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**FOREIGN EXCHANGE EXPOSURE EFFECTS ON THE VALUE OF  
MEXICAN COMPANIES**

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Abstract			
<p>This thesis aims to investigate the exchange rate fluctuations' effect on firm value by looking at the relationship between price index returns and changes in exchange rates using price indices from ten industries in Mexico over a time period 1996-2018. The aim is to find out whether there are differences in the results gotten between industries, time periods and exchange rate measurements used.</p> <p>The thesis consists of three parts. In the first part the theoretical framework is constructed, and existing empirical evidences are presented in order to justify the relevance of the study. The theoretical framework is constructed on the base of currency supply and demand, which create the existence of exchange rates. The concepts of exchange rate risk and exposure are built on these main definitions in order to understand the importance of the topic. Later on, the relationship between the exchange rates and firm value is explained by the exchange rate exposure puzzle.</p> <p>Previously conducted researches are used in order to understand the current situation of the area of study and to choose the methodological approach for the research. The research is conducted by running several two-factor regressions, first explanatory variable being the market return and second one the measurement of the changes in exchange rate. The data sample is gathered from DataStream from a time period 1996-2018. The time period is chosen in order to exclude specific events, hence assuring unbiased results gotten.</p> <p>The results of the study indicate that Mexican firms' values in seven out of ten investigated industries are positively affected by the contemporaneous appreciation of the home currency. Cross-sectional differences between different industries are detected and the most affected industries are found to be the ones involved in international trade, especially with the USA. The effect of developing economy conditions are also discussed as a possible reason behind the gotten results supported by the previously published studies.</p> <p>The purpose of this thesis is to provide a country-specific study on developing economy perspective to the area of exchange rate exposure studies. The study aims to challenge the existing literature and to find support to the previously conducted developing economy – based researches in the same area. The aim of this research is not to provide information about the firm specific components of exchange rate exposure but instead to look for the more general guidelines in order to understand the industrial differences during different time periods.</p>			
Keywords Exchange Rate, Exchange Rate Exposure, Firm Value			
Additional information			

## CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>6</b>
1.1	Introduction to the Topic.....	6
1.2	Research Question and Objectives.....	8
1.3	Methodology and Data.....	9
1.4	Structure of the Study.....	11
<b>2</b>	<b>EXCHANGE RATES .....</b>	<b>12</b>
2.1	Exchange Rate .....	12
2.2	Currency Supply and Demand.....	13
2.3	Currency Supply and Demand Determinants.....	14
2.4	The Theory of Exchange Rates.....	17
2.4.1	Arbitrage and the Law of One Price.....	17
2.5	Purchasing Power Parity .....	18
2.6	Uncovered Interest Rate Parity.....	18
<b>3</b>	<b>EXCHANGE RATE RISK AND EXPOSURE.....</b>	<b>21</b>
3.1	Exchange Rate Risk.....	21
3.2	Foreign Exchange Exposure.....	23
3.2.1	Determinants of Foreign Exchange Exposure.....	24
3.3	Exchange Rate Exposure Types .....	26
3.3.1	Translation Exposure .....	26
3.3.2	Operating Exposure.....	27
3.3.3	Transaction Exposure.....	27
3.4	Exchange Rate Risk and Exposure Management.....	28
3.5	Exchange Rate Exposure Puzzle .....	29
<b>4</b>	<b>EXCHANGE RATE EXPOSURE AND FIRM VALUE.....</b>	<b>31</b>
4.1	Firm Value .....	31
4.2	Exchange Rate Exposure Measurement.....	31
4.3	The Capital Asset Pricing Model .....	33
4.4	Empirical Evidence .....	34
<b>5</b>	<b>EMPIRIA .....</b>	<b>37</b>
5.1	Set Up.....	37
5.2	Construction of Data Set.....	39
5.3	Research Method .....	42

<b>6</b>	<b>RESULTS.....</b>	<b>46</b>
6.1	Industry .....	46
6.2	Exchange Rate Measurement .....	48
6.2.1	USD/MXN as an Exchange Rate Measurement.....	48
6.2.2	Lagged Values as Exchange Rate Measurement.....	49
6.3	Time .....	51
<b>7</b>	<b>FINDINGS .....</b>	<b>54</b>
7.1	Main Findings of the Study.....	54
7.2	Managerial Implications .....	56
7.3	Limitations .....	57
7.4	Suggestions for Future Research.....	58
<b>8</b>	<b>CONCLUSIONS.....</b>	<b>60</b>

## TABLES

Table 1.	Effects of a home currency appreciation by Bodnar and Gentry (1993). .....	22
Table 2.	Research results on exchange rate exposure. ....	35
Table 3.	Sample distribution. ....	39
Table 4.	Two-factor model regression results with nominal effective exchange rates. ....	47
Table 5.	Two-factor model regression results with USD/MXN exchange rate. ....	48
Table 6.	Two-factor model regression results with lagged NEER. ....	50
Table 7.	Two-factor model regression results with lagged USD/MXN exchange rate. ....	51
Table 8.	Two-factor model regression results divided by subperiods (NEER) .....	52
Table 9.	Two-factor model regression results divided by subperiods (USDMXN).....	53

## FIGURES

Figure 1.	Currency supply and demand by Rodseth (2010, p. 10). .....	13
Figure 2.	Sources of exchange rate changes adapted from Madura (2001, p. 104). ....	15
Figure 3.	Inflation effect on money supply and demand by Madura (2001, p. 100). .....	15
Figure 4.	The interest rate change effect on the money supply and demand by Madura (2001, p. 101). .....	16
Figure 5.	Exposure Pass Through by Ma and Kao (1990). .....	24

<b>Figure 6. Exposure distribution within time and companies.....</b>	<b>26</b>
<b>Figure 7. Exchange rate puzzle. ....</b>	<b>30</b>
<b>Figure 8. Capital market line by Sharpe (1964). ....</b>	<b>33</b>
<b>Figure 9. Merchandise trade as % of GDP in Latin America and the USA. ....</b>	<b>38</b>
<b>Figure 10. Exports of goods and services as % of GDP in Latin America and the USA. ....</b>	<b>38</b>
<b>Figure 11. Evolution of the USD/MXN exchange rate and NEER.....</b>	<b>41</b>
<b>Figure 13. Exchange rate exposure puzzle pieces solved. ....</b>	<b>61</b>

## 1 INTRODUCTION

### 1.1 Introduction to the Topic

The concept of international trade is nothing but new, and the transfer of services and goods across the national borders has been occurring already for thousands of years (Shapiro, 1996). However, especially during the past decades numerous barriers to enter foreign markets have been removed or reduced, thereby boosting firms to expand their business and in many cases as well evolve into multinational corporations.

Countries all over the world have encouraged the growth of international trade by engaging in different agreements. The flow of these agreements started in 1947 when the General Agreement on Tariffs and Trade (GATT) was implemented in order to eliminate and reduce tariffs, quotas and other barriers. After GATT, example of the significant agreements aiming to increase the globalization and the easier movement of goods and services are the European Union (EU) in 1993 and North American Free Trade Agreement (NAFTA) in 1995 (Madura, 1992).

After the second world war, since the majority of national economies have opened to the global markets, thus raising the share of the international trade in the total trade of the countries, the need for companies to pay attention to financial risks arising from changes in exchange rates has also become necessary (Lhabitant, 2001; Shapiro, 1996). After the Bretton Woods fixed exchange rate system collapse in early 1970's, especially the floating exchange rates have been in the interest of corporate managers, creating new threats to the financial performance of companies (Aggarwal, 1981; Bartram, 2008; Taylor, 2003). During the 1980s and 1990s a fast integration of international financial and capital markets was taking place, as well as the deregulation of foreign exchange markets including for example Tokyo's and London's exchange's liberation for foreign brokerage firms (Madura, 1992). Dunn and Mutti (2004) endorse these views by justifying that the proportional share of international trade has been growing faster than national income starting in 1970s in many developed countries, followed by developed countries starting to get faster growth in the area in 1980s as well.

As a result of the increasing amount of international trade and floating exchange rates, the exchange rate fluctuations have been started to be considered as one of the most important sources of macroeconomic uncertainty (Levi, 1994; Shapiro, 1975). According to He and Ng (1998) exchange rate fluctuations have grown their importance as a factor affecting companies because of their effect in the future cash flows of companies, thus making them one of the essential issues for financial managers to consider as well. Since the values of floating currencies change on a daily-basis, they tend to affect the value of firm's assets and liabilities denominated in foreign currencies continuously (Shapiro & Rutenberg, 1976).

In order to understand how and why the exchange rate fluctuations affect firms, the concept of exchange rate exposure is presented. Exchange rate exposure aims to explain how sensitive firm's value is to the changes in exchange rates (Shapiro, 2010, p. 355). Adler and Dumas (1984) state that the exchange rate exposure can be measured as the correlation between the change in exchange rates and the change in firm value.

The existing empirical evidence on whether companies are exposed to the exchange rate fluctuations and whether they are affected by the exposure they face includes mixed and highly varying results mostly concentrated in the US markets (Bartram, 2008; He & Ng, 1998). Especially the US markets based studies have resulted with not significant results, however other researchers such as Chow and Chen (2008), He and Ng (1998), Bartram and Bodnar (2012) have found significant results when the study has not been focused purely on the US markets. In addition, researchers like Allayannis and Ofek (2001) and Bartram and Bodnar (2005) have been focusing on investigating why the results have been so mixed.

In this study the motivation is to look for evidence of whether Mexican companies are affected by the exchange rate fluctuations and whether the level of exposure is linked to the industry of the firm. Mexico, being a developing, the 15th greatest economy in the world and also the most important exporter of Latin America, having a currency with quite a volatile history provides a compelling area of study when it comes to the exchange rate exposure. (Flota, 2014; Worldbank, 2017)

According to Dunn and Mutti (2004) exchange rates play a crucial role especially in open economies, which refer to economies having economic activities both in domestic and foreign markets. In addition, open economy macroeconomics state that smaller and more open economies, like Mexico, are affected by international changes, like foreign exchange rate fluctuations, more than greater and less open economies, like the USA (Bodnar & Gentry, 1993). Since OECD (2005) among other sources states that Mexico is the second most open economy in the American area right after Canada, its relevance as the target area of the research is endorsed as well.

## **1.2 Research Question and Objectives**

Even if exchange rate changes and their effect on stock prices have been studied increasingly during the past decades, the studies have focused mostly on developed economies and especially in the US markets. Rahman and Uddin (2009) state that developing economies act as an important area of study because the conditions in developing economies create a different kind of framework in which to operate when compared to the developed economies. A significantly narrower part of the studies has investigated the effect when it comes to the emerging economies, thus there remains still a lot to investigate in this specific area, especially when it comes to the Latin America.

