University of Cyprus
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The potential impact of a currency crisis for Turkey and its impact on its sovereign bond yield and (Turkey's – US) sovereign bond yield spread.

Master Thesis in Finance

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Abstract

Though currency and debt crises quite often occur simultaneously, the links between these two types of crises are not well understood. In this research study, we review how monetary policy, debt structure and trade outcomes in Turkey affects the Turkey's 5-year sovereign bond yield and the (Turkey's – US) sovereign bond yield spread among the quarterly period 2005 – 2020. In addition, we examine and indicate the strongest relationships between the monetary policy, debt, and trade outcomes during the examined period.

Keywords: Currency crisis, Debt Crisis, Sovereign bond yield, Sovereign bond yield spread

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Β Ε Β Α Ι Ω Σ Η

Βεβαιούται ότι η μεταπτυχιακή φοιτήτρια Βασιλική Ιωαννίδου (Αρ. Ταυτότητας 930384) ολοκλήρωσε με επιτυχία την προφορική υποστήριξη της διπλωματικής της μελέτης σε εξέταση που έλαβε χώραν ενώπιον διμελούς εξεταστικής επιτροπής, στις 18 Μαΐου 2021. Παρέδωσε την διπλωματική της μελέτη στις _____.

Η εξεταστική επιτροπή,

_____ _____

Ανδρέας Μιλιδώνης Γιώργος Νησιώτης

(Πρόεδρος, Σύμβουλος) (Σύμβουλος)

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Chapter One – Introduction

INTRODUCTION

The existence of currency and sovereign debt crises at the same time is a very usual phenomenon. Those two types of crises might be connected. Despite that fact, the literature on currency crises and sovereign defaults often ignores the important question of how the two types of crises might be connected. This has as a result to treat currency and debt crises as independent events which is something that may lead to misjudge conclusions.

In several studies, the level of external debt of countries is an important indicator which leads to currency crises. A significant question is through which channels a high level of debt may lead to depreciation. However, this question remains unanswered. It is essential to make a research and come to a conclusion regarding this issue. If for example the increase of debt levels is directly increasing the risk of currency crisis, or does it just raise the possibilities of a debt crisis and it is actually the existence of the debt crisis which may lead to increase the risk of a currency crisis? Actually, if currency and debt crises are caused by the same reasons and/or by domino effects from the one type of crisis to the other, a consideration of these interconnections may enlarge the results of a research and the same time improve the quality of early warning systems.

In this research study, we study how monetary policy, debt structure and trade outcomes in Turkey affects the Turkey's 5-year sovereign bond yield and the (Turkey's – US) sovereign bond yield spread among the quarterly period 2005 – 2020. In addition, we examine and indicate the strongest relationships between the monetary policy, debt, and trade outcomes during the examined period.

In chapter two, we shortly review the literature based on the link between debt and currency crisis. In Chapter three, we discuss the methodology of the research study which conducted from search terms based on finding variables, data sources, exclusion and inclusion criteria, the explanation of variables, state the statistical models and the analysis

of these models. In Chapter four, we explain the descriptive analysis of the variables and significant statistical results of the two statistical models. Finally, we conclude the results based on study's facts.

Chapter Two – Literature Review

LITERATURE REVIEW

2.1 CONNECTION BETWEEN CURRENCY AND DEBT CRISES

The financial turmoil and distress in the 1990s led several countries experienced issues in the banking sector and in parallel the balance of repayments. The literature created the term "twin crisis" to explain this phenomenon which motivated extensive research on the links between currency and banking crises (e.g. Kaminsky, G. and Reinhart, C. 1999). On the contrary, a second type of twin crises, the simultaneous existence of sovereign debt and currency crises, has drawn less attention.

> 'A currency crisis is a speculative attack on the foreign exchange value of a currency, resulting in a sharp depreciation or forcing the authorities to sell foreign exchange reserves and raise domestic interest rates to defend the currency' (Reuven Glick and Michael Hutchison, 2011)

For Frankel and Rose (1996), an annual depreciation of at least 25% is considered as currency crisis. For the countries with high inflation rates and correspondingly high rates of depreciation, the authors put another criterion to not consider each of these depreciations as an independent crisis episode: the change in the exchange rate should also exceed the previous year's change in the exchange rate by a margin of at least 10%.

For Glick and Moreno (1999), a crisis occurs when the monthly percentage change in the exchange rate exceeds the index mean (μ) plus two standard deviations ($2 \times \sigma$). For Esquivel and Larrain (2000), a currency crisis occurs if the accumulated three-month real exchange rate is greater than 15% or the one-month real exchange rate is higher than 4% and also greater than the index means (μ) plus 2.54 standard deviations ($2.54 \times \sigma$).

> ‘From a legal perspective, a default episode is an event in which a scheduled debt service is not paid beyond a grace period specified in the debt contract’ (Ricardo Correa and Horacio Sapriza, 2014)
>
> Standard and Poor's (2002) that defines a country to be in default as long as the sovereign is not current on any of its debt obligation.

Typically, the majority of literatures on currency crises and sovereign defaults usually ignores the question of how the two types of crises might be related and typically treats currency and debt crises as two completely separated events. However, many authors have found possible interconnections between those type of crises (e.g. Chiodo and Owyang 2002; Mussa 2002; Chui, M., Gui, P., and Haldanc, A. 2000; Corsetti, G. and Mackowiak, B. 2001; Janjah, S. and Montiel, P. 2003.)

The principal approach of the sovereign debt literature was to ask why governments repay their debt at all. Creditors can apply only a few legal institutions or sanctions to enforce their claims. A usual answer is that governments repay their debt because they want to avoid huge damage in reputation, they would make it more expensive to issue new debt in the near future (e.g Eaton, J. and Gersovitz, M. 1981; Grossmann, H. and van Huyck, K. 1988; Cole, H., Dow, J., and English, W. 1995). Cole and Kehoe (1998) identify the level and the maturity structure of the debt to be crucial factors that can cause self-fulfilling debt crises. They find that multiple equilibria become possible as soon as the debt exceeds a specific level. With a longer maturity structure, a higher debt level can be maintained without risking a debt crisis.

