^d_t denote nominal money supply and nominal money demand at time t, respectively. The present setup handles money demand as a function of income and domestic

nominal interest rate, $M^d(y_t, i_t)$, where the interaction is related positively on the former and negatively on the latter.

$$M_t^s = P_t M_t^d(y_t, i_t) \tag{12}$$

$$\frac{dM^d}{dy_t} > 0, \qquad \frac{dM^d}{di_t} < 0 \tag{13}$$

It should be assumed that $M^d(0, i_t) > 0$ since the production is determined by the previous period's profit which might be zero in a crisis case. The combination of the money market equilibrium and the interest parity condition with the purchasing power parity at period t = 2 gives us the IPLM-curve that clearly shows the connection between exchange rate and subsequent period's output level:

$$E_1 = \frac{1 + i^*}{1 + i_1 - \rho_1} \cdot \frac{M_2^s}{M_2^d} \tag{14}$$

Equation (15) comes in handy to observe the relation between today's exchange rate and tomorrow's output by taking the derivative of E_1 with respect to y_2. Here is the result:

$$\frac{dE_1}{dy_2} = -\frac{1 + i^*}{1 + i_1 - \rho_1} \frac{M_2^s}{[M_2^d]^2} M^d_{(y_2)} < 0 \tag{15}$$

Now, it is known that the curve has a negative slope in the (y_2, E_1) plane. The intuition can be summarized as: the rise in expectations about the future output increases the expected future money demand for a given i_2, and this leads to a decline in the expectation of future exchange rate. It makes sense to hold domestic currency today for the individuals in the economy and this is why the current exchange rate appreciates.

$$\frac{d^2E_1}{dy_2^2} = \frac{(1 + i^*)}{1 + i_1 - \rho_1} \left[\frac{2(M^d_{(y_2)})^2}{(M^d(y_2, i_2))^3} - \frac{M^d_{(y_2)(y_2)}}{(M^d(y_2, i_2))^2} \right] M_s^2 \tag{16}$$

The last thing that should be analyzed about IPLM-curve is its shape. The second order derivative result, which is shown by equation (16), implies that we need

further assumptions about the money demand function to determine the sign. By following the standard money-in-the-utility and cash-in-advance functions, I assume $M^{d}_{(y_2)(y_2)}$ equals zero for all t. Therefore, the second term in the squared bracket is also zero, and the remaining parts result that the sign of the second derivative is positive which indicates IPLM-curve has a convex structure as shown by Figure 8.

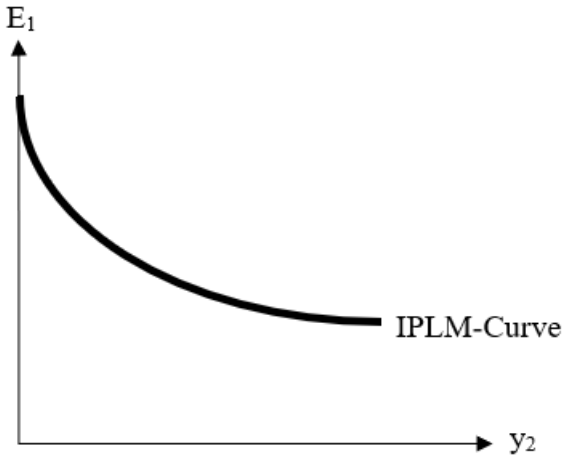


Figure 8. The representation of IPLM-curve

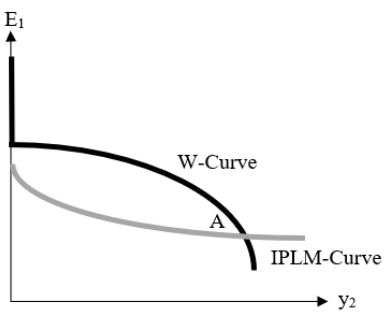
3.4 Graphical representation of equilibrium

3.4.1 Equilibrium before any shock

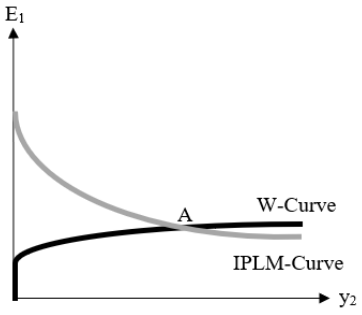
The intersection of the IPLM and W curves gives us the equilibrium point in an economy. ABB (2001) examines the possible situations in three categories, and I will analyze the curves, which changed due to the added variables, with the same method.