In consideration of the mixed and widely varying results gotten until today there might be two reasons why clear and congruent results have not been found: either the markets studied have not been suitable for conducting a research, or the relationship between the exchange rate fluctuations and firm value does not exist or is not significant.

The purpose of this thesis is to investigate how exposed Mexican companies are to the fluctuations in foreign exchange rates. More specifically, the differences between the levels of exposure in different industries are investigated.

The main research question of the thesis is:

*Do changes in exchange rates affect the stock prices of Mexican companies?*



In addition, the following sub-questions are stated in order to support the main research question and to evaluate more detailed answers:

*Is the effect positive or negative?*

*Does the industry of the company affect the level of exposure they face?*

*Does the level of exposure vary within the time?*

*Does the measurement of exchange rate affect the level of exposure?*

### **1.3 Methodology and Data**

This thesis will be contributing to the existing literature as it provides a more-detailed research focused on developing country perspective on the field of foreign exchange exposure. Country-specific researches have been conducted beforehand as well, but especially the area of Latin America has not been examined very deeply. Country-level research also enables the research to exclude the effect of regulatory differences which could affect the results since all the companies operate under the same law.

First part of the thesis is a literature review of the most important existing theories and empirical studies regarding the topic. The literature used varies from basic theories of exchange rates and exchange rate exposure to recent studies focusing on the relationship between the exchange rate fluctuations and firm value. The usage of literature from different countries and various sources ensures the validity of the findings and assumptions made in this study (Koskinen et al., 2005). Literature will be integrated from a wide time frame, combining more recently conducted studies with perspectives and definitions from older sources in order to understand the development of the topic and main concepts within time. However, most of the sources used are found from the 1990s and early 2000, and a lack of more recent literature forces the study to focus on this time frame mostly when creating the theoretical base for the study.

Most of the articles used have been found from ProQuest Business and Business Source Complete (EBSCO) – databases. In order to secure the validity of the articles all of them are ensured to be peer reviewed. During the literature gathering process some significant authors, such as Adler, Bartram, Bodnar, Dornbusch and Shapiro, were found to be cited continuously and as a result their studies and pieces of literature were chosen as some of the most important ones when constructing the theoretical base of the thesis.

As the main theoretical base, especially when defining the most important concepts regarding the topic, the books *International Financial Management* from Madura (1986) and *Multinational Financial Management* from Shapiro (2010) are used in order to provide a basis for the main concepts and backgrounds of the theories. Other editions of these books are used as well. Later on, the most important empirical researches and results regarding the main concepts and phenomenon are presented and used as a base and benchmark for the study. The most important empirical studies used as a base in this study have been conducted by Adler and Dumas (1984), Jorion (1991).

Based on the existing theories and empirical evidences, the possible relationship between exchange rate changes and firm value changes will be examined by running several two-factor regressions, the dependent variable being the value of the firm and the explanatory variable the change in exchange rates measured during different time periods and defined by different indices. In addition, market return is used as an additional explanatory variable in all of the regressions.

The data sample for the research is gathered from DataStream, from a time period 1996-2018. The sample consists of industry-specific price indices from 10 chosen industries. The time range has been chosen in order to exclude the times when Mexican Peso's value was varying a lot and these events could have biased the results of the study. In addition, the pre-NAFTA era (before the year 1995) has been excluded in order to also avoid any biases that might arise from the significantly different trade conditions before and after its signing.

Even if the sample used provides a reliable and sufficient base for the research, the study conducted in this thesis is limited by the existence of suitable data. Amongst

other factors, the data regarding the hedging activities of the companies is not available, thus the research does not consider the effect of the use of these instruments as a part of factors affecting the level of exposure the companies face.

A more detailed description of the methodology, the data and the models used will be discussed in chapter five of this thesis. Further limitations for the study and its results will be discussed in chapter seven.

#### **1.4 Structure of the Study**

This thesis consists of eight chapters, which will be assembled as follows. The first chapter provides a brief introduction to the topic and to the objectives of the research. The main methodological practices and the data are also described briefly, this way giving the reader an overview of the study conducted.

The following three chapters focus on describing the theoretical framework of the study. The fifth chapter describes the data sample and the methodologies used in the empirical research in order for the reader to understand the reasons behind the sample selection and the methods used in the research process.

The sixth chapter concentrates on presenting and describing the results gotten from the study supported by statistical evidence for and against the stated hypotheses.

In order to sum up the thesis, the seventh chapter aims to combine the gotten results and the existing theories and studies this way presenting the main findings and contributions of this study to the existing literature. In addition, the future research suggestions are presented, and the limitations of the study are discussed. Chapter eight concludes the thesis by answering the original research questions.

## 2 EXCHANGE RATES

In this chapter the concepts of exchange rate, exchange rate equilibrium and currency supply and demand are determined and discussed in order to understand their relevance. In addition, the most important theories related to their determination are presented.

### 2.1 Exchange Rate

The most common definition of exchange rates in the existing literature, provided for example by Cassel (1916), Madura (1986, p. 93), Rødseth (2000, p. 9) and Shapiro (2010, p. 58), states that exchange rate defines the value of one currency in another one. According to Asea and Corden (1994) exchange rates act as the most significant prices in an open economy. The theory of open economy macroeconomics argues that smaller and more-open economies are affected more by international changes, hence also by the changes in the prices of the currencies, than greater and less open economies (Bodnar & Gentry, 1993).

Traditionally exchange rates have been classified into two main categories: fixed and floating exchange rates. If an economy chooses to follow a fixed exchange rate system, exchange rates are maintained stable, or they are allowed to fluctuate within highly limited scope by the power of the government (Madura, 1986, p. 153). In fixed exchange rate regimes, the government (central bank) is responsible for keeping the exchange rate level inside specific limits by controlling the money supply and demand when needed (Madura, 1986, p. 153; Rødseth, 2000, p. 11; Shapiro, 2010, p. 104).

In economies using the floating exchange rates, the rates can be said to be freely floating, managed floating or pegged exchange rates (Madura, 1986, p. 153). In a freely floating exchange rate system, exchange rates are determined by changes happening in markets without any governmental intervention. Managed floating rates fall between the fixed and freely floating exchange rates, letting the exchange rates to float without any official limits, but with government's possibility to intervene to the situation if the fluctuations start to wide too much. Pegged exchange rates, as their

name indicates, refer to currencies which value is pegged to a value of another currency (Madura, 1986, p. 691).

Rødseth (2000, p. 11) argues that even though fixed and floating exchange rate systems may seem really different from each other, they both are based on the same kind of decisions the government has to make regarding the supply and demand of the currency. The difference between these two exchange rate strategies has its base on how the government decides to respond to the changes in the supply and demand of the currency; whether it intervenes to the changes in the market by making changes to the quantity or to the price of the currency.

## 2.2 Currency Supply and Demand

Madura (1986, pp. 93–95), Rødseth (2000, p. 9) and Shapiro (2010, p. 65) justify that exchange rates tend to move in their value like any other asset would, since their fundamental nature is equal to any other financial asset, such as bond or stock, and they are determined in the markets by the currency supply and demand. Thus, the main function of the exchange rates is to work as an instrument with which the relationship between the currency supply and demand is stabilized (Shapiro, 2010, p. 65).

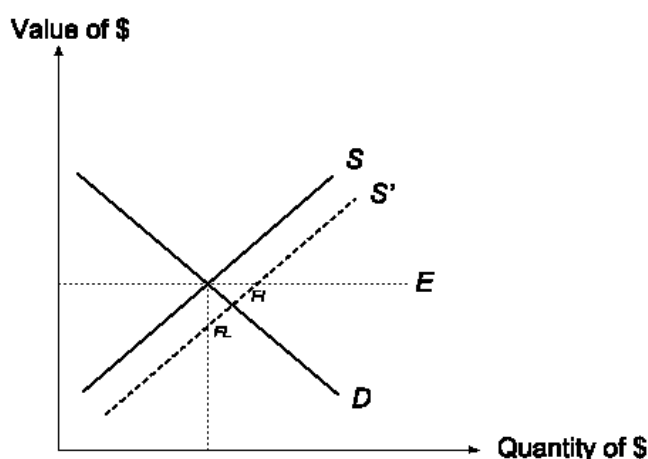


Figure 1. Currency supply and demand by Rodseth (2010, p. 10).

Figure 1 reflects the difference between the actions when floating versus fixed exchange rate systems are applied and when there are changes in the money supply. S

and  $S'$  curves indicate the money supply in the original scene and when the supply is reduced respectively.  $D$  curve reflects the money demand, and  $E$  the current equilibrium exchange rate.  $FI$  and  $FL$  indicate the new equilibrium points in the figure when the money supply changes respectively in cases of a fixed exchange rate system and a floating one respectively.

As it can be analyzed from the figure 1, when the money supply curve falls, in the fixed exchange rate region the value of the currency will not change, but instead the balance is restored by increasing the quantity of money in the economy. In the case of floating exchange rate system, the situation is balanced by changes in exchange rate; in the case of a fall in money supply, the quantity of money in the economy stays constant but the currency will depreciate.

### 2.3 Currency Supply and Demand Determinants

Understanding how the currency supply and demand affect the economy requires the understanding of the most important factors affecting the supply and demand as well. The most frequently mentioned factors in the existing literature have been inflation, interest rates, economic growth and political and economic risk (Madura, 1986, pp. 94–102; Shapiro, 2010, pp. 60–61). Adopted from Madura (2001) we can demonstrate an exchange rate by using the following equation:

$$e = f(\Delta INF, \Delta INT, \Delta INC, \Delta GC, \Delta CF) \quad (1)$$

where  $e$  stands for the percentage change in the spot exchange rate and  $\Delta INF$ ,  $\Delta INT$ ,  $\Delta INC$ ,  $\Delta GC$  and  $\Delta CF$  respectively for the changes in the differential between the domestic and foreign inflation, interest rate, income, government control levels and cash flow restrictions. In this section floating exchange rates are assumed as the tool to balance the changes in money supply.