In the literature of currency crisis, the first generation approach describes the breakdown of a fixed exchange rate as an inevitable result of excessive fiscal or monetary policies which are inconsistent with the exchange rate regime (e.g. Krugman, P. 1979; Flood, R. and Garber, P. 1984). In the second generation models the exit from an exchange rate peg is seen as a deliberate and strategic policy choice of a government, that maximizes public welfare by weighting the costs and benefits of the fixed exchange rate (e.g. Obstfeld, M. 1986, 1994, and 1996; Ozkan, G. and Sutherland, A. 1998). Shifts in private expectations have an important role in these models since they insert the government’s welfare function

or its budget constraint in various ways, e.g. via an expectations increased Phillips curve or interest rate premiums. The government policy choice becomes endogenous in so far as it also depends on the private expectations. This feature typically allows for multiple equilibria solutions. However, fundamentals still have a crucial role in those models, since multiple equilibria exist only for some scopes of fundamentals. In one hand, there are situations in which the fundamentals are adequate good so that the government holds the exchange rate peg regardless of the privates' expectations. On the other hand, there exist situations with very bad fundamentals in which the government chooses to devalue regardless of the private expectations. In between those two cases there is a zone of multiple equilibria, a "grey area" in terms of Krugman (1996), in which changes in the private beliefs lead to self-fulfilling currency crises.

While currency and debt crises have been treated as independent events in the literature so far, it seems to be necessary to investigate their interconnections since the one type of crisis may affect the other type. The simultaneous emergence of currency and sovereign debt crises is probably a common phenomenon. Reinhart (2002) finds that 84% of the defaults in her emerging markets sample are associated with currency crises while almost half of the currency crises in the sample are linked with defaults. For example, in 1998 and 2001, Russia and Argentina faced simultaneous currency and debt crises, respectively. She also conjectures that countries such as Mexico, South Korea, Thailand and Turkey would most likely have experienced exchange rate disturbances as well as sovereign defaults if they had obtained vast international rescue packages. Herz and Tong (2003) find that 32% of all debt crises in their developing countries sample are linked to currency crises, while 20% of the currency crises are related to debt crises.

Based on Axel D., Bernhard H., and Volker K., who assumes that currency and debt crises could be positively related based on the same causes, the concurrent existence of problems in the balance-of-payments and the government's budget could be because currency and debt crises are caused by common factors. Firstly, negative shocks on total demand might lead to a breakdown in real economic activity and impose market pressure on the local currency to underestimate. A government that has committed itself to keep a

fixed exchange rate peg is forced to sell international reserves and/or to raise the interest rate in order to defend the peg, thereby deteriorating the recession. Nevertheless, output and employment losses imply that the authorities have strong incentives to exit the peg and fight the recession by monetary expansion. Rational speculators recognize the incentives of government. They forecast devaluation and withdraw their capital, thereby increasing devaluation pressure on the local currency and the costs of defending the peg. It finally gives in to the devaluation pressure, there by validating speculators' expectations. Also, output and employment losses also have a negative impact on the primary budget balance of the government, as public expenditures tend to raise while taxable income gets smaller. This increases the probability of sovereign default, particularly if the government has no further access to credits from the international capital market or can issue new debt at terribly high interest rates. Secondly, the increase in the level of the international (real) interest rate is a second important factor that may trigger both a currency and a debt crisis. Under capital mobility domestic debtors must increase their interest payments if they want to rollover maturing debt or raise additional funds. If such adjustment does not occur, important outflows of portfolio capital put pressure on the currency. However, if the adjustment does take place, increased interest rates may cause investment and consumption to decline, leading to a recession with all the negative consequences for the balance-of-payments and the government's budget that have already been discussed. Additionally, higher interest rates also directly increase the government's /and other borrowers' incentive to default on its/their debt, as debt rollovers become more expensive and debt service raises. Finally, currency and debt crises can be caused by political, institutional and structural problems that may well have existed for a long period or have been worsening over time but that have so far been unobserved by international investors.

In addition, based on Axel D., Bernhard H., and Volker K., opinion who believe that a default can simply be considered as the source of a recession that affects the exchange rate. Furthermore, in the case of a sovereign default rational investors don't lend additional funds to the sovereign debtor but try to recover their capital. Additionally, if speculators correctly define the sovereign fiscal crisis as a sign that the economy enters recession and crisis, they do not only claim back and refuse to roll-over the maturing debt of the

government, but they also remove a large part of their portfolio investments from the economy, thereby deteriorating devaluation pressure.

Also, currency and debt crises could be positively related based of internal contagion from currency to debt crisis. In response to speculative pressure on their currency peg, policymakers face a trade-off. Keeping in mind multiple factors like the economy's initial fundamental situation, the structure of the financial markets, and the balance sheets of banks, firms, and its own budget, the government compare the costs and benefits of each option and chooses the least costly one (Axel D., Bernhard H., and Volker K., 2006)

Defending the peg indicates increasing interest rates, as monetary authorities raise short-term interest rates to stimulate capital inflows and stop capital outflows. Nevertheless, these higher interest rates increase the risk of a sovereign debt to default. First, rising interest rates make the future debt service more expensive and thus increase the government's probability to default. Second, high interest rates may lead into a recession as they cause total demand to decline. The number of bankruptcies and private debt defaults increases, tax revenues decrease, and the fiscal deficit and thus the risk of sovereign debt default both increase (Flood and Jeanne, 2001; Lahiri and Vegh, 2003, 2005).

If the government abandons the peg, it risks harming its reputation and output. In addition, fiscal policy also may be negatively affected so that the risk of a sovereign debt default increases. After devaluation it might be difficult for a country to get into the international capital market. Especially emerging markets' currency crises are often followed by downgrades of the credit rating (Calvo and Reinhart, 2000a,b; Reinhart, 2002). Devaluation can thus be conveying the meaning of a wake-up call and Investors withdraw their funds unless the government is prepared to offer higher risk premiums. For the government , this again makes borrowing and rolling over its maturing debt more expensive, so that a public debt default becomes more likely.