In accordance with ABB (2001), the situations shown in Figure 9 are the "good" cases where the equilibrium points "A" simply denote a high level of output and relatively low single exchange rate. When the economy is in a good balance, the necessary condition for a crisis is that at least one of the curves shifts due to any shock. Otherwise, it is not possible to face a crisis.

In Figure 10, the economy has multiple equilibria where the point "A" is the good case with high production and low exchange rate and point "C" is the crisis equilibrium since the production drops to zero and the value of the foreign currency



(a) Good case with decreasing W-curve



(b) Good case with increasing W-curve

Figure 9. Good equilibrium case

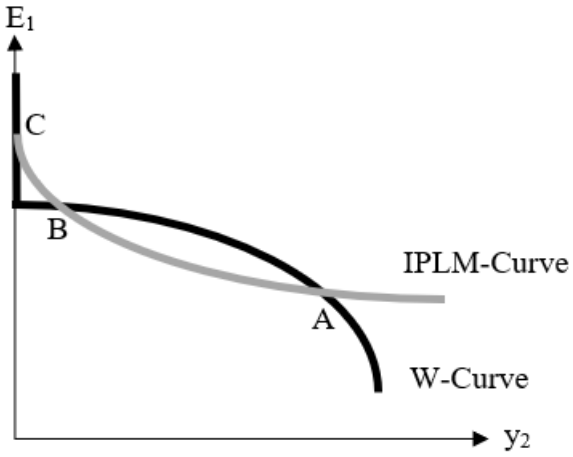


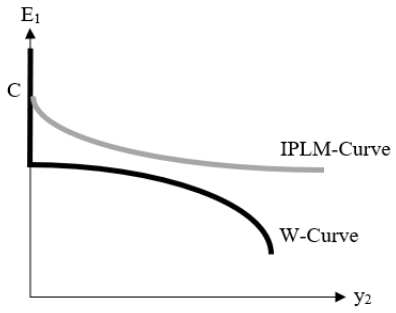
Figure 10. Intermediate case

is extremely high. The intuition behind the intermediate case can be explained as follows: if the consumers expect an appreciation of the foreign currency, they would demand less money since they also think the production will decrease. These beliefs put pressure on the exchange rate and cause its increase. So, in the multiple equilibria case, the expectations are the factors that lead to changes between equilibrium points. This situation can be seen when the W-curve is decreasing because otherwise, they do not intersect at more than one point since IPLM-curve is also decreasing. In other words, multiple equilibria occur when the W-curve intersects the E_1 axis above the IPLM-curve. More mathematically, the condition of the intermediate case can be

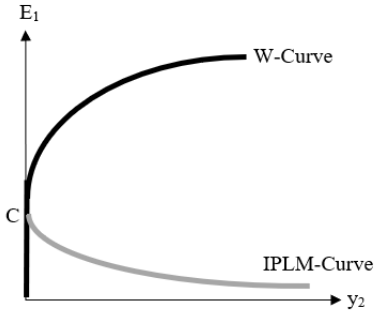
shown by the Equation (17) and it never holds when the W-curve has an increasing shape.

$$E_{1_{y_2=0,W}} < E_{1_{y_2=0,IPLM}} \tag{17}$$

According to ABB (2001), the last possible outcome is the "bad" case where the depreciated domestic currency in the first period results in zero profit in the same period and thus zero production in the following period. As shown by Figure 11, unlike the intermediate case, the expectations do not play any role since the curves only intersect at point "C", and the economy is already in a crisis. Figure 11(a) mainly displays the crisis situation when the cost of the appreciation of the foreign currency is higher (i.e. W-curve is negatively sloped) where Figure 11(b) shows the crisis equilibrium even though the increase in the exchange rate stimulates exports (i.e. the sign of the W-curve is positive).



(a) Bad case with decreasing W-curve



(b) Bad case with increasing W-curve

Figure 11. Bad equilibrium case

3.4.2 Impact of a productivity shock

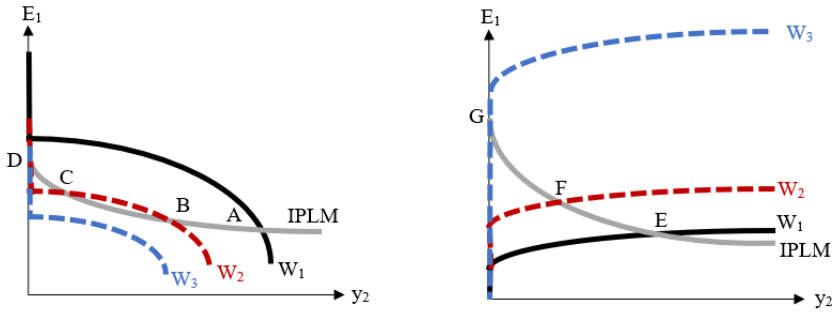
As explained before, the locations of the IPLM and the Wealth curves are the determinants of the possibility of a crisis in an economy since their intersection(s) gives us the corresponding equilibrium point(s). On the purpose of observing the effects of shifts in each curve, I will analyze different scenarios separately. Firstly, I