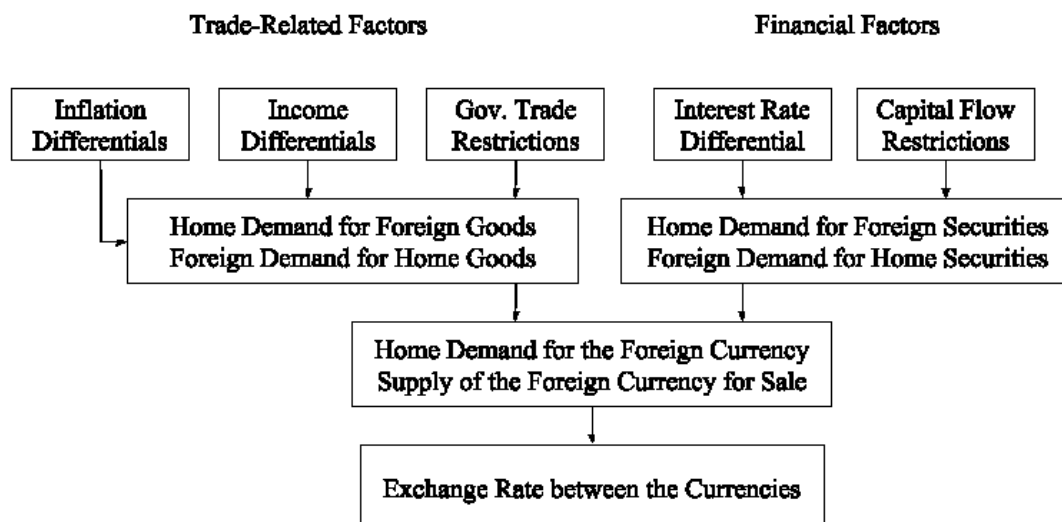


Figure 2. Sources of exchange rate changes adapted from Madura (2001, p. 104).

Another way presented, the factors affecting the currency supply and demand can be divided into trade-related and financial factors as in figure 2. The final demand and supply of the foreign currency originate from these factors and as a result of their effect on the home (foreign) demand for foreign (home) goods and securities.

Changes in inflation between economies is supposed to affect the international trade and that way also the supply and demand of the currencies, thus influencing the exchange rates as well. Theoretically the relationship between inflation and changes in exchange rates is based on the Purchasing Power Parity (PPP), which states that whenever there is a change in inflation in one country, it will be reflected in the exchange rates (Shapiro, 2010, p. 151).

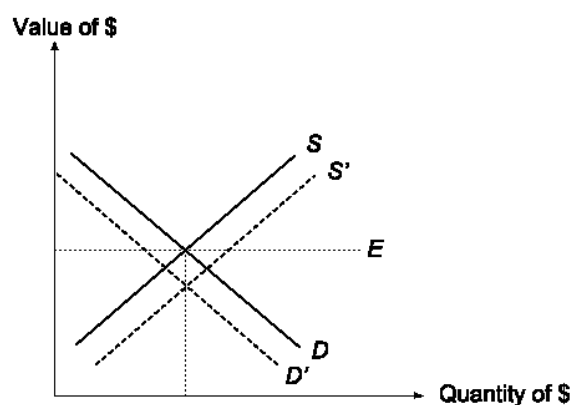


Figure 3. Inflation effect on money supply and demand by Madura (2001, p. 100).

Whenever the economy faces inflation, the purchasing power parity moves from equilibrium  $S = D$  to  $S' = D'$ , stating that inflation in the domestic currency area makes the currency depreciate (Madura, 1986, p. 96).

Shapiro (2010, pp.60-61) states that whenever the interest rates of one economy raise, the outcome is the appreciation of the currency. Higher interest rates make the investments in home country more attractive for foreign investors, which will also lead to the growing demand for the currency, thus pushing up the value of the currency as well.

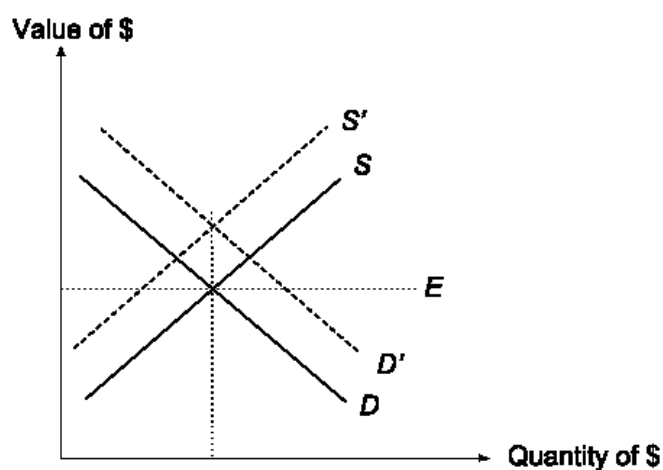


Figure 4. The interest rate change effect on the money supply and demand by Madura (2001, p. 101).

Figure 4 expresses the relationship between the shocks resulting from changes in interest rate levels and money supply and demand. When the interest rates rise, the money demand curve moves from  $D$  to  $D'$  thus moving the supply curve and the equilibrium point in the figure as well higher.

However, as Madura (2001, p. 101) argues, high interest rates also tend to reflect expectations of high inflation, which as we discussed above would lead to the decrease in the value of the currency. It is possible to eliminate this effect and to disconnect the inflation effect from the interest rate by using the real interest rate instead of the nominal interest rates, which is done simply by deducting the inflation rate from the nominal interest rate value (Madura, 2001, p. 101; Shapiro, 2010, pp. 60–61).



Other factors that may cause variations in the exchange rates are the expectations of future exchange rates, different types of government controls, such as foreign trade barriers, and changes in relative income levels (Madura, 2001, pp. 102–103). In addition, when an economy is supposed to have steady economic growth in the near future, it also attracts more investors to acquire more of its currency, which also leads to the appreciation of the currency, *ceteris paribus* (Shapiro, 2010, pp. 60–61). Finally, it is a known fact that people tend to choose to invest in assets which are less risky, in this case the asset being a currency (Shapiro, 2010, pp. 60–61).

## **2.4 The Theory of Exchange Rates**

Many theories have been implemented in order to analyze the relationship between the changes in exchange rates and the changes in the money supply and demand in the economy. The theories of exchange rates deal with parity conditions and are usually divided into the long-term and short-term explaining theories, since exchange rates behave differently when money supply and/or demand face different kind of shocks. In order to explain the long-term relationship, purchasing power parity theory is presented and for the short-term relationship the uncovered interest parity is introduced.

### **2.4.1 Arbitrage and the Law of One Price**

Shapiro (2010, p. 143) and Shleifer and Vishny (1997) among many others highlight arbitrage as one of the main concepts when talking about finance, and fundamentally, the absence of arbitrage creates the base for numerous theories of modern finance (Lamont & Thaler, 2003). Sharpe and Alexander (1998) define arbitrage as a concurrent buying and selling of the same asset in two markets having different prices. In practice arbitrage refers to a situation in which an investor buys an asset at a cheaper price in one market and sells it then at a higher price in another market, thus profiting from the price difference in the markets. Shleifer and Vishny bring arbitrage up as a critical component in keeping markets efficient, since it results in bringing prices back to their fundamental values whenever they are not in the equivalent level. Thus, as argued by Obstfeld and Rogoff (1996), arbitrage promotes the existence of the law of one price.

## 2.5 Purchasing Power Parity

Purchasing Power Parity (PPP) acts as one of the key theories in international finance (James, Marsh & Sarno, 2012, p. 55). The theory was presented for the first time by Cassel (1918), arguing that there exists a parity between the purchasing power of currencies, and that exchange rates cannot vary a lot from the parity neither.

PPP has its roots in the law of one price, which in its simplest form states that alike goods should always be priced similarly (Lamont & Thaler, 2003). Obstfeld and Rogoff (1996) expand this definition by describing the law so that an asset or good should have the same price everywhere when converted to the same currency which also connects the theory to the purchasing power parity and to the exchange rates. The theory can be expressed simply with the following equation:

$$e_1 = \frac{P_h}{P_f} \quad (2)$$

where  $e_1$  stands for the exchange rate of the home currency related to the foreign currency, and  $P_h$  and  $P_f$  stand for the price levels in both home and foreign country respectively. As it can be already analyzed from the equation, inflation and exchange rates are correlated so that the changes in exchange rates just reflect the different levels of inflation in two countries (Shapiro, 2010, p. 151), thus not making any changes for example to the competitiveness of the country or the currency in the markets. Whenever the price level in home country increases or the price level in foreign country decreases, the home currency is supposed to lose its value and vice versa.

## 2.6 Uncovered Interest Rate Parity

Uncovered interest parity (UIP) creates an important macro-economic base for the analysis of open economies (Isard, 2006). This theory provides an explanation for the short-term relationship between the interest rates of comparable assets in two different currencies as well as for the expected changes in the exchange rate between these currencies.

Isard (2006) defines interest parity as a relationship between the interest rates of two currencies within a time frame from time  $t$  to time  $t + 1$ . The covered interest parity (CIP), which creates the base for the uncovered interest parity (UIP), is defined with the following equation:

$$1 + r_t = s_t \frac{(1+r_t')}{f_t} \quad (3)$$

, where  $r_t$  refers to the interest rate in a domestic currency,  $r_t'$  to the interest rate in a foreign currency,  $s_t$  the exchange rate, and  $f_t$  the forward rate. The CIP states that when investors are in an equal situation in choosing between a domestic and foreign investment, the only difference being the currency of denomination, and they are able to cover against the risk of changes in exchange rates, the market equilibrium should hold.

UIP continues from the CIP model because of the existence of investors' possibility to not cover the positions they have in foreign currencies. The difference when compared to the CIP presented by equation (3) is that in UIP, presented by equation (4), while  $f_t$  is a known value at time  $t$ , the value of the new variable  $s_{t+1}$  is unknown at the same time point. UIP presumes that the market equilibrium domestic currency return is restored with the yield gathered from the uncovered position in foreign currency and the model is expressed with the following equation:

$$1 + r_t = s_t(1 + r_t') * E_t \frac{s_{t+1}}{s_t} \quad (4)$$

Even though UIP is considered as an important model for the short-run relationship between interest rates and exchange rates, strong empirical evidences against its reliability have been found, mainly because of the failure of the predictions of the model (Flood & Rose, 2002; Isard, 2006). According to the model the currencies of the economies with high interest rates should be depreciating, but the empirical research has shown the opposite situation.

The definitions and determinants of the exchange rates, and the theories behind their determination enable further the understanding of how the fluctuations of exchange rates create risks, and how and why companies might be exposed to these risks. Both

financial and trade-related factors can act as sources of the changes in exchange rates, thus it can be concluded that changes in exchange rates have multidimensional, often from many sources grounding factors behind them.

### **3 EXCHANGE RATE RISK AND EXPOSURE**

Traditionally it has been thought that the companies involved in international trade are the ones affected by the changes in exchange rates (Padmavathi & Thirumalvalavan, 2011). However, various studies (Adler & Dumas, 1984; Bartram, Brown & Minton, 2007; Eun & Resnick, 2015; Jorion 1990) have showed that purely domestically operating companies are as well exposed to the risks arising from the currency fluctuations, for example because of the foreign competitors on domestic markets, or because of their customers' dependence on the value of the currency (Adler & Dumas, 1984). In this chapter the concepts of exchange rate risk and exposure are defined and the differences between these concepts are also marked out.