Another significant channel results from the so-called 'original sin' phenomenon (Eichengreen and Hausmann, 2005; Jeanne, 2005). Developing countries and emerging

markets are usually not able to borrow from the international capital markets in their own currencies. As developing countries typically accumulate net external debt positions and as their few financial assets are usually at least partly denominated in local currency, there is a currency mismatch in most countries' balance sheets.

Underneath original sin, high debt is a double burden for sovereign borrowers. A government which targets to roll-over maturing debt or wants to issue new debt has to convince its international creditors not only that it will be able to raise enough taxes to honour its debt service obligations but also that it will be able to convert those revenues into foreign exchange, as debt service is due in foreign currency. If prices are inflexible so that purchasing power parity does not hold at least in the short run, a nominal devaluation drastically increases costs of carrying the debt and might cause a sovereign debt crisis, as the government cannot immediately compensate the higher real debt level by higher tax revenues. Instead, as a large part of private corporations in emerging markets are also indebted in foreign currency, a nominal devaluation has the same damaging consequences on their balance sheets and can cause significant firm and bank bankruptcies, thereby lowering the tax base and expanding the fiscal crisis even further (see e.g. Mishkin, 1996)

Finally, currency and debt crises could be negatively related based on budget financing. The two types of crises may also be negatively connected via the government's budget constraint. There are other ways for the government to finance its regular expenditures and to balance the budget. If the budgetary position is strained, the government may decrease expenditures, increase taxes, try to roll-over maturing debt and to issue new debt. The government has to choose between these options in every period. If it cannot or does not want to reduce expenditures and increase taxes, then a monetary expansion, which lead to inflation and devaluation pressure, and a sovereign debt default are the only options to balance the budget. To the extent that the government chooses to finance its budget by printing money, the need of financing through a debt default decreases and vice versa. Therefore, on the issue of budget financing is concerned, the existence of a currency crisis should make the emergence of a simultaneous debt crisis less likely and vice versa (Axel D., Bernhard H., and Volker K., 2006).

2.2 OVERVIEW OF THE TURKISH ECONOMY IN 2021

The last 10 years the Turkish Lira to US Dollar exchange rate presents a huge decline. Specifically, on 31 December 2011, 1 Turkish Lira was equal to 0.528541 and on 31 December 2020 the exchange rate of TRY to USD was 0.135285. That means that currency of Turkey depreciated every year in contrast of US Dollar and the Turkish Lira devaluated. The currency depreciation in Turkey based mainly on domestic political stability, balance of trade deficit, low foreign currency reserves.

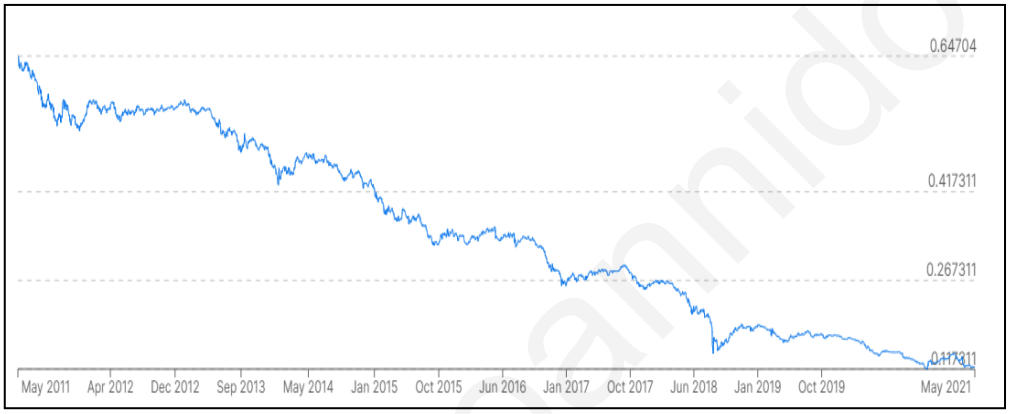

Figure 1: Turkish Lira to US Dollar; 2011 - 2021

Turkey's current government debt is about ₺1800 billion, which is equivalent to $285 billion. The national debt per citizen is ₺22,459 and the Debt as percentage of GDP is 33.43%. The GDP of Turkey and the population is about ₺ 5380 billion and 80 million, respectively.

Turkey's sovereign debt is not valued only in the country's currency (Table1), the Turkish Lira (TRY). Investors who want to buy Turkish government bonds can avoid the problem of the falling Lira by buying bonds in other currencies.

Bond Currency	No of Outstanding Issues	Value in TRY
TRY	62	576,051,992,432
USD	27	55,250,000,000
EUR	5	6,500,000,000
JPY	3	370,000,000,000
Total Value in TRY		1,007,801,992,432

Table 1: Sovereign Debt of Turkey divided on different currencies (commodity.com)

Chapter Three - Methodology

METHODOLOGY

3.1 INTRODUCTION

In this section will discuss and analyse several issues related to the methodology on which this research study is founded including the methods, the data collection approach, the exclusion and inclusion criteria, the search terms that will be utilised, data and statistical analysis. Methodology is a fundamental part of a research study which helps to ensure the comprehension of the problem, the consistency between selected tools, techniques, and underlying philosophy. In addition, methodology helps to facilitate identification of potential solutions to the problem that is being investigated. One of the ways of research methodology construction is based on theoretical concept of "research onion", which developed by Saunders et al. (2007). The research 'onion' provides an exhausting description of the main layers or stages which are to be accomplished in order to formulate an effective methodology (Raithatha, 2017).