will take a look at the changes in the position of both types (increasing and decreasing) of W-curve. In Figure 12(a), the initial equilibrium point was point “A”, and the economy is in the good case with high level of production and low exchange rate. A decline in productivity ($\sigma \searrow$) and/or a tightening of the credit market ($\mu \searrow$) results in a decrease in production for a given level of exchange rate according to Equation (9). This means a downward shift in W-curve that may drag the economy to the intermediate case with multiple equilibria, which is shown by points “B”, “C” and “D” if a slight shift occurs. However, if these shocks push the Wealth curve downward strong enough, as illustrated by W_3, the equilibrium takes place at point “D”, which exactly signifies a bad equilibrium, with zero production and high exchange rate. To sum up, when the Wealth curve is a decreasing function, the result of the shock depends on its magnitude.

On the other hand, when the W-curve is increasing, we would have different possible results in the case of a decline in productivity or in credit multiplier. As an identical background, any negative shock causes lower output for a given exchange rate value and this pushes the W-curve upward as shown by Figure 12(b). Since it can be only talked about the existence of good and bad cases when the curves have different signs of slope, as it explained in the previous subsection, the economy moves from the initial equilibrium point as shown by “E” where high output and low exchange rate occur to “F” or “G”. If the movement of the W-curve is not so large, the depreciation of exchange rate and the decline in output would not be so powerful that implies equilibrium point shifts to “F”. In the opposite case, if W_3 is the new Wealth curve, then it intersects with the IPLM-curve at point “G” with zero production and an extremely high exchange rate.

3.4.3 Impact of an increased risk premium

Unlike the productivity shock (or credit market tightening), the the rise of risk premium ($\rho \nearrow$) does not always bring out a worse situation in terms of production. As it can be seen in Equation (15), if there is an increase in risk premium, there

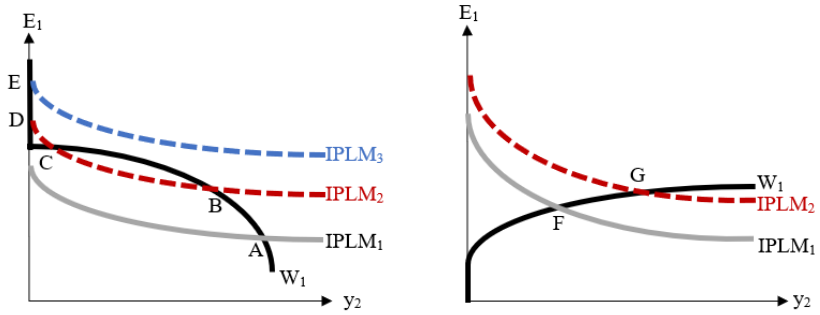


(a) A shift in decreasing W-curve (b) A shift in increasing W-curve

Figure 12. In case of a productivity shock or tightening of the credit market

would also be a rise in the exchange rate for a given output level. This pressure implies an upward shift of IPLM-curve, as shown in Figure 13. The critical point that will guide the analysis is the sign of the W-curve's slope. In Figure 13(a), we see that costs of depreciation dominate and that is why W-curve is decreasing. The point "A" was the only initial equilibrium before the upward movement of IPLM-curve from $IPLM_1$ to $IPLM_2$ due to the increase in the risk premium following an unanticipated financial shock. The new intersections indicate an intermediate case with the new equilibrium points where anticipations of investors may drag the economy into the crisis point, which was denoted by point "D", easily. However, it is possible to observe the collapse directly if the decline of the confidence (i.e. boom of risk premium) is as large as to move the IPLM-curve to $IPLM_3$ and to make "E" the new intersection point.

Figure 13(b) presents a thoroughly different scenario. The first thing that should be noticed is that the intermediate case is no longer possible. The second novelty is that since the share of exports and/or its elasticity are larger, the depreciation of domestic currency following the rise of risk premium increases the firms' current profits and investments for the next period and thus outputs of the subsequent period. It can be supported graphically since the intersection of the curves moves towards point "G" where higher production and exchange rate co-occur.