#### **3.1 Exchange Rate Risk**

Exchange rate fluctuations act as the most significant risk for numerous companies and as a result they are in a high interest of different corporate managers as well (Bartram, Brown & Minton, 2007; Shapiro, 1975; Shapiro, 2010, p. 355). According to Jorion (1990) exchange rates are four times more volatile than interest rates and even 10 times more volatile than inflation rates, which highlights their significance as a risk factor for companies.

The overall effect of the exchange rate fluctuations to the company depends on its total position on a foreign currency, in other words whether it has receivables or payables in a foreign currency. Companies having receivables in foreign currency will suffer from the appreciation of the home currency, since the changes in exchange rates affect the future revenues. The other way around, companies having expenses in a foreign currency will be benefiting from the appreciation of one's currency and suffering from the depreciation of it. (Bartov & Bodnar, 1994)

**Table 1. Effects of a home currency appreciation by Bodnar and Gentry (1993).**

<b>Activity</b>	<b>Effect</b>
Non-traded good producer	Positive
Exporter	Negative
Importer	Positive
Import competitor	Negative
User of internationally-priced inputs	Positive
Foreign Investor	Negative

Table 1 represents how the appreciation of the home currency affects the industries when it comes to different types of actions in which the companies are involved. Non-traded good producers, importers and users of internationally-priced inputs tend to be the ones benefiting (suffering) from the appreciation (depreciation) of the home currency, while exporters, import competitors and foreign investors face the opposite effects.

Exchange rate risk, arising from the fluctuations in the values of currencies, is one of the three types of financial risks that non-financial companies can face (Jorge & Augusto, 2011). When talking about exchange risk and exposure, it is important to understand that these two concepts do not act as each other's synonyms. The risk that companies face refers to the variation in company's value resulting from uncertain changes in exchange rates (Saphiro, 1990, p. 982). Adler and Dumas (1984) define the risk measured as the possibility that the value of the currency at time  $t + 1$  will differ from its value at time  $t$ .

However, companies cannot be said to be facing exchange rate risk because of the possibility of the devaluation or appreciation of their currency, but instead companies face the exchange rate risk because of the uncertainty of how the value of their home currency is going to change in the future (Adler & Dumas, 1984). In other words, instead of the changes themselves, the uncertainty is the factor giving rise to the risk, since if the changes would be known beforehand there would not exist any kind of risk related to them.

### 3.2 Foreign Exchange Exposure

Risk of the changes in exchange rates does not directly state that a firm is facing foreign currency exposure (Eun & Resnick, 2015). The fact whether a firm faces this exposure can be measured and defined by how sensitive company's assets, liabilities and cash flows are for the changes in exchange rates (Eun & Resnick, 2015). The risk leads to an exposure if company's future economic value is dependent on the changes in the exchange rates (Oxelheim, 1984; Madura, 1995).

Adler and Dumas (1984) determine firm's exposure to the fluctuations in exchange rates as the correlation between the value of the firm and the exchange rate. The exchange rate exposure can also be defined as the probable change in the domestic currency value of cash flows that are denominated in foreign currency (Calderon-Rossell, 1979). On the other hand, Shapiro (2010, p. 355) defines exchange rate exposure in terms of a measurement of how sensitive the company is to the changes in exchange rates.

Dumas (1978) defines company's exposure to foreign exchange risk by the following equation:

$$V = \alpha + \beta S \quad (5)$$

where  $V$  represents the value of company in a specified time in future,  $\alpha$  represents a linearly independent random variable, and  $S$  the current spot rate. In equation (5),  $\beta$  represents the exposure to the risk faced by the company examined, in other words, how sensitive the value of the firm is to the changes happening in the spot rate. Adler and Dumas (1984) provide supporting perspectives to the equation by arguing that exposure to exchange rate risk can be measured in the same way as the exposure to the market risk in capital asset pricing model.

In general, the net exposure resulting from the changes in exchange rates depends on all the long and short positions it has on foreign currencies (Bartov & Bodnar, 1994). Thus, the following equation reflects the net exposure the firm faces:

$$\begin{aligned} \text{Net Exchange Rate Exposure} = \\ \text{Liabilities Denominated in Foreign Currency} - \\ \text{Assets Denominated in Foreign Currency} \end{aligned} \quad (6)$$

Analyzed from the equation (6) we can conclude that even if the firm has a significant amount of liabilities denominated in a foreign currency, it can create so-called “natural hedge” by having also assets denominated in that currency, thus invalidating the risk and exposure arising from the uncertainty of the liabilities. However, it has to be considered that not only the companies with foreign operations are the ones affected by the changes, hence the equation (6) does not count as a complete explanation and calculation for the net exchange rate exposure for the companies.

Ma and Kao (1990) explain firm’s exposure to the changes in home currency value by showing the steps of the causal relationship as presented in figure 5. As showed, once for example the home currency appreciates, it will be reflected in the financial statements. Once these effects are announced to the public as profits, the stock price will be affected by an increase in the stock value.

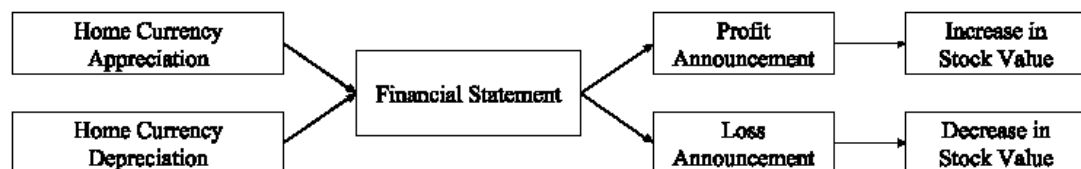


Figure 5. Exposure Pass Through by Ma and Kao (1990).

### 3.2.1 Determinants of Foreign Exchange Exposure

Different determinants of foreign exchange exposure have been studied and found during the past decades, depending on numerous different factors, such as the market and time frame of the study conducted. According to Shapiro (1975), the main characteristics affecting the amount of risk that companies face when it comes to the exchange rates are the level of domestic import competition, the distribution between foreign and domestic sales and production. Jorion (1990) argues that the level of foreign involvement derives positive correlation, while Marston (2001) finds that



industry structure and the level of exposure are correlated. Many researchers, among them Dominguez and Tesar (2006) present firm size and industry in which the firm operates as some of the significant factors determining the level of exposure the firms face.

The extent to which the value of a company is affected by the changes in exchange rates depends also on the characteristics of the combination of company's production decisions (Bartram, 2008; Shapiro, 1975). Amongst the first studies regarding the topic, Laursen and Metzler (1950) state that when companies' clients or cooperation partners business might be affected by the changes in exchange rates, there can be found indirect effects on the business of another company as well. This supports the fact that even if the company itself has no direct transactions in foreign currencies, in other words, if it does not export or import its products or components, or does not have any assets or liabilities in other currencies, it might still be affected by the changes in the exchange rates (Adler & Dumas, 1984; Bartram, Brown & Minton, 2007; Eun & Resnick, 2015; Jorion, 1990).

Aggarwal (1981) and Bartram state that changes in exchange rates have direct effect on companies involved in foreign operations and indirect effect on purely domestically operating companies. More specifically, according to the international trading effect approach, the extent to which the stock prices are affected by the changes in exchange rates depends on whether the company / industry / economy is export- or import-dominated and how competitive the markets are, hence how affected the companies are by the changes in other companies' trading conditions (Chow & Chen, 1998; Erol, Algüner & Kücükkoçaoğlu, 2013). From the existing theories and researches it can be generalized that when the home currency appreciates, exporters' sales tend to decrease and as a result also the stock prices follow the path (Aggarwal, 1981; Ma & Kao, 1990). Simultaneously the importers face more attractive prices, which will lead to the growth in the stock prices. Whenever the currency depreciates, the effects are the contrary.

### 3.3 Exchange Rate Exposure Types

The exchange rate exposure is traditionally divided into two categories subject to the way it affects companies: accounting (translation and transaction) exposure and economic (transaction and operating) exposure. While accounting exposure affects the financial statements of the company and results from transactions already made, economic exposure affects the company by generating changes in the future cash flows of the company by creating variation to the future yet unknown cash flows. (Shapiro, 2010, pp. 355-359)

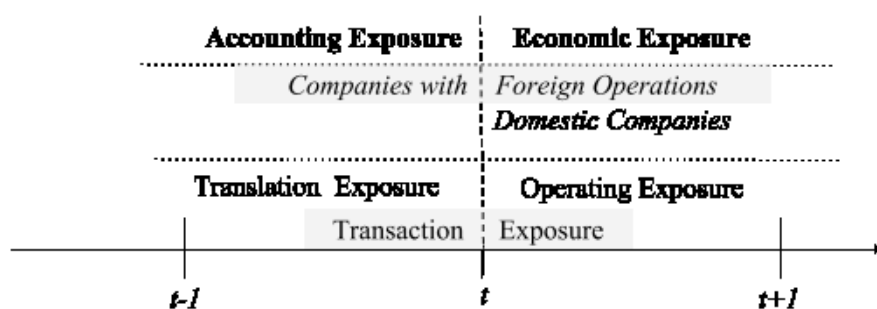


Figure 6. Exposure distribution within time and companies.

The figure 5 reflects the differences between exchange rate exposure types by the time horizon in which they affect the company and also how the purely domestic companies and companies with foreign operations face different kind of exposures. While the translation exposure, often also called accounting risk, arises from something that has happened already before the change in the exchange rates occurs, simultaneously translation risk reflects the events happening in the moment in which the exchange rates are changing. Operating exposure in turn, refers to the exposure that emerges during the time and to the events after the change in the rates (Bartram, 2008).

#### 3.3.1 Translation Exposure

Translation exposure, many times in the literature referred as an accounting exposure, originates from the change in the domestic value of firm's financial statements denominated in foreign currencies (Dumitrescu, 2009; Eun & Resnick, 2015; Shapiro, 1996). As a result, this exposure affects the financial reports of multinational

companies, and instead of generating changes in future cash flows of the company, it affects the assets and liabilities of the company when financial statements denominated in foreign currencies are consolidated into parent company's statements (Belk & Edelshain, 1997; Dumitrescu; Eun & Resnick; Nydahl, 1999; Padmavathi & Thirumalvalavan, 2011). Basically, the level of this exposure is calculated by the difference between the exposed assets and liabilities (Nydahl, 1999; Shapiro, 2010, pp. 356–357).