The research onion consists of six main layers:

1. Research philosophy

2. Approach to theory development

3. Methodological choice

4. Strategy

5. Time horizons

6. Techniques and procedures include data collection and analysis

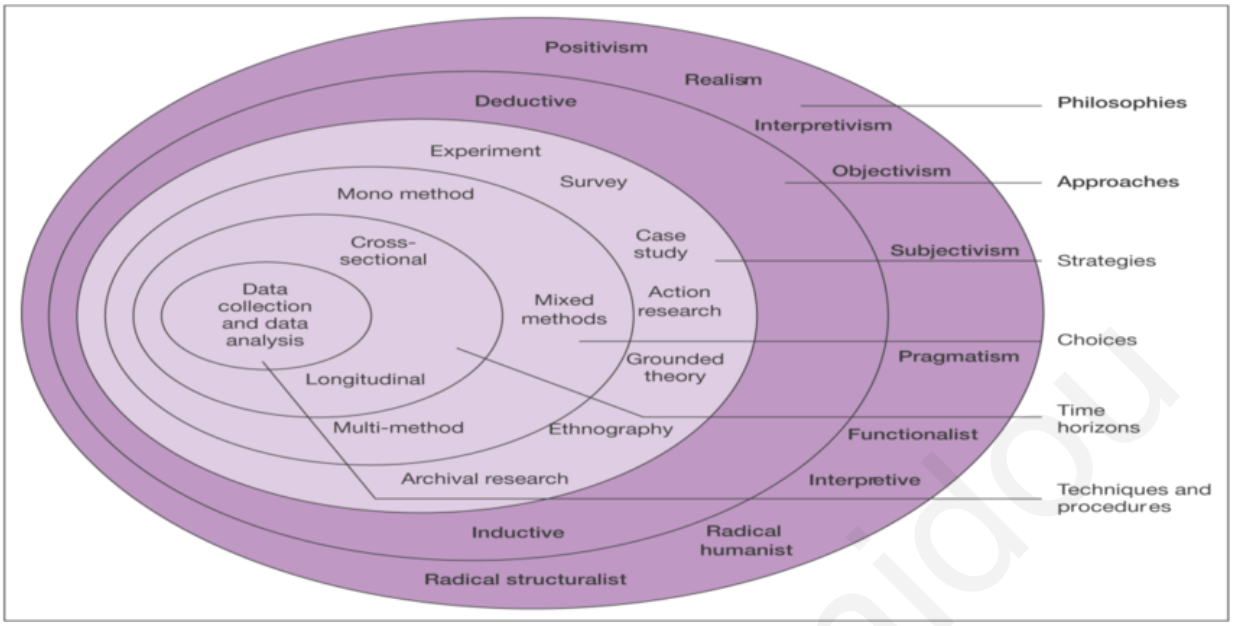

Figure 2: Research 'Onion' (Source: Saunders et al., 2007)

3.2 METHODS

Based on Creswell (2008) there are three principal methodologies from which a researcher may choose as they engage in a study. The three main methodologies are:

1. the quantitative method
2. the qualitative method
3. the mixed methods

Each methodology has different attributes which contribute to different outcomes. More specifically, the strengths and weaknesses of the qualitative approach are different from that of the quantitative approach (Polit & Beck, 2004). Therefore, every researcher should select a methodology which match his/her criteria while at the same time fulfils the research purposes. For example, qualitative methods which it is based on non-numerical data, are more suitable for hypothesis generation than for hypothesis testing, whereas the opposite pattern can be said to hold for quantitative methods. In addition, by qualitative methods we ordinarily obtain greater depth than by quantitative ones, while quantitative methods which defined with combinational and probabilistic approach (Kolmogorov, 1965) often result in better objectivity and generalizability than qualitative ones. The main

argument of the mixed methods strategy is that by combining qualitative and quantitative methods can enlarge their strengths and at the same time minimise their weaknesses (Tashakkori & Teddlie, 1998). In addition, mixed methods allow a more complete usage of data than do separate quantitative and qualitative data collection and analysis for the broad purposes of breadth and depth of understanding and corroboration (Johnson et al. 2007, p.123).

In this research study, the appropriate methodology is a combination of qualitative and quantitative methods, which means that the selected method for this research is the multi-methods. This study requires the usage of quantitative approach because of the investigation of the cause-and-effect relationship concerning the potential impact of the currency crisis for Turkey and the impact on Turkey's and US sovereign. Also, the quantitative unit of this research will be based on the usage of a statistical model which mainly consists of debt and currency variables based on Turkey's economy. The qualitative approach helps the researcher to explain and understand with more precisely the statistical model, statistical estimators and any other issue based on statistical assumptions.

3.3 SEARCH TERMS AND VARIABLES

The search terms that will be particularly helpful for the descriptive property of variables and used in this research study are listed below:

- 2008 Global Financial Crisis
- Political Government and Governance
    - Recep Tayyip Erdogan presidency
- Turkish Coup d'état attempt
- Turkey Currency and debt crisis (2018)
- Dismissal of central bank governor Murat Cetinkaya (2019)
- Covid19 and excess mortality

- Turkey's Monetary Policy
- Exchange rate and Depreciation of Turkish Lira
- Turkey's Foreign Currency Rating
    - Credit Rating agencies (Moodys, Fitch and S&P500) downgraded Turkey's sovereign credit rating to non-investment grade
- Turkey's Local Currency Rating
- Corruption Perceptions Index (CPI) and country's transparency
- Current account deficit

3.4 DATA SOURCES

For research purposes have to be considered a lot of information regarding this subject. Therefore, the access to various databases that contain that information is imperative. First of all, the Google Scholar will be used as a searchable database of scholarly literature. It is a database that provides information from different fields and includes studies and journal articles. It is mainly used in order to find articles from academic publishers based on similar topics related to currency crisis and sovereign debt link. Most of the articles that used are from International Journal of Finance and Economics. The historical financial databases were used to extract the data are DataStream, CountryData.com, DSI Global Environmental Database, Global Financial Data, World Bank Statistics. In addition, the economic and politic environment in Turkey was very volatile therefore the study of local and global newspapers like Financial Times and Hurriyet Daily News will be very useful in order to inform, understand and explain some of the issues.

The data set will based on quarterly data and consists of monetary, debt and trade parameters concerning Turkey for the period 2005 to 2020

3.5 INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

The collection and the selection of the most appropriate variables will be a product of an investigation, which will be done based on scholarly articles and publications from reliable sources and journals. Additionally, the publications which are going to be selected are those whose give emphasis only on sovereign debt and currency crisis issues and emphasize the casual link between of them.

EXCLUSION CRITERIA

The variables which have huge lack of observations will not be selected for further examination and research. More specific, variables which their missed values exceed the 10% of their total observations will be excluded. Furthermore, publications which will be based on someone's opinion on case studies and not proven facts will be also excluded.