(a) A shift in IPLM-curve when W-curve is decreasing

(b) A shift in IPLM-curve when W-curve is increasing

Figure 13. In case of an expectational shock

3.5 Policy recommendation

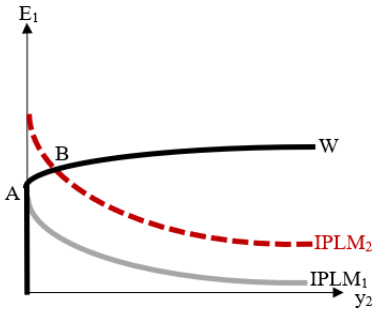
As stated before, the policies that should be implemented are at least as important and remarkable as the causes and consequences of the crises. Due to this critical role, some monetary policies implemented in past crises have been criticized widely, and the IMF's policies after the 1997 Asian crisis have been argued by many analysts. According to the IMF, the combination of restrictive fiscal policies and a tight monetary policy should be followed in order to prevent capital outflow and depreciation of the domestic currency. However, the interest rate hike did not provide a successful result in some Asian crisis economies since it just caused a higher domestic debt burden of the firms and limited their investment levels. Some critics used the "Laffer curve"[10] to support their arguments by implying a lower interest rate would be an appropriate policy response in case of an increase in exchange rate. In this context, the last part of this section is devoted to some policy recommendations in line with the new format of the third generation crisis models.

Industrial investments, which will reduce the amount of imported intermediate goods, will not have an effect in the short term, but can be considered as one of the policies that will prevent the crisis in the long run. Using more domestic products instead of imported intermediate goods in the production process will

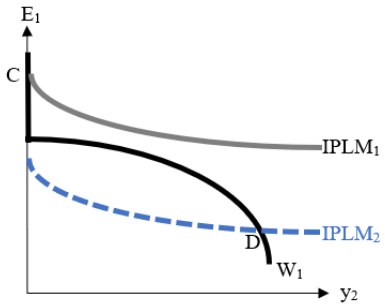
[10] Arthur Laffer uses an inverted-u shaped curve to explain that sometimes tax rates should be reduced in order to increase total government tax revenue and mentioned criticisms apply this approach for the relationship between interest rate and currency valuation.

somewhat reduce the impact of exchange rate fluctuations on the economy. Similarly, directing firms to borrow from domestic lenders in order to minimize the effects that will occur after the depreciation of the domestic currency will similarly reduce the power of exchange rate changes on the economy. Since increase in banks' loan supplies may cause a banking crisis, this policy also requires banking regulation.

One of the most discussed topics in the literature has been short-term monetary policies. Therefore, as I mentioned before, there are different opinions regarding the optimal interest rate adjustment. According to the new model I have established, it is not possible to talk about a standard optimal monetary policy for each economy. Firstly, I will examine the case where the W-curve has an increasing slope. Figure 14(a) shows the crisis situation as initial equilibrium since the curves intersect at point "A" by the effect of any shock. What the authorities need to do to escape from the zero production position is to shift the IPLM curve upwards, which is possible with a reduction in the rate of interest. This intervention will ensure that the next period production will increase despite the increase in the current exchange rate and the equilibrium point will be at "B". Secondly, I will analyze the monetary policy suggested by the model if the W-curve slopes downward. If the scenario is as shown in Figure 14(b), where the intersection point is "C" after a shock, the policy required is to shift the IPLM curve down by increasing the interest rate, thereby decreasing the exchange rate and increasing the production level. To summarize, this new model proposes different interest rate policies for different economies instead of proposing a single correct interest rate policy. This indicates that country-specific policies should be implemented in times of currency crisis.



(a) Decline in interest rate as a monetary policy



(b) Increase of interest rate as a monetary policy

Figure 14. Optimal monetary policies for different cases

CHAPTER 4

ANALYSIS FOR TURKEY

In this section of the study, I will examine how the theoretically mentioned variables in the previous part affected the exchange rate fluctuations in Turkey between 1994-2019.