### 3.3.2 Operating Exposure

Operating exposure threatens firms, as it is named, because of the changes in the values of future operating cash flows as a result of changes in exchange rates (Saphiro, 1990, p. 982). It is the most complicated and interesting one of the three types of exposure and the extent to which the company is exposed to it depends highly on the nature of company's operations (Nydahl, 1999). In general, operating exposure is referred as economic exposure as well, and the main difference between it and accounting exposure is the way it can threaten company's financial situation (Nydahl, 1999; Shapiro, 2010, pp. 356–357); Economic exposure in general refers to the changes in the present value of the company as a result of changes in future cash flows arising from unforeseen changes in exchange rates (Dumitrescu, 2009; Madura, 1995). Unlike accounting exposure, operating exposure affects also firms producing and selling only in domestic markets by influencing the revenues and costs through intermediaries like customers, suppliers or competitors (Bartram, 2008). Since the fluctuations in the exchange rates can have effects on the costs of importing firms, on customers' decisions and on competitors' pricing policies, they do have effect on domestic companies as well (Bartram, 2008; Shapiro, 2010, pp. 356–357).

### 3.3.3 Transaction Exposure

Transaction exposure emerges from the uncertainty of the future gains or losses on transactions that are denominated in a foreign currency and that have already been implemented, for example lending and borrowing in foreign currencies and cross-border trade (Eun & Resnick 2015; Nydahl, 1999; Saphiro, 1990, p. 982; Padmavathi & Thirumalvalavan, 2011). Transaction exposure is one of the two ways of economic

but also accounting exposure since it emerges because the changes in exchange rates effect the cash flows of the company (Saphiro, 1990, p. 982).

Since the variance of exchange rates is relatively high when compared to the variance of inflation and interest rates for example, transaction risk is crucial for MNCs, hence the degree of the exposure is dependent on the extent to which the transactions of a firm are in foreign currency (Padmavathi & Thirumalvalavan, 2011). Transaction exposure is easy to measure, since it can be said to be just the amount of receivables or payables the company has in foreign currency, thus making it also the easiest one to hedge against from the three types of exposures (Eun & Resnick, 2015; Nydahl, 1999).

### **3.4 Exchange Rate Risk and Exposure Management**

According to the most important theories behind exchange rates (Disequilibrium-theory, Purchasing Power Parity, Arbitrage) the market conditions should not enable exchange rates to affect the stock prices. However, the exposure that a company faces despite of these theories can be covered by company's risk management activities.

According to Shapiro (2010, p. 362) companies are exposed to changes in exchange rates because they affect companies' future cash flows by increasing their costs or by decreasing their sales. The object of company's exposure risk management is therefore to either increase the sales or decrease the costs of the company, resulting in increasing the total future cash flows.

Hedging is mentioned in numerous studies as one of the factors making the research results insignificant since it affects the extent to which exchange rate changes affect the company financially (Nydahl, 1999). By a definition, hedging refers to the offsetting of a position in one currency by a contrary transaction made in that same currency (Shapiro, 2010, p. 362). Foreign currency exposure can be hedged against with different kind of instruments including money market hedging and different foreign currency derivatives such as futures, options, forwards and swaps (Clark & Judge, 2009). When implementing a hedging strategy, it is important for the company to recognize which type of hedging can protect it best by analyzing the type of

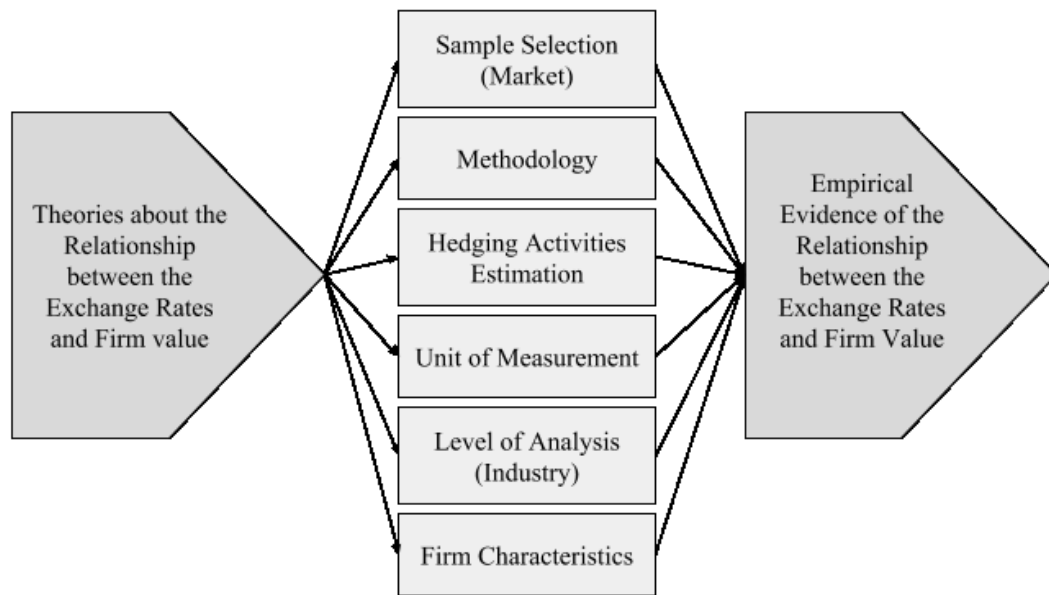
exposure it faces (Clark & Judge, 2009). He and Ng (1998) argue in their study that derivatives use is supposed to decrease the level of exchange rate exposure companies face.

The attempt to hedge against the risks arising from the changes in exchange rates may lead to a failure as a result of various reasons. The problems in general have their base on the wrong-set objects, which leads to the unnecessary use of resources making the whole hedging unsuccessful (Shapiro, 2010, p. 362). According to De Jong, Ligtering and Macrae (2006) the accounting exposure may be hedged against, but when it comes to the economic exposure it is impossible to hedge against because of its unpredictability. Nydahl (2001) states that economic exposure stands out as the most complicated of the three different types and is dependent on the nature of operations in which the company is involved.

However, despite of the intentions to protect firm's assets and liabilities from the unexpected changes, many firms remain facing problems. One of the most important reasons behind the failure of hedging activities has been the lack of control in hedging activities, leading to numerous accounting frauds and falls of companies as well (Shapiro, 2010, p. 370).

### **3.5 Exchange Rate Exposure Puzzle**

Even if there is strong theoretical evidence stating that firms are exposed to the exchange rate risks, a so-called exchange rate exposure puzzle has been presented and discussed as the dilemma between the financial models and researches conducted. Bartram and Bodnar (2007) argue that the exposure puzzle refers to the conflict arising from the financial theoretical models suggesting that exchange rate movements affect firm value, while empirical evidence fights against these models because researchers have not been able to find significant and constant evidences in order to support the theoretical framework.



**Figure 7. Exchange rate puzzle.**

The puzzle remains unsolved because of several reasons the researchers have justified as the reasons for not finding significant results. In figure 7 the different possible reasons researchers have indicated as the sources of failure while aiming to empirically investigate and determine the level of exposure the firms face are gathered. Varying sources have been found, amongst them the problems related to the sample selection, methodology, hedging activities estimation and the level on which the analysis has been conducted (Bartram, 2008).

The exchange rate puzzle concludes the themes of exchange rates, the risks and exposures related to them and how these are theoretically connected to each other and how different kind of factors raise as barriers between the theoretical and empirical approaches. The comprehension of the puzzle permits one to understand the connection and the causal relationship between the exchange rate fluctuations and the firm value by bringing together the different levels of theories discussed in this thesis.

## 4 EXCHANGE RATE EXPOSURE AND FIRM VALUE

Exchange rates, the risk and exposure related to them and the other relevant concepts and theories were discussed in the previous chapters in order to provide a well-describing framework of the existing literature regarding the topic of the study. In this chapter firm value will be defined briefly, followed by the explanation of how the effect of the exposure on firm value has been measured. Later on, the most relevant existing empirical evidences will be presented and discussed in order to later on make the relevant assumptions of the results gotten from the research conducted in this thesis.

### 4.1 Firm Value

The way of definition when talking about firm value varies depending on the context in which it is discussed. In general, firm value can be determined the same way as the asset value; the present value of its expected future cash flows (Cochrane, 2000; De Jong, Ligterink & Macrae, 2006). This definition combined with the definition of the exchange rate exposure, as how sensitive asset's value is to the changes in exchange rates (Adler and Dumas, 1984), creates the base for the relationship between exchange rate fluctuations and changes in firm value.

In this study firm value will be measured as the firm's stock price since this approach has been adapted in the majority of the studies conducted (Bodnar & Gentry, 1993; Jorion, 1990; Nydahl, 1999) and since the measurement is the one used in the model chosen to conduct the research as well.

### 4.2 Exchange Rate Exposure Measurement

Different models in order to measure the level of exposure have been used in order to get the most unbiased and significant results. The most widely used model by the researchers so far has been the *capital market approach*, the model used in this study as well. This model has been used for example by Bodnar and Gentry (1993), Jorion (1990) and Adler and Dumas (1984). The model can be expressed with the equation (7):

$$R_{it} = a + \beta_1 e_t + \beta_2 R_{mt} + v_{it} \quad (7)$$

where  $R_{it}$  as the left-hand side variable reflects the return on stock  $i$  at time  $t$ ,  $e_t$  stands for the exchange rate changes at time  $t$  and  $R_{mt}$  reflects the market risk, measuring the changes in market return at time  $t$ ,  $v_{it}$  being the error term. The coefficient  $\beta_1$  is created in order to measure the exchange rate exposure and  $\beta_2$  measures company's exposure to the market risk. In general, the model has been applied to test the null hypothesis stating that exchange rate fluctuations do not affect stock returns ( $H_0: \beta_1 = 0$ ) against the alternative hypothesis  $H_1: \beta_1 \neq 0$ . Hence, if the research conducted by using this model results in non-zero coefficient of exchange rate changes, it is concluded that exchange rate fluctuations do have an effect on the changes in firm value.

Another, more recently developed approach to measure the exchange rate exposure has its base on the cash flows of the company. *Cash flow approach* provides a model to measure company's exposure to the exchange rate fluctuations without the use of market and stock returns and instead bases the analysis purely on the cash flows of the company. The model was developed by Bodnar & Marston (2002) since the original capital market approach was found to exclude firm behaviour, thus it was complicated to interpret the findings of low levels of exposure when it comes to the economic behavior of companies. The cash flow model developed by Bodnar & Marston is expressed with the equation (8):

$$\delta = h_1 + (h_1 - h_2) \left( \left( \frac{1}{r} \right) - 1 \right) \quad (8)$$

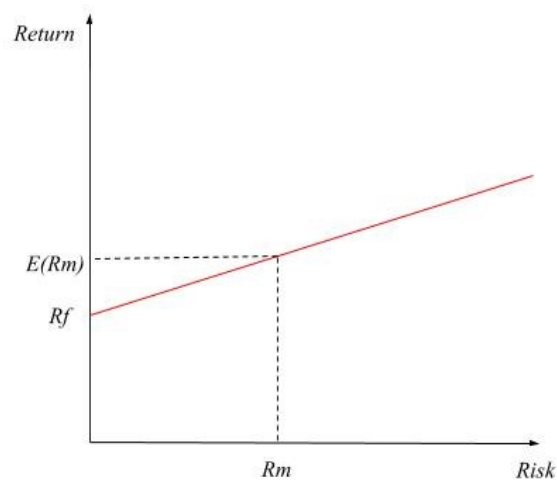
where  $\delta$  acts as the measurement of exposure elasticity explained by three variables:  $h_1$  standing for the foreign currency -denominated revenues,  $h_2$  standing for the foreign currency -denominated costs, and  $r$  standing for the firm's profits. All of the mentioned are presented as a percent of total revenue / costs. The model has not been in a wide use but still provides an interesting alternative model in order to measure and investigate the exposure to exchange rate fluctuations. However, in this research the capital asset approach is applied in order to measure the exposure.