3.6 DATA ANALYSIS

VARIABLES ANALYSIS

This study mainly focuses on finding the potential impact of the currency crisis on Turkey over the last 15 years and its impact on Turkey's 5-year sovereign bond yield and also the impact on the spread between Turkey's and US 5-year sovereign bond yield. As dependent variables will be used (a) the spread between Turkey's and US (5-year) sovereign bond yield and (b) the Turkey's 5-year sovereign bond yield. In addition, all the independent variables based on Turkey's economy and can be interpreted as variables which are related with the monetary policy and outcomes, variables which concern the amount and the structure of the debt, and the variables which are related with the trade outcomes.

In total, the independent variables are nine for both statistical models and will be found in quarters for the period 2005 to 2020.

3.6.1 DEPENDENT VARIABLE

Broadly, a sovereign bond is a specific debt instrument issued by the government. They can be denominated in domestic and foreign currency. Also, they promise to pay the buyer a certain amount of interest for a specified number of years and repay the face value on maturity. They also have a rating associated with them which essentially speaks of their credit worthiness. The government bond yield is the interest rate that the government pays on issuing bonds. Countries with volatile economies and high level of inflation rates have to issue higher interest returns on their bonds in contrast to more stable ones.

For the purposes of the research study, the dependent variables that are going to be used, are the 5-year Turkey's sovereign bond yield and the 5-year bond yield spread between Turkey and US. More specific, the 5-year Turkey's sovereign bond yield is the yield received for investing in a Turkey's government bond that has maturity of 5 years. Also, the bond yield spread, refers to the difference between the yield of Turkey's and the US and reflect the relative risks between of the bond yields.

3.6.2 INDEPENDENT VARIABLES

Currency variables:

Total Reserves (includes Gold) as percentage of External Debt: Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities (World Bank). Gross external debt, at any given time, is the outstanding amount of those actual current, and not contingent, liabilities that require payment(s) of principal and/or interest by the debtor at some point(s) in the future and that are owed to non-residents by residents of an economy (IMF).

Gross Domestic Product (GDP) growth: Gross domestic product is the value of the goods and services produced by the nation's economy less the value of the goods and services used up in production. GDP is also equal to the sum of personal consumption expenditures, gross private domestic investment, net exports of goods and services, and government consumption expenditures and gross investment. Real Economic Growth Rate is the rate at

which a nation's GDP changes/grows from one year to another (Bureau of Economic Analysis, BEA).

Exchange Range Depreciation: Exchange rates are the price of one country's' currency in relation to another (International Financial Statistics Yearbook, IMF). In this study the exchange rate will be used is Turkish Lira (₺) to US Dollar ($). The depreciation of an exchange rate is a fall in the value of a currency in terms of its exchange rate versus other currencies, calculated as follows:

$$\%\Delta X_t = \frac{X_t - X_{t-1}}{X_{t-1}} \times 100$$

Current Account Balance as percentage of GDP: The ratio of the current account balance to the GDP provides an indication of the country's level of international competitiveness. Gross domestic product (GDP) is the value of the goods and services produced by the nation's economy less the value of the goods and services used up in production.

Money supply as percentage Year over Year (YOY): The total stock of money circulating in an economy is the money supply, and in this study founded as percentage YOY. The circulating money involves the currency, printed notes, money in the deposit accounts and in the form of other liquid assets.

Consumer Price Index (CPI) as percentage YOY: defined as a measure of the average change over time in the prices paid by urban consumers for a market basket of consumer goods and services. In this study founded as percentage year over year.

Debt variables:

Short Term Debt over Total External Debt: Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Total external debt is debt owed to non-residents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt (World Bank).

Trade variables:

Exports of goods and services as percentage of GDP: merchandise trade comprise goods leaving the statistical territory of a country and it calculated as percentage of GDP (OECD).

Imports of goods and services as percentage of GDP: goods and services which add to the stock of material resources of a country by entering its economic territory and it calculated as percentage of GDP.

3.7 EMPIRICAL MODELS

Equation 1:

$$\Upsilon = \alpha + [\beta 1\ (\text{TK SHORT TERM DEBT OVER EXTERNAL DEBT})] + [\beta 2(\text{TK\_TOTAL\_RESERVES\_INCLUDES\_GOLD\_\%EXTERNAL DEBT}) + \beta 3(\text{TK\_GDP\_GROWTH}) + \beta 4(\text{DEPRECIATION\_ER}) + \beta 5(\text{TK\_CURRENT\_ACCOUNT\_BALANCE\_\% GDP}) + \beta 6(\text{TK\_MONEY\_SUPPLY\_\% YOY}) + \beta 7(\text{TK\_CPI\_\% YOY})] + [\beta 8(\text{TK\_EXPORTS\_\% GDP}) + \beta 9(\text{TK\_IMPORTS\_\% GDP})] + \varepsilon_i$$

Where Y **=** 5-YEAR SOVEREIGN BOND YIELD SPREAD (TURKEY'S – US)

Equation 2:

$$\Upsilon = \alpha + [\beta 1\ (\text{TK SHORT TERM DEBT OVER EXTERNAL DEBT})] + [\beta 2(\text{TK\_TOTAL\_RESERVES\_INCLUDES\_GOLD\_\%EXTERNAL DEBT}) + \beta 3(\text{TK\_GDP\_GROWTH}) + \beta 4(\text{DEPRECIATION\_ER}) + \beta 5(\text{TK\_CURRENT\_ACCOUNT\_BALANCE\_\% GDP}) + \beta 6(\text{TK\_MONEY\_SUPPLY\_\% YOY}) + \beta 7(\text{TK\_CPI\_\% YOY})] + [\beta 8(\text{TK\_EXPORTS\_\% GDP}) + \beta 9(\text{TK\_IMPORTS\_\% GDP})] + \varepsilon_i$$

Where Y = TURKEY 5-YEAR GOVERNMENT BOND YIELD

3.8 STATISTICAL ANALYSIS

In this research, panel data will be analysed using Multiple Linear Regression (MLR). In addition, the selection procedure of the predictor variables is backward elimination (or backward deletion) method. Specifically, the backward elimination method first includes all the independent variables into the statistical equation fand each one is deleted one at a time if they do not contribute to the regression equation.