As one of the main reasons for the selection of Turkey, we need country-specific analysis and policy recommendations since the structures of the emerging, and developed economies are not similar, as shown by Carpatanis et al. (1998). The dynamics of economic variables may differ among countries, and this requires different approaches for before, during, and after crisis periods. Even if the determinants of exchange rate movements are the same, their explanatory powers might be different. This situation brings with it country-based analysis and policy recommendations instead of universal ones. From this perspective, it can be explained that the IMF-recommended policies implemented after the Asian crisis gave positive results in some countries but did not work in others. The second reason is that Turkey is one of the countries with high exchange rate volatility and the most depreciating currency against the US dollar, especially in recent years. The Turkish lira depreciated 21% between November 2016 and February 2017, 33% from the beginning to the end of August 2018, and 15% between February and April 2019. Even though political developments and uncertainties are essential factors that put pressure on the exchange rate in these processes, the fragilities in the economic structure have created a suitable basis for such volatilities. The third and final reason is the access to necessary data for economies with similar characteristics. In this respect, Turkey provides an opportunity for research by sharing long-term data among developing countries. It is impossible to achieve all the data needed for many other emerging economies, as an indicator of a general problem in developing countries.

The time range of the sample set was determined as between 1994 and 2019. The starting date is a crucial time for Turkey since the Turkish economy has experienced one of the biggest crises in its history. I ended the observation period in 2019 because I wanted to eliminate the effects of COVID-19, which has affected the whole world together since 2020, on economic uncertainty and changes in government revenues and expenditures. In addition, I use monthly data rather than annual or quarterly in order to better cover the momentary situations of crises. I used interpolation via frequency conversion methods in EViews for the cases where monthly data is not available.

4.1 Data

I use the real exchange rate changes as the dependent variable because I want to examine the dynamics of exchange rates. This means I do not make an analysis of the probability of a currency crisis. Thus, I run an OLS regression model by following Sachs, Tornell, and Velasco (1996). The real exchange rate was chosen rather than the nominal exchange rate to eliminate exchange rate valuations caused by high inflation periods.

In this regard, I will analyze the effects of independent variables on the real exchange rate. The variables on the right-hand side can be given as follows:

- RER L1: The lag value of the real exchange rate. Since it is thought that the latest changes in the real exchange rate will affect the current exchange rate through the dynamic structure and expectations, the expected sign is positive. The first generation currency crisis models are the reference points. Moreover, the model without the lagged RER suffered from the autocorrelation problem and this trouble was cleared away by adding this variable.
- EXPORTEFFECT: The log of monthly exportation level multiplied by $(1+\varepsilon_x)$. An increase in exportation level and/or in elasticity means a decrease in the exchange rate, thus the expected sign is negative.
- IMPORTEFFECT: The log of monthly imported intermediate goods multiplied

by $(1+\varepsilon_m)$. The expected sign is positive which means an increase in this variable indicates depreciation of the local currency.

- DEBTEFFECT: The ratio of short-term external debt to GDP. The rise of the external debt burden of private firms causes possible liquidity problems. This situation indicates a positive expected sign.
- CAGDP: The ratio of the current account balance to GDP. As shown by the first and second generation currency crisis models, the effect is expected to be negative.
- INTEREST: The local nominal interest rate is one of the common features of the second and third generation models. An increase in the policy interest rate can provide capital input and that is why the expected sign is negative.
- GDPGROWTH: A variable in which quarterly GDP growth rates are given in monthly conversions. Studies in the literature do not reach a consensus on the direction of the effect.
- USINTEREST: The nominal interest rate of US. In contrast to the effect of domestic interest rate hikes, a rise in this variable will affect the decisions of investors and cause an outflow of capital. Therefore, the expected sign is positive.
- TOTALEFFECT: The combination of the effects of export, import and short-term debt as shown by the model. The sign of the coefficient would determine the optimal monetary policy.

All the variables used in the regression model are stationary at the 5% level of significance.

4.2 Results

The results of the regression show that the effect of exportation and the lag value of the real exchange rate are the statistically significant variables with the expected signs in terms of explaining the movement in the real exchange rate. The coefficient of the lag of real exchange rate indicates that one point rise in the value of the previous

month's real exchange rate causes an increase of 0.31 in the current exchange rate. As explained by the part of the data description, the dynamic structure of the real exchange rate and the deterioration in expectations for the exchange rate are the main reasons for this outcome. As another statistically significant regressor, the coefficient of the total impact of exportation on the real exchange rate has a negative sign. According to the findings of the linear regression, one unit increase in this explanatory variable, which may arise from the level and/or elasticity of exportation, leads 0.6 point decrease in the real exchange rate. The imported intermediate goods effect, which is one of the original parts of this study, is not statistically significant but this can be acceptable since the ratio of intermediate goods imports to total imports is not much volatile in the Turkish economy. This means that the significance of this independent variable might increase in a different structured economy. However, the sign of the coefficient is positive as explained by the theoretical part. Similarly, the effect of short-term debt is not statistically significant at 5 % but the sign of the impact is positive as expected. Despite the statistical insignificance, the negative coefficient for the nominal interest rate variable points out that a rise in interest rate ensures a decline in the real exchange rate. Even though the control variables in the regression, which are current account ratio, GDP growth and nominal US interest rate, are not statistically significant, the direction of their effects on the real exchange rate is consistent with the studies in the literature.