### 4.3 The Capital Asset Pricing Model

Capital asset approach and the way it models the exposure is related to the Capital Asset Pricing Model (CAPM), which acts as one of the fundamental equilibrium models of the asset pricing and it has its roots on the ideology of Sharpe (1964), extended by the studies conducted by Lintner (1965) and Black (1972).

The basic idea behind the model relies on the fact that a higher return can only be achieved by simultaneously accepting a higher level of risk as well. The CAPM is based on the capital market line, which indicates the relationship between the returns and risk associated to it (Figure 8).



**Figure 8. Capital market line by Sharpe (1964).**

In addition to the figure 8, the basic CAPM can be presented as follows in the equation (10):

$$E(r_i) = r_f + \beta_{im}(E(r_m) - r_f) \quad (9)$$

where  $E(r_i)$  stands for the expected return on asset  $i$ ,  $r_f$  and  $r_m$  for the risk free and market return respectively, and  $\beta_{im}$  measures the sensitivity of the asset's value to the changes in market excess return.  $\beta_{im}$  can be expressed also as in equation (11).

$$\beta_{im} = \frac{Cov(r_i, r_m)}{Var(r_m)} \quad (10)$$

Thus, according to the CAPM the return of the asset should be proportional only to the market returns, and to the extent to which it is correlated with the market returns. However, Black, Jensen and Scholes (1972) conclude that when creating an asset pricing model, several assumptions are considered as taken. First of all, all investors choose their investment portfolio based on the mean and variance. Second, the existence of transactions costs and taxes is denied. Third, each investor is equal when looking at the joint probability distributions of the returns of the assets. Finally, all investors are able to lend and borrow at the given interest rate which is assumed riskless.

#### **4.4 Empirical Evidence**

Numerous studies have been conducted in order to find out whether exchange rate fluctuations really affect the value of a company and which are the factors that affect the extent to which the companies are exposed to these fluctuations. Before the current decade the studies concentrated mostly on the aspect of the U.S. and other developed countries, but during this decade studies concerning the developing countries have been conducted as well.

As mentioned when talking about the exchange exposure puzzle, the results until today in the studies conducted in the area of exchange rate exposure have been mixed and varying. The variance between the results have been explained by several factors and it is important to understand the possible reasons behind the variance. The table below gathers the most important studies conducted in the area, the target markets of the studies and the most significant findings in them in order to get a concluded and clear understanding about where the current research relies on.

**Table 2. Research results on exchange rate exposure.**

<b>Researcher</b>	<b>Time Frame</b>	<b>Market</b>	<b>Main Findings</b>
Aggarwal (1981)	1974-1978	the USA	Past changes do not have effect
Jorion (1990)	1971-1987	the USA	Level of exposure connected to the involvement in foreign trade
Bodnar & Gentry (1993)	1979-1988	the USA, Canada, Japan	Level of exposure depends on the industry
He & Ng (1999)	1979-1993	Japan	Level of exposure connected to the involvement in foreign trade and to the size of the company
Chow & Chen (2008)	1975-1992	Japan	Level of exposure connected to the competition situation in the industry Level of exposure depends on the usage of derivative instruments in hedging Level of exposure more significant in non-traded industries
Bartov & Bodnar (1994)	1978-1989	the USA	Level of exposure depends on the usage of derivative instruments in hedging
Allayannis & Ofek (2001)	1993	S&P 500	Level of exposure depends on the usage of derivative instruments in hedging Level of exposure connected to the involvement in foreign trade Level of exposure robust to changes in exchange rate determinant and time
Bartram & Bodnar (2012)	1994-2006	37 developing and developed countries	Level of exposure larger in emerging than in developed markets Exchange rate exposure creates cross-sectional return variation
Bartram and Bodnar (2007)			Level of exposure depends on the usage of hedging instruments
Erol, Algüner & Kücükocaoglu (2013)	1998-2001	Turkey	Level of exposure connected to the involvement in foreign trade and competitiveness in the industry Level of exposure depends on the usage of hedging instruments Level of exposure larger in emerging than in developed markets
Flota (2014)	1994-2003	Mexico	Level of exposure connected to the involvement in foreign trade, size of the company and level of foreign debt

One of the first studies focusing on the effects that changes in exchange rates might have on the variation in stock prices is the one conducted by Aggarwal (1981). In his study he argues that exchange rates can affect the values of both purely domestically operating companies and companies with foreign operations. The most significant finding of his study could be mentioned to be that the lagged values do not affect the

firm value. However, his study is conducted in a relatively short time period (1974-1978) and during the time when the exchange rates were just starting to float.

The second continuously cited study is conducted by Jorion (1990), who amongs the first researchers justifies that the exchange rate exposure is connected to the level of involvement in international trade. He and Ng (1998) conduct a study on exchange rate exposure on Japanese markets finding evidence about export ratio's relation to the level of exposure companies face.

Bartram and Bodnar (2012) amongst other researchers (He & Ng, 1998; Levi, 1994) comment on the fact that numerous previous studies have found out that there is no statistically significant nor large enough evidence of the foreign exchange rate changes effect on companies' value. They conduct an international study including companies from 37 developing and emerging countries, this way their sample being relatively wide compared to many previous studies that have concentrated on the U.S. or country specific markets.

Bartram and Bodnar find that exchange rate exposure affects on companies regardless of the country of origin, however, the exposure is found to be greater in developing economies than in the developed ones. They also conclude that even if the effect would not be large, the fact that there is a relationship found in the empirical studies verifies the matter that the effects contain economic information at least up to some point.

One of the reasons of somewhat mixed results found in the previous researches might be the focus on US markets. Jorion (1990) for example finds only 15 of 287 U.S. companies exposed to the exchange rate fluctuations, whereas Booth and Rotenberg (1990) focused on Canadian markets, He and Ng (1998) focused on Japanese markets and Nydahl (2001) focused on Swedish markets find significant evidences of existing exposure. The latter ones present open economies while the USA is an example of a large and closed economy. This could be one of the reasons why the studies based on U.S. companies have not showed significant evidences about the exposure.

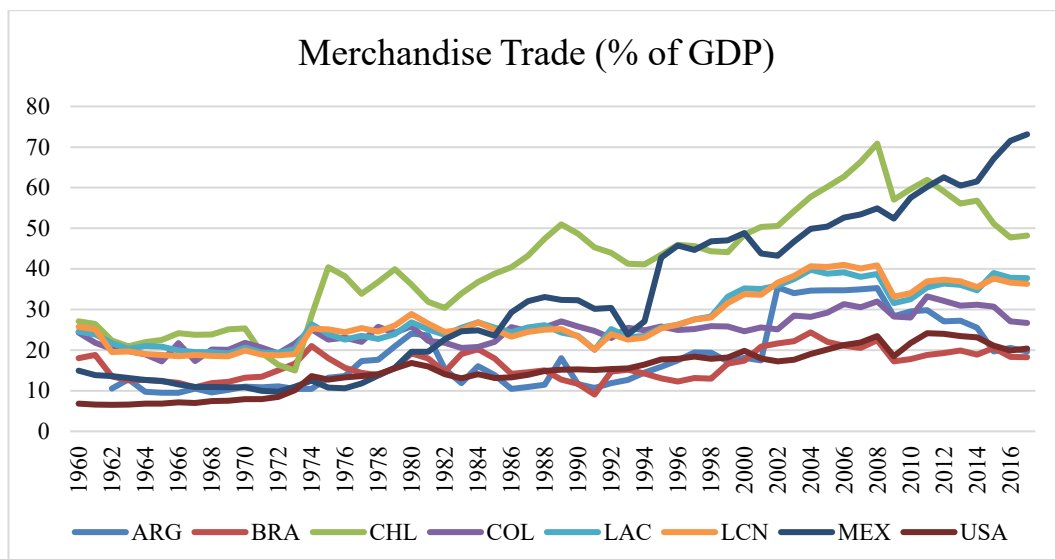
## 5 EMPIRIA

In this chapter the empirical research methods, the data selection and the progress of the research are described and justified. The object of the research is to investigate empirically how Mexican companies' value is affected by the changes in exchange rates, and whether the industry of the company affects the amount of exposure they face. When the exchange rate exposure puzzle is reflected, the focus can be said to be in the puzzles of sample selection (market), level of analysis (industry), time frame and exchange rate measurement. These factors are chosen as the areas of interest because of the previous researches and the findings provided by them.

### 5.1 Set Up

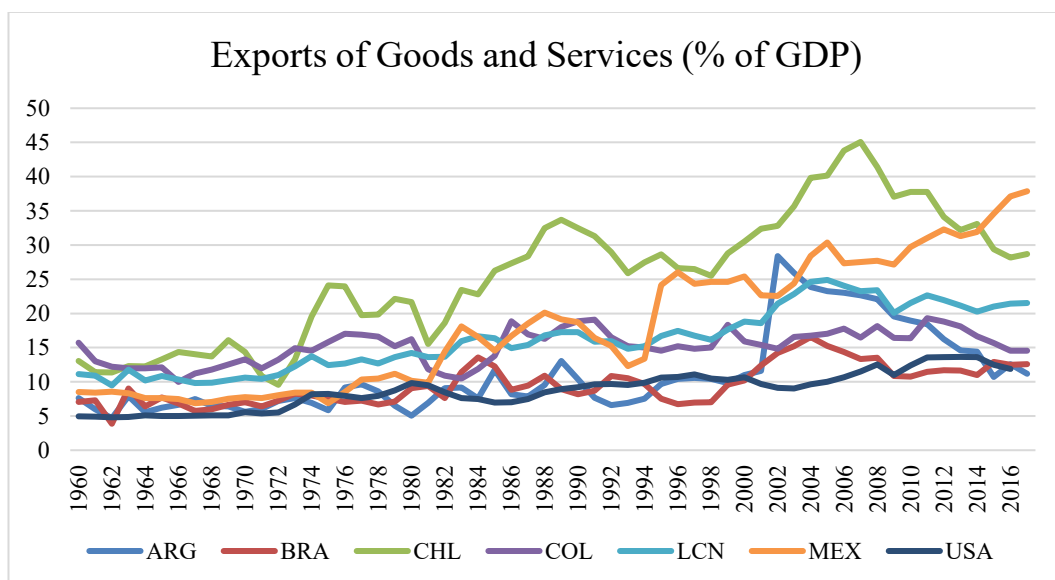
Mexico is chosen as the target market because of numerous reasons. First of all, a few studies have been concentrated in the Latin American area, thus leaving a significant gap in this growing economic area. The World Bank (2017) defines Argentina, Brazil, Chile and Colombia with Mexico as the main economies in Latin America. When comparing their export level to the total GDP, we can clearly say that Mexico stands out as the most open economy of them (The World Bank). Leaning on the open economy macroeconomics we can state that Mexico is the best option in order to investigate the effects of the changes in exchange rate fluctuations.