Before fitting the models, the variables that have values in US dollar currency will be normalized in order to be comparable and measured in same scale . After fitting the statistical models using the Multiple Linear Regression based on backward deletion method, the null hypothesis will test at the 5% level of significance as indicated by the test statistic and the p-values.

Chapter Four – Empirical Results

EMPIRICAL RESULTS

4.1 DESCRIPTIVE STATISTICS AND GRAPHICAL ILLUSTRATION OF DEPENDENT VARIABLES

Table 2 and Figure 3 presents the descriptive statistics, and the graphical illustration of the dependent variables were used for statistical analysis purposes. More specific, the Turkey 5-year sovereign bond yield has minimum value equal to 3.65% and maximum value equal to 12.58%. The mean value and the standard deviation are 12.58% and 0.58, respectively. The sovereign bond yield spread fluctuates between 1.09% and 18.129% with mean value equals to 10.4% and standard deviation equals to 0.48.

As we can observe (Figure 3), the US 5-year sovereign bond yield has a stable trend between 2005 and 2020 with smooth fluctuations. On the other hand, the Turkey's 5-year sovereign bond yield has many and huge fluctuations during the examined period without a stable trend and as a result has a greater minimum, maximum, mean and standard deviation value than US 5-year sovereign bond yield.

Variable	N	Min	Max	Mean	Std. deviation
Turkey 5-year sovereign bond yield	64	3.65	22.54	12.58	0.58
US 5-year sovereign bond yield	64	0.272	5.098	2.18	0.16
Sovereign bond yield spread	64	1.09	18.139	10.4	0.48

Table 2: Descriptive statistics of dependent variables (2005-2020)

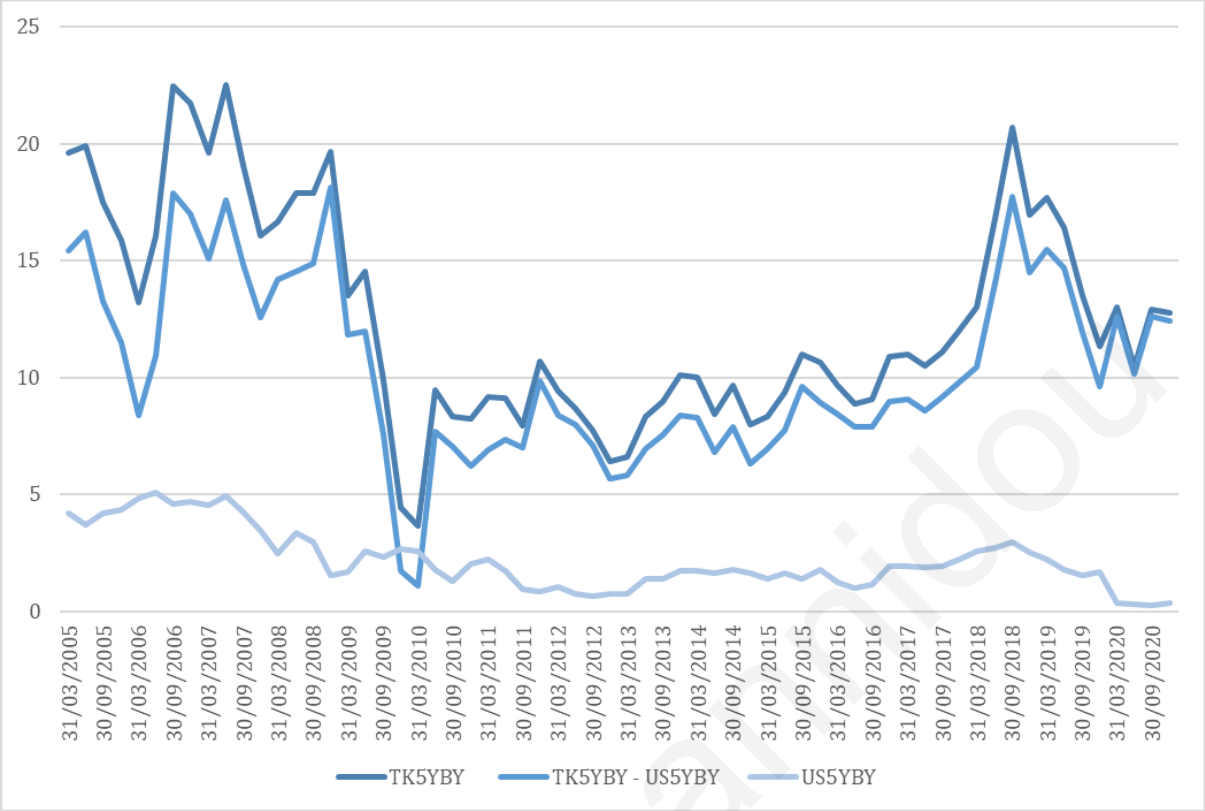

Figure 3: Sovereign bond yields and spread

4.2 DESCRIPTIVE STATISTICS OF INDEPENDENT VARIABLES

Table 3 presents the descriptive statistics of the independent variables for the period 2005 until 2020 on quarterly basis. More specific, the independent variables are based on Turkey's economy and can be interpreted as variables which are related with the monetary policy and outcomes, variables which concern the amount and the structure of the debt, and variables which are related with the trade outcomes.

Panel A presents the descriptive statistics of the debt variable, short term debt over external debt. More specific, it fluctuates between 16.664% and 34.638% with mean 25.656% and standard deviation 5.235. The short-term debt over external debt has an increase trend between the period 2005 until 2015 with a maximum and a minimum value was observed in 2013 and 2007, respectively.