When I use TOTALEFFECT variable as a combination of export, import and debt variables, it can be possible to test the implementations of the theoretical model on the monetary policy. The model built in the previous section claimed that if the exportation effect is higher than the sum of the impacts of imported intermediate goods and short-term debt, the monetary authorities should decrease the interest rate but if the opposite situation is the case, it should be raised. When I analyze the period between 1994 and 2019 for Turkey, the total effect is not statistically significant. However, the coefficients' signs confirm the argument of the theoretical model since the coefficients of total effect and local interest rate have opposite signs.

Table 2. Regression Results

	(1) RER	(2) RER
L.RER	0.312***	0.318***
	(4.20)	(4.08)
EXPORTEFFECT	-0.607***	
	(-5.51)	
IMPORTEFFECT	0.00233	
	(0.07)	
DEBTEFFECT	0.336	
	(1.00)	
CAGDP	0.0377	0.171
	(0.30)	(1.52)
INTEREST	-0.153	-0.149
	(-1.28)	(-1.17)
GDPGROWTH	0.187	0.239
	(1.59)	(1.94)
USINTEREST	0.692	0.539
	(0.61)	(0.46)
TOTALEFFECT		-0.0284
		(-0.90)
_cons	1.354	-0.139
	(0.35)	(-0.34)
N	310	310
r2	0.215	0.148

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 5

CONCLUSION

The primary purpose of this study is to expand the study of Aghion, Bachetta and Banerjee (2001), one of the third generation crisis models in the literature, in order to explain the crises caused by the vulnerability in balance sheets of financial intermediaries or companies in the real sector. Even though the study, which is based on, has crucial advantages in terms of understanding currency crises and determining appropriate monetary policies, the addition of these three variables will make the model more meaningful and inclusive: the exportation, intermediate imported goods and risk premium. The structure of the export sector dependent on the exchange rate makes it an indispensable element of currency crises. With the depreciation of the domestic currency, gaining competitiveness in the international market will increase both the level of exports and the ratio of exports to GDP. Besides, the amount of imported products used in production within the country's borders is one of the factors that must be included in the currency crisis models. The increase in imported products used in the production process will bring both capital outflow and decreased production. In addition to these two variables, the risk premium is also not taken into account in the based model and it is assumed that the uncovered interest parity holds. In parallel with the criticisms in the literature on this subject, it was thought that this parity does not always hold and the risk premium should be added to the model.

The results obtained in the theoretical part are striking. First of all, the differentiation in the economic structures of the countries, depending on the effect sizes of imports, exports and external debt, provides different interpretations of the crises. Depending on the weights of the aforementioned variables on the economy, there may be cases that are given as good, bad and intermediate. These situations show why similar shocks have a devastating effect in some countries but have a medium or zero effect in others. Similarly, it can be understood within this structure that similar policies applied to simultaneous crises are a solution to the crisis in some

economies, while in some countries it is a factor that increases the impact of the crisis. According to the model, if the exportation effect is more dominant than the sum of debt and intermediate imports effects, the monetary authorities then should decrease the interest rate to prevent the economy from a “bad” case. If the weight of exportation is not higher, then the policy rate should be increased. In other words, the model states that different policies can be implemented by various countries for the same crisis, taking into account structural differences, instead of suggesting a single solution that can be applied to each country.

The last part of the study is devoted to the results of the regression analysis obtained using the Turkish economy data between 1994 and 2019. The exports, imported intermediate products and short-term external debt variables, which I think have an impact on the third generation currency crisis models, are handled together with some control group variables and their effects on the real exchange rate are shown. When I tested the model on the Turkish economy data, it is not surprising that the imported intermediate goods variable did not give a statistically significant result because the ratio of intermediate goods imports to total imports did not show volatility during the specified period and was between 70% and 75%. The export was statistically significant and its negative effect on the real exchange rate was determined. One of the striking findings was that short-term external debt did not give a statistically significant result. However, the coefficient was in line with the expectations. To sum up, the results of the regression analysis do not support the validity of the model established in the theoretical section on Turkey.