When comparing the merchandise trade ratios of the most important economies in Latin America, the area as a whole and the United States, presented in the chart 1, it can be seen that Mexico has been showing up as with the most growing rate of international trade of its total trade (together with Chile) after the establishment of NAFTA. Thus, according to the previously conducted researches it can also be assumed that Mexican firms would be exposed to the fluctuations in exchange rates since the share of international trade is high.



**Figure 9. Merchandise trade as % of GDP in Latin America and the USA.**

Figure 10 supports the argument made by the analysis based on the figure 9, since it shows that in addition to Mexico's involvement in international trade, its export ratio is significantly higher when compared to the other Latin American economies and the USA, thus it is justified that Mexico indeed is an open economy when compared to other economies in Latin America.



**Figure 10. Exports of goods and services as % of GDP in Latin America and the USA.**

Whenever the currency fluctuates more, it is also more probable that the companies operating in the market are more affected. Mexican Peso as a currency has been floating quite a lot after the breakdown of the fixed exchange rate systems which as well. Especially the relationship between the values of Mexican Peso and the US Dollar have been in high interest of the companies since most of the exports (imports) of Mexico go to (from) the USA. Bringing the trade conditions and the exchange rate fluctuations together makes Mexico a justified market area for this research.

## 5.2 Construction of Data Set

The data used for the research was chosen to be secondary data, which refers to data that has already been gathered for other purpose and which is now used to re-evaluate it (Saunders, Lewis & Thornhill, 1997, p. 256). The data set will be a multiple-source secondary data since the data used is already gathered from various data sets (Saunders et al., p.256). Use of secondary data also enables the usage of more time to the analysis and the reliability of the data can be assured because of its origins as well.

The sample consists of monthly returns on industry-specific price indices for 10 industries. The industries taken into the study are chosen mainly based on the availability of the relevant data during the specific time period. The indices are obtained from Datastream. Financial institutions or companies such as banks or investment companies were excluded from the study because their products and services are in a different kind of position whenever the currency value decreases or increases, thus it was not thought to be relevant to include them in this study.

**Table 3. Sample distribution.**

Code	Industry	# of Stocks
CHMCL	Chemicals	5
BRESR	Basic Resources	5
INDGS	Industrial Goods & Services	9
CNSTM	Construction & Materials	10
FDBEV	Food & Beverage	11
PERHH	Personal & Household Goods	2
RTAIL	Retail	10
MEDIA	Media	3
TRLES	Travel & Leisure	6
TELCM	Telecommunications	2

The sample period is chosen to be from January 1995 to December 2018. The start point of the period is chosen after the establishment of the North American Free Trade Agreement (NAFTA), which changed the conditions regarding the cross-border trade significantly in the North American area in 1994 (Cameron & Tomlin, 2002). Caliendo and Parro (2014) show that NAFTA affected Mexico's welfare and tariff conditions, thus the results could be highly biased if the period before the agreement would be taken into account when running the regressions.

In order to measure the market return a country index from DataStream Global Equity Indices is used. In case of Mexico, this index consists of approximately 90 stocks.

For the measurement of exchange rates, the nominal effective monthly average exchange rates are used. In the second phase, the exchange rate between the US dollar and Mexican Peso is used in order to investigate whether this specific exchange rate has different effect on specific industries. The US Dollar and Mexican Peso exchange rate acts as the most significant one for Mexico since over 70% of its exports and almost 50% of its imports are from and to the United States (OCE).





**Figure 11. Evolution of the USD/MXN exchange rate and NEER.**

Figure 11 presents the exchange rate fluctuations when it comes to the nominal effective exchange rates (NEER) and the US dollar / Mexican Peso exchange rate. The related monthly exchange rates are obtained from DataStream as well. The exchange rates used in the research are defined as US Dollars per Mexican Peso.

Exchange rates, and the price indices are time series of continuous variables. By discovering their autocorrelation functions, we find out that the series are not stationary, in other words, they are autocorrelated. In order to remove this effect, the logarithm values of them are used in the regression in order to obtain more unbiased results. Once we check for the autocorrelation of the logarithmic time series, returns have correlations almost zero. If the prices were used as they are, their mean value and variance could be dependent on the previous period's values,

Even though in the theories discussed above the use of real exchange rates is recommended in order to get results not biased by the inflation, nominal exchange rates will be used in this research. The reasons behind the choice are based on the research conducted by Bodnar and Gentry (1993), in which they state that first, if the real exchange rates are used, we would presume that changes in inflation rates are constantly observed in financial markets. Thus, it is less complicated to expect that nominal exchange rates are correctly weighted in markets. Secondly, a high correlation between real and nominal exchange rates can be documented.

Both lagged and contemporaneous changes in the value of the currency will be used to analyze even further the extent to which the exchange rates are affecting the value. The exchange rate will be defined in this research in a way that when there is an increase (decrease) in the value of the variable, the home currency appreciates (depreciates).

### **5.3 Research Method**

According to Burns and Burns (2008) a scientific research method consists of four main characteristics, which are control, operational definitions, replication and hypothesis testing. The most fundamental and significant element of a good scientific methodology can be said to be the first mentioned control since it allows the researches to determine the explanations of the observations made in the study. In order to comply with the operational definitions, the variables should be defined in a way that they can be quantified. Replication refers to that it should be possible to repeat the study in order to ensure the reliability of the results gotten from it.

Hypothesis testing means that in general, in order to empirically test some kind of phenomenon, a hypothesis is created with specific variables and the empirical test is then conducted in order to test whether the hypothesis is accepted or rejected (Burns & Burns, 2008).

The research method adopted to this study is causal research, since the object is to find out whether there is a causal relationship between the changes in exchange rates and stock prices (Saunders, Lewis & Thornhill, 1997, p. 140).

The empirical research will be conducted as a time-series regression (Cochrane, 2000). First step of the testing will be running a time-series regression in order to find the beta estimates to see, if the exchange rates have effect on the stock prices (Jorion, 1990). We test this with the following regression (Cochrane, 2000; Jorion, 1990):

$$R_{it} = \beta_{0i} + \beta_{1i}R_{st} + \epsilon_{it}, t = 1, \dots, T \quad (11)$$

where  $R_{it}$  describes the rate of return of the company's stock and  $R_{st}$  states for the changes in exchange rate. Thus, equation (11) shows that  $\beta_{1i}$  measures how exposed company's stock prices are to changes in exchange rates. Better defined,  $\beta_{1i}$  measures the effect of home currency appreciation to the stock price. If  $\beta_{1i}$  results positive (negative), stock prices are positively (negatively) correlated to the appreciation of the home currency.

Equation (11) has been used by numerous researchers such as Adler and Dumas (1984) and Bodnar and Gentry (1993). However, Jorion (1991) extends the model by adding a market index as a second explanatory variable, this way making the model a two-factor model which can be represented as follows:

$$R_{it} = +\beta_{1i}R_{st} + \beta_{2i}R_{mt} + \epsilon_{it}, t = 1, \dots, T \quad (12)$$

where all other variables equal, an additional variable,  $R_{mt}$ , market return is added with a  $\beta_{2i}$  to measure its effect on the dependent variable  $R_{it}$ .

Based on these two models new, more independent variables including models can be derived, this way measuring the exchange rate exposure better and other factors which jointly affect the level of exposure in a more detailed way. However, in this study the equation (12) will be used in conducting the regression since it is a known fact that both exchange rates and stock prices are affected by changes in market conditions. This means that if we exclude the market return variable, our regression will not be determining us the effect of exchange rate changes to the firm value but instead the results will be biased because most of the effect comes from the market conditions.

The statistical significance of the results from the equation (12) will be tested by using the t test and analyzing the probability values related to the results of the t-test conducted. In order to test whether exchange rate changes act as a significant tool to explain the changes happening in stock prices, the following null-hypothesis and alternative hypothesis will be tested:

$$H0: \beta_{1i} = 0 \quad (13)$$

$$H1: \beta_{1i} \neq 0 \quad (14)$$

The object is to find out whether the null hypothesis can be rejected, then it can be proved with statistical evidence that the coefficient is statistically significant, thus the causal relationship between the changes in exchange rates and the changes in stock prices exists.

Several different regressions will be run in the research in order to find out the key differences that can be specified. As the measurement of exchange rates, two different variables are used. Nominal effective exchange rate (NEER) is used in order to find out the effect of the change in the exchange rates in general, while the exchange rate between the US dollar and Mexican Peso (USD/MXN) is used in order to find out whether this specific relationship between the currency values affects industries in divergent ways. The choice of this currency pair as the second variable of interest is justified because of the important trade relationship between Mexico and the USA: Around 70% of the exports and 50% of the imports of Mexico are to and from the USA.

The majority of the required coding for the research is done with R. However, some supporting statistical analysis is done with the help of EViews as well. Excel is used in order to manage and manipulate the data sets.

First of all, two-factor regressions with market return and NEER or USD/MXN variable will be run in order to find out whether these two different measurements of exchange rates affect the firm value differently. The regression will be run for the whole time period from January 1996 to December 2018.

Second, the sample will be divided into two sub-period samples because of a possible breakpoint found in December 2008 when checked with a Chow's breakpoint test.

The regressions for these two subperiods (January 1996 – December 2008 and January 2009 – December 2018) are conducted for both, NEER and USDMXN exchange rate measurements in order to also see whether the regressions run with these two different variables result in different kind of outcomes.

## 6 RESULTS

In this chapter the results of the study described above are presented and analyzed in order to later on provide an answer to the initial research question. First, two two-factor regressions are run using the NEER and USD/MXN as the exchange rate variable measurements for the complete time period. Afterwards, both of the variables are tested in the two sub periods divided by the possible and believed breakpoint (December 2008) found in the Chow's breakpoint test. Finally, both regressions are run using the lagged exchange rate values in order to test whether the choice between contemporaneous and lagged exchange rate value affects the outcome of the study.