Panel B shows the descriptive statistics of the currency variables; Total reserves (includes gold) as % of external debt, GDP growth, Exchange rate depreciation, Current

account balance as % of GDP, Money supply (% YOY) and Consumer Price Index (% YOY). Total reserves (includes gold) as % of external debt fluctuates between 18.272% and 35.388% with mean 27.957% and standard deviation 4.182. More specific, the highest value was observed in 2013 and the lowest value in 2020. Also, GDP growth has minimum value equal to -24.380% and maximum value equal to 35.388%. The mean value is 1.721% and the standard deviation is 17.352. The GDP growth fluctuates continuously with many ups and downs among the examined period and the 40% of the total observations have negative values. The exchange rate depreciation fluctuates continuously between -16.660% and 37.566% with mean 3.182% and standard deviation 8.455. In addition, the Current account balance as % of GPD has minimum value -11.39% and maximum value 3.68%, with mean -4.428% and standard deviation 2.873. More specific, the majority (93%) of the observations have negative values. The money supply as % YOY, fluctuates between 7.70% and 125.58%, with mean equal to 25.307% and standard deviation 24.879. More specific, a peak of 125.58% occur in 2005 and afterwards from 2007 until 2020 a stable trend was observed. The Consumer Price Index as % YOY has minimum value equal to 4.34% and maximum value 22.37%. The mean value and standard deviation are 9.63% and 3.341, respectively. More specific, it fluctuates continuously between the examined period with a maximum value was observed in 2018.

Panel C concerns the trade outcomes of the Turkey relative to exports and imports as percentage of GDP. More precisely, the exports as % of GPD fluctuates between 19.294% and 34.112%, with mean value 24.242% and standard deviation 3.708. The imports as % of GDP has minimum value of 22.408% and maximum value of 34.243. The average value is equal to 27.776% and the standard deviation is equal to 3.708. The trade variables have many fluctuations with a constant upward trend over the 15 years period.

Based on the above, we observe fluctuations and peaks in variables in specific years. Firstly, the fluctuations were observed in 2008 where global economic crisis occurred, in 2016 where coup d'état attempt was attempted in Turkey against state institutions, including the government and President Recep Tayyip Erdoğan, in 2018 due to currency

crisis of Turkish lira; 1 Turkish lira was fallen to 0.1894 US dollars, in 2019 due to COVID19 effects and in 2020 where the President decided to dismiss the Central bank governor.

Variables	N	Min	Max	Mean	Std. deviation
Panel A: Debt Variables					
TK SHORT TERM DEBT OVER EXTERNAL DEBT	64	16.664	34.638	25.656	5.235
Panel B: Currency Variables					
TK TOTAL RESERVES (INCLUDES GOLD) (% OF EXTERNAL DEBT)	64	18.272	35.388	27.957	4.182
TK GD GROWTH	63	-24.380	29.776	1.721	12.532
ER DEPRECIATION	63	-16.660	37.566	3.182	8.455
TK CURRENT ACCOUNT BALANCE (% GDP)	64	-11.39	3.68	-4.428	2.873
TK MONEY SUPPLY (% YOY)	64	7.70	125.58	25.307	24.879
TK CPI (% YOY)	64	4.34	22.37	9.63	3.341
Panel C: Trade Variables					
TK IMPORTS (% GDP)	64	22.408	34.243	27.776	2.917
TK EXPORTS (% GDP)	64	19.294	34.112	24.242	3.708

Table 3: Descriptive statistics of independent variables

4.3 CORRELATION MATRIX

In table 4; Correlation Matrix presents the correlation between independent variables. As we observe most of the associations are very weak (0 to ±0.2), weak (±0.2 to ±0.4) and moderate (±0.4 to ±0.6). The strong associations (±0.6 to ±0.8) are limited and occurs between the following variables:

- Total reserves (incl. gold) as % of GPD and Consumer Price Index as % YOY (ρ=-0.66)
- Total reserves (incl. gold) as % of GPD and Exports as % of GDP (ρ=-0.62)
- Consumer Price Index as % YOY and Exports as % of GDP (ρ=0.79)
- Exports as % of GDP and Imports as % of GDP (ρ=0.62)

Finally, neither very strong (±0.8 to ±1.0) associations are observed.

	TK TOTAL RESERVES (INCLUDES GOLD) (% EXTERNAL DEBT)	TK GDP GROWTH	ER DEPRECIATION	TK CURRENT ACCOUNT BALANCE (% GDP)	TK MONEY SUPPLY (% YOY)	TK CPI (% YOY)	TK IMPORTS (% GDP)	TK EXPORTS (% GDP)	TK SHORT TERM DEBT OVER EXTERNAL DEBT
TK TOTAL RESERVES (INCLUDES GOLD) (% EXTERNAL DEBT)	1								
TK GDP GROWTH	0.02	1							
ER DEPRECIATION	-0.10	-0.37	1						
TK CURRENT ACCOUNT BALANCE (% GDP)	-0.37	-0.20	-0.18	1					
TK MONEY SUPPLY (% YOY)	0.04	0.01	-0.02	-0.11	1				
TK CPI (% YOY)	-0.66	-0.03	-0.005	0.47	0.02	1			
TK IMPORTS (% GDP)	-0.34	0.12	0.16	-0.28	-0.06	0.47	1		
TK EXPORTS (% GDP)	-0.62	-0.03	-0.008	0.57	-0.14	0.79	0.62	1	
TK SHORT TERM DEBT OVER EXTERNAL DEBT	0.09	-0.12	0.19	-0.03	-0.16	0.06	0.49	0.37	1

Table 4: Correlation Matrix

4.4 STATISTICAL MODELS

As mentioned above (methodology), our analysis focuses on finding the potential impact of the currency crisis on Turkey over the last 15 years and its impact on Turkey's 5-year sovereign bond yield and on sovereign 5-year bond yield spread between Turkey and US. . The analysis conducted with the usage of Multiple Regression Analysis (MLR). The statistical models that were used for our analysis are the following:

5-YEAR SOVEREIGN BOND YIELD SPREAD (TURKEY'S – US) = α + [β1 (TK SHORT TERM DEBT OVER EXTERNAL DEBT)] + [β2(TK_TOTAL_RESERVES_INCLUDES_GOLD_%EXTERNAL DEBT) + β3(TK_GDP_GROWTH) +β4(DEPRECIATION_ER) + β5(TK_CURRENT_ACCOUNT_BALANCE_% GDP) + β6(TK_MONEY_SUPPLY_% YOY) + β7(TK_CPI_% YOY)] + [β8(TK_EXPORTS_% GDP) + β9(TK_IMPORTS_% GDP)] + ε_i