REFERENCES

Abiad, M. A. (2003). Early Warning Systems: A Survey and a Regime-Switching Approach [IMF Working Papers]. *International Monetary Fund*(2003/032).

Aghion, P., Bacchetta, P., & Banerjee, A. (2001). Currency crises and monetary policy in an economy with credit constraints. *European Economic Review*, *45*(7), 1121-1150.

Ari, A. (2012). Early warning systems for currency crises: The turkish case. *Economic Systems*, *36*(3), 391-410.

Ari, A., & Cergibozan, R. (2018). Currency crises in turkey: An empirical assessment. *Research in International Business and Finance*, *46*, 281-293.

Aziz, J., Caramazza, F., & Salgado, R. (2000). Currency crises - in search of common elements. *SSRN Electronic Journal*.

Babić, A., & Žigman, A. (2001). Currency Crises: Theoretical and Empirical Overview of the 1990s [Surveys]. *The Croatian National Bank, Croatia*(5).

Berg, A., & Pattillo, C. (1999). Predicting currency crises:: The indicators approach and an alternative. *Journal of International Money and Finance*, *18*(4), 561-586.

Bergman, U. M., & Hassan, S. (2008). Currency crises and monetary policy in an economy with credit constraints: The no interest parity case [EPRU Working Paper Series]. (2008-01).

Bergman, U. M., & Jellingsø, M. (2010). Monetary policy during speculative attacks: Are there adverse medium term effects? *The North American Journal of Economics and Finance*, *21*(1), 5-18. (Special Issue on Crisis and Opportunity: policy evaluation during the Global Turmoil)

Bernanke, B., & Gertler, M. (1989). Agency Costs, Net Worth, and Business Fluctuations. *American Economic Review*, *79*(1), 14-31.

Bleaney, M. (2008). Openness and real exchange rate volatility: In search of an explanation. *Open Economies Review*, *19*, 135-146.

Bouvatier, V. (2004). Crise de change et politique monétaire optimale dans un modèle de troisième génération : le rôle de la prime de risque [Cahiers de la Maison des Sciences Economiques]. *Université Panthéon-Sorbonne (Paris 1)*.

Buch, C. M., & Heinrich, R. P. (1999). Twin Crises and the Intermediary Role of Banks. *International Journal of Finance & Economics*, *4*(4), 313-323.

Burnside, C., Eichenbaum, M., & Rebelo, S. (2004). Government guarantees and self-fulfilling speculative attacks. *Journal of Economic Theory*, *119*(1), 31-63.

Caballero, R. J., & Krishnamurthy, A. (2001). International and domestic collateral constraints in a model of emerging market crises. *Journal of Monetary Economics*, *48*(3), 513-548.

Cartapanis, A. (2004). *Les marchés financiers internationaux*. La Decouverte.

Castillo, F. (2006). Predicting a currency crisis alternative approaches and applications to the philippines.

Chang, R., & Velasco, A. (2001). A model of financial crises in emerging markets. *The Quarterly Journal of Economics*, *116*(2), 489-517.

Chinn, M. D., & Meredith, G. (2004). Monetary policy and long-horizon uncovered interest parity. *IMF Staff Papers*, *51*(3), 409–430. Retrieved from http://www.jstor.org/stable/30035956

Comelli, F. (2014). Comparing parametric and non-parametric early warning systems for currency crises in emerging market economies. *Review of International Economics*, *22*.

Corsetti, G., Pesenti, P., & Roubini, N. (1999). What caused the asian currency and financial crisis? *Japan and the World Economy*, *11*(3), 305-373.

Céspedes, L. F., Chang, R., & Velasco, A. (2004). Balance sheets and exchange rate policy. *The American Economic Review*, *94*(4), 1183–1193.

Dhillon, A., Garcia-Fronti, J., Ghosal, S., & Miller, M. (2006). Debt restructuring and economic recovery: Analysing the argentine swap. *The World Economy*, *29*, 377-398.

Dooley, M. P. (2001). A Model of Crises in Emerging Markets. *The Economic Journal*, *110*(460), 256-272.

Edison, H. J. (2000). Do indicators of financial crises work? an evaluation of an early warning system. *International Monetary Fund*.

Eichengreen, B., Hausmann, R., & Panizza, U. (2007). Currency mismatches, debt intolerance, and the original sin: Why they are not the same and why it matters. In *Capital controls and capital flows in emerging economies: Policies, practices, and consequences* (p. 121-170). National Bureau of Economic Research, Inc.