The object of the research conducted was to investigate the existence and the possible direction and volume of the exchange rate exposure on Mexican firms on 10 different industries. In the research and results when talking about the exchange rates, it is referred as how many units of the foreign currency can be acquired with one unit of the home currency. Thus, an increase in the exchange rate refers to the appreciation of the home currency.

### 6.1 Industry

When the regressions on market return and NEER are run, it can be seen that seven out of ten industries result with a positive and significant coefficient on NEER on a 0,1% significance level. We should also pay attention to the  $R^2$  values in the regressions, since all of them increase when compared to the one-factor CAPM with only the coefficient of market returns explaining the industry-specific returns.

**Table 4. Two-factor model regression results with nominal effective exchange rates.**

$r_{i,t}$	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$
CHMCL	0,01* (2,284)	0,461*** (5,445)	1,074*** (5,557)	0,260
BRES	0,002 (0,552)	0,734*** (9,390)	0,298' (1,669)	0,302
INDGS	0,005' (1,949)	0,65*** (13,440)	0,659*** (5,965)	0,541
CNSTM	0,003 (1,061)	0,715*** (12,520)	1,054*** (8,079)	0,560
FDBEV	0,008*** (4,267)	0,388*** (10,643)	0,373*** (4,481)	0,418
PERHH	-0,001 (-0,123)	0,483*** (8,955)	0,514*** (4,179)	0,348
RTAIL	0,009*** (3,658)	0,416*** (9,141)	0,712*** (6,846)	0,430
MEDIA	-0,001 (-0,376)	0,703*** (11,411)	0,206 (1,461)	0,380
TRVEL	0,002 (0,521)	0,465*** (8,204)	0,627*** (4,849)	0,338
TELCOM	0,005' (1,658)	0,705*** (12,117)	0,014 (0,108)	0,385

$r_{i,t} = \alpha + \beta_1 r_{Mkt,t} + \beta_2 \Delta f x_t + \epsilon$ .  $r_{i,t}$  = the return on industry price index, the  $r_{mkt,t}$  the return on market price index and  $\Delta f x_t$  the change in the nominal effective exchange rates. Significance codes: \*\*\* = 0,1%, \*\* = 1%, \* = 5%, ' = 10%

All of the industry returns seem to be positively correlated with the changes in nominal effective exchange rates. However, telecommunications, media and basic resources industries do not result with statistically significant coefficients for the changes in exchange rates, thus it can be concluded that these industries do not face exchange rate exposure.

The industries which firms are the most affected by the changes in exchange rates are chemicals and construction and materials industries, with a  $\beta_2$  values higher than 1. When we analyze the  $\beta_2$  in these industries more in detail, it can be interpreted that the firm values in these industries are actually more volatile than the exchange rates; when the currency appreciates (depreciates) by 1 percentage, then the firm value would increase (decrease) by 1,074 and 1,054 percentage respectively.

The level of exposure in other industries with significant  $\beta_2$ , industrial goods and services, food and beverage, personal and household goods, retail and travel and leisure, varies between 0,373 and 0,712, thus there is quite a significant difference on

the levels within the industries. Among these, the firm value is affected the most in the retail industry, where 1% appreciation (depreciation) of home currency means 0,71% increase (decrease) in firm value. Industrial goods and services industry results in the second most affected one, with 0,659% increase (decrease) in firm value when home currency appreciates (depreciates) by 1%. Personal and household goods follow with a 0,514% increase (decrease) relative to appreciation (depreciation) of the home currency, and the least exposed of the industries is the food and beverage industry with 0,388% change.

## 6.2 Exchange Rate Measurement

The USA acts as the most important trade partner for Mexico, thus another regression is run by using the direct exchange rate between the US dollar and Mexican Peso. The purpose of this regression is also to find out whether there are industry-level differences when it comes to the importance of this specific exchange rate on the level of exposure. The exchange rate is defined here as well as the units of foreign currency that can be purchased with one unit of the home currency.

### 6.2.1 USD/MXN as an Exchange Rate Measurement

**Table 5. Two-factor model regression results with USD/MXN exchange rate.**

$r_{i,t}$	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$
CHMCL	0,100* (2,447)	0,404*** (4,754)	0,967*** (6,441)	0,285
BRES	0,003 (0,632)	0,711*** (8,912)	0,297* (2,114)	0,307
INDGS	0,005' (1,795)	0,643*** (12,858)	0,480*** (5,439)	0,532
CNSTM	0,002 (0,678)	0,725*** (11,932)	0,682*** (6,361)	0,525
FDBEV	0,007*** (3,906)	0,400*** (10,505)	0,210*** (3,128)	0,397
PERHH	-0,001 (-0,377)	0,496*** (8,859)	0,297** (3,011)	0,328
RTAIL	0,008** (3,204)	0,428*** (8,885)	0,440*** (5,180)	0,392
MEDIA	-0,002 (-0,683)	0,732*** (11,552)	0,024 (0,216)	0,376
TRVEL	0,001 (0,276)	0,474*** (8,041)	0,392*** (3,775)	0,317
TELCOM	0,005 (1,530)	0,721*** (12,110)	-0,056 (-0,543)	0,385



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$r_{i,t} = \alpha + \beta_1 r_{Mkt,t} + \beta_2 \Delta f x_t + \epsilon$ .  $r_{i,t}$  = the return on industry price index, the  $r_{mkt,t}$  the return on market price index and  $\Delta f x_t$  the change in USD/MXN exchange rate. Significance codes: \*\*\* = 0,1%, \*\* = 1%, \* = 5%, ‘=10%

When the regressions are run using the direct exchange rate between the US dollar and Mexican Peso, the results gotten do not change the outcome significantly. The same industries remain unexposed, and also chemicals and construction and materials industries remain the most exposed to the changes. However, all the industries now face a lower exposure. While chemicals, industrial goods and services and food and beverages industries remain exposed quite at the same level, construction, personal and household goods, retail and travel industries’ levels fall almost to a half of the exposure levels gotten when the nominal effective exchange rate is used as the estimate.

Two out of the three industries which in the table 4 result insignificant remain insignificant in results in the table 5 as well. However, the coefficient in the industry of basic resources becomes significant at 10% significance level, thus it could be interpreted that the exchange rate between the US Dollar and Mexican Peso affects the industry more than the NEER.

### 6.2.2 Lagged Values as Exchange Rate Measurement

Various researches have showed that lagged changes in exchange rate values affect the present firm value instead of the contemporaneous changes. Simultaneously, some have resulted in opposite outcome. In order to test which statement stands true in case of Mexico, another regression is run using the lagged values as the values of the explanatory variable (changes in exchange rates). Table 6 indicates the results gotten from the regression run.

**Table 6. Two-factor model regression results with lagged NEER.**

$r_{i,t}$	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$
CHMCL	0,006 (1,369)	0,621*** (7,464)	0,312 (1,643)	0,185
BRES	0 (-0,022)	0,803*** (10,969)	-0,265 (-1,584)	0,302
INDGS	0,002 (0,616)	0,764*** (15,843)	-0,037 (-0,338)	0,482
CNSTM	-0,001 (-0,242)	0,875*** (14,792)	0,256' (1,894)	0,463
FDBEV	0,006** (3,212)	0,457*** (12,967)	-0,060 (-0,742)	0,381
PERHH	-0,002 (-0,799)	0,556 (10,725)	0,163 (1,379)	0,31
RTAIL	0,005' (1,968)	0,540*** (11,681)	-0,057 (-0,545)	0,333
MEDIA	-0,003 (-0,893)	0,751*** (12,997)	-0,183 (-1,388)	0,38
TRVEL	-0,001 (0,234)	0,556*** (10,091)	0,2 (1,594)	0,288
TELCOM	0,004 (1,422)	0,727*** (13,493)	-0,249* (-2,020)	0,398

$r_{i,t} = \alpha + \beta_1 r_{Mkt,t} + \beta_2 \Delta f x_t + \epsilon$ .  $r_{i,t}$  = the return on industry price index, the  $r_{mkt,t}$  the return on market price index and  $\Delta f x_t$  the change in the lagged nominal effective exchange rates. Significance codes: \*\*\* = 0,1%, \*\* = 1%, \* = 5%, ' = 10%

The results in table 6 show that lagged currency appreciations (depreciations) do not affect the present value of the company since all the coefficients result insignificant. The same can be interpreted from the table 7 which presents the results when instead of the NEER, the USD/MXN exchange rate is used as the measurement of currency value changes.

**Table 7. Two-factor model regression results with lagged USD/MXN exchange rate.**

$r_{i,t}$	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$
CHMCL	0,006 (1,333)	0,631*** (7,649)	0,252' (1,731)	0,186
BRES	0,001 (0,151)	0,789*** (10,830)	-0,084 (-0,653)	0,297
INDGS	0,002 (0,629)	0,763*** (15,960)	-0,029 (-0,349)	0,482
CNSTM	-0,001 (-0,302)	0,883*** (15,065)	0,200' (1,936)	0,463
FDBEV	0,006*** (3,342)	0,453*** (12,955)	-0,002 (-0,029)	0,38
PERHH	-0,002 (-0,777)	0,559*** (10,913)	0,178* (1,970)	0,315
RTAIL	0,005' (1,913)	0,541*** (11,828)	-0,099 (-1,224)	0,336
MEDIA	-0,002 (-0,793)	0,743*** (12,949)	-0,096 (-0,947)	0,378
TRVEL	-0,001 (-0,425)	0,567*** (10,346)	0,051 (0,528)	0,282
TELCOM	0,005 (1,578)	0,716*** (13,352)	-0,217 (-1,342)	0,392

$r_{i,t} = \alpha + \beta_1 r_{Mkt,t} + \beta_2 \Delta f x_t + \epsilon$ .  $r_{i,t}$  = the return on industry price index, the  $r_{mkt,t}$  the return on market price index and  $\Delta f x_t$  the change in the lagged USD/MXN exchange rates. Significance codes: \*\*\* = 0,1%, \*\* = 1%, \* = 5%, ' = 10%

### 6.3 Time

Using a Chow's breakpoint test we find out that a possible breakpoint in the sample could be on December 2008. In order to test this, we run regression on sub-periods, before the breakpoint and after it, and we then compare the results with the results from the regression run over the whole period from January 1996 to December 2018. The two subperiods will be referred in the following discussion as the first subperiod (January 1996 – December 2008) and the second subperiod (January 2009 – December 2018). A breakpoint on December 2008 is used in order to run regressions on two subperiods.

When we conduct the subperiod regressions in the two different time frames with NEER as the measurement of exchange rates, we find significant differences which are presented in table 8. Even though during the both time periods the same industries remain with significant coefficients, the values of the coefficients change critically. As it can be analyzed from the  $\beta_2$  values, for the first subperiod (1996-2008) the appreciation of the home currency affects the firm value more than during the second subperiod