TURKEY 5-YEAR GOVERNMENT BOND YIELD = α + [β1 (TK SHORT TERM DEBT OVER EXTERNAL DEBT)] + [β2(TK_TOTAL_RESERVES_INCLUDES_GOLD_%EXTERNAL DEBT) + β3(TK_GDP_GROWTH) +β4(DEPRECIATION_ER) + β5(TK_CURRENT_ACCOUNT_BALANCE_% GDP) + β6(TK_MONEY_SUPPLY_% YOY) + β7(TK_CPI_% YOY)] + [β8(TK_EXPORTS_% GDP) + β9(TK_IMPORTS_% GDP)] + ε_i

4.5 STATISTICAL ANALYSIS

Prior to fitting the regression models, the values in currency are normalized in order to be comparable and measured in the same scale. Also, all the variables were examined for potential missing values. As we observed from the descriptive statistics the missing values cases were less than 10% and in multiple regression analysis, they were substituted by their respective mean values.

The null hypothesis test examined at the 5% level of significance as indicated by the test statistic and the p-values. Regarding co-linearity, variance inflation factor (VIF) values were less than 10 for each variable, authorising the absence of multi-collinearity between the independent variables.

Diagnostic tests were performed to check the validity of the models. Linearity and normality were checked too by the usage of Q-Q plots while heteroscedasticity was checked through a residual plot.

4.5.1 MULTIPLE REGRESSION MODEL – MLR

The MLR estimation results for the two statistical model that mentioned above is described below. The examined level of significance is equal to 5%.

Table 4 below reports the MLR results on the statistical model 1; Y= 5-year sovereign bond yield spread (Turkey's – US), for the significant variables. Firstly, the constant value is equal to 13.257. In addition, the short-term debt over external debt is statistically significant at the 5% level. More specific, for every 1 percentage point of increase in the short term over external debt the 5-year sovereign bond yield spread between Turkey and US is decreased by 0.351 percentage points. Also, concerning the currency variables only the Consumer Price Index as % YOY is statistically significant at 5% level. Specifically, for every 1 percentage point of increase in the Consumer Price Index as % YOY the 5-year sovereign bond yield spread is increased by 0.638 percentage points.

Variables	Constant	Short term debt over external debt (X1)	Consumer Price Index (% YOY) (X2)
5-year sovereign bond yield spread (Turkey's – US) (Y)	β0= 13.257	β1= -0.351 (<0.001)**	β2= 0.638 (<0.001)**

Table 4: Empirical results on MLR; Y= 5-year sovereign bond yield spread (Turkey's – US)

Table 5 below reports the MLR results on the statistical model 2; Y= Turkey's 5-year government bond yield, for the significant variables. As we can observe, the short-term debt over external debt, the Consumer Price Index as % YOY and the Money Supply as % YOY are the statistically significant variables at 5% level.

The constant variable of the statistical model is equal to 17.519. In addition, for every 1 percentage point of increase in the short-term debt over external debt the 5-year Turkey's sovereign bond yield is decreased by 0.475 percentage points. Concerning the currency variables, for every 1 percentage point increase in the Consumer Price Index as % YOY and in the Money Supply as % YOY the 5-year Turkey's sovereign bond yield is increased by 0.643 and 0.041 percentage points, respectively.

Variable	Constant	Short term debt over external debt (X1)	Consumer Price Index (%YOY) (X2)	Money Supply (%YOY) (X3)
Turkey 5-year sovereign bond yield (Y)	β0=17.519	β1=-0.475 (<0.001)**	β2=0.643 (<0.001)**	β3=0.041 (0.014)**

Table 5: Empirical results on MLR; Y= 5-year Turkey's sovereign bond yield

Based on the above results, we observe that the Consumer Price Index as % YOY and short-term debt over external debt are statistically significant in both models. Specifically, the Consumer Price Index has higher impact than debt indicator. In addition, the signs of the coefficients are considered logical with an exemption. More specific, we expected negative sign on the short-term debt over external debt because a decrease on the external debt has as a result to decrease the exposure risk of a country and therefore reduces the Turkey's sovereign bond yield and at the same time the sovereign bond yield spread. Also, in terms of inflation (Consumer Price Index) we expected positive relationship with the Turkey's 5-year sovereign bond yield as well as with the sovereign bond yield spread because the higher the current and future rate of inflation, the higher the yields will rise across the yield curve, as investors will demand this higher yield to compensate for

inflation risk. Finally, based on the second statistical model where the money supply as % YOY is statistically significant, we expected negative sign because the increase in money supply led to a decrease in bond yields and in interest rates. The above statement is based on static Wicksellian model (Jack Carr and Lawrence B. Smith, 1972) which indicates that an increase in the money supply initially causes the real interest rate to decline, and then reverse its movement back to its original value, so that variations in the money supply have an effect, but only a temporary effect, upon the real rate of interest. Therefore, unexpected monetary changes have a significant but temporary impact on real interest rates, with the greatest impact occurring on the short end of the market ($\beta 3=0.041$).

CONCLUSION

In conclusion, we observed that the Turkish lira is more volatile currency in contrast of US dollar. Also, we observed that the 5-year Turkey's sovereign bond yield has many ups and downs among the period 2005 to 2020 in contrast of US 5-year sovereign bond yield which has a stable trend among the examined period. In addition, we observe a strong positive relationship between (i) Consumer Price Index as % YOY and Exports as % of GDP and (ii) Exports as % of GDP and Imports as % of GDP. Negative strong relationships are observed between (i) Total reserves (includes golf) as % of GDP and Consumer Price Index as % of YOY and (ii) Total reserves (includes gold) as % of GDP and Exports as % of GDP. Finally, from the results of the statistical analysis, we can conclude that the sovereign bond yield (spread) has positive relationship with consumer price index and negative with short term debt over external debt. Regarding the impact of the statistically significant variables on the dependent variables, the consumer price index has a bigger impact on sovereign bond yield (spread) than short term debt over external debt. The impact of the money supply on the sovereign bond yield is infinitesimal.

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