Eichengreen, B., Rose, A., & Wyplosz, C. (1994). Speculative attacks on pegged exchange rates: An empirical exploration with special reference to the european monetary system. *National Bureau of Economic Research, Inc*.

Eichengreen, B., Rose, A., & Wyplosz, C. (1996). Contagious currency crises. *Scandinavian Economic Review*, *98*, 29-56.

Esquivel, G., & Larrain, F. (1998). Explaining currency crises. *John F. Kennedy Faculty Research WP Series*(1998-01).

Flood, R., & Marion, N. (2002). A model of the joint distribution of banking and exchange-rate crises. *IMF Working Papers*, *01*.

Flood, R., & Rose, A. (2002). Uncovered interest parity in crisis. *IMF Staff Papers*, *49*, 252-266.

Fontaine, T. (2005). Currency crises in developed and emerging market economies: A comparative empirical treatment. *IMF Working Papers*, *05*.

Frankel, J. A., & Rose, A. K. (1996). Currency crashes in emerging markets: an empirical treatment [International Finance Discussion Papers]. *Board of Governors of the Federal Reserve System (U.S.)*(534).

Furman, J., & Stiglitz, J. (1998). Economic crises: Evidence and insights from east asia. *Brookings Papers on Economic Activity*, *29*(2), 1-136.

Glick, R., & Moreno, R. (1999). Money and Credit, Competitiveness, and Currency Crises in Asia and Latin America [Papers]. *Economisch Institut voor het Midden en Kleinbedrijf-*.

Goderis, B., & Ioannidou, V. (2008). Do high interest rates defend currencies during speculative attacks? new evidence. *Journal of International Economics*, *74*, 158-169.

Kaminsky, G., Lizondo, S., & Reinhart, C. (1998). Leading indicators of currency crises. *International Monetary Fund*, *45*, 1-48.

Karabulut, G., Bilgin, M. H., & Danisoglu, A. C. (2010). Determinants of currency crises in turkey: Some empirical evidence. *Emerging Markets Finance Trade*, *46*, 51–58.

Krugman, P. (1979). A model of balance-of-payments crises. *Journal of Money, Credit and Banking*, *11*(3), 311–325.

Krugman, P. (1998). It's Baaack: Japan's Slump and the Return of the Liquidity Trap. *Brookings Papers on Economic Activity*, *29*(2), 137-206.

Krugman, P. (1999). Balance Sheets, the Transfer Problem, and Financial Crises. *International Tax and Public Finance*, *6*(4), 459-472.

McKinnon, R. I., & Pill, H. (1997). Credible economic liberalizations and overborrowing. *The American Economic Review*, *87*(2), 189–193.

Milesi-Ferretti, G. M., & Razin, A. (1998). Current account reversals and currency crises: Empirical regularities [IMF Working Papers]. *International Monetary Fund*.

Nakatani, R. (2017a). The effects of productivity shocks, financial shocks and monetary policy on exchange rates: An application of the currency crisis model and implications for emerging market crises. *Emerging Markets Finance and Trade*, *53*, 2545-2561.

Nakatani, R. (2017b). Structural vulnerability and resilience to currency crisis: Foreign currency debt versus export. *The North American Journal of Economics and Finance*, *42*, 132-143.

Nakatani, R. (2018). Real and financial shocks, exchange rate regimes and the probability of a currency crisis. *Journal of Policy Modeling*, *40*(1), 60-73.

Nordhaus, W. D. (1975). The political business cycle. *The Review of Economic Studies*, *42*(2), 169–190.

Obstfeld, M. (1996). Models of currency crises with self-fulfilling features. *European Economic Review*, *40*(3), 1037-1047.

P.Flood, R., & M.Garber, P. (1984). Collapsing exchange-rate regimes: Some linear examples. *Journal of International Economics*, *17*(1), 1-13.

Sachs, J. D., Tornell, A., & Velasco, A. (1996). Financial crises in emerging markets: The lessons from 1995. *Brookings Papers on Economic Activity*, *27*(1), 147-216.

Saxena, S. (2004). The changing nature of currency crises. *Journal of Economic Surveys*, *18*, 321-350.

Weller, C. (2001). Financial crises after financial liberalisation: Exceptional circumstances or structural weakness? *The Journal of Development Studies*, *38*, 98-127.

Zeyneloglu, I. (2018). Currency crises and monetary policy: The role of foreign inputs. *Economics Bulletin*, *38*, 2008-2015.

Zhang, M. Z. (2001). Speculative Attacks in the Asian Crisis [IMF Working Papers]. *International Monetary Fund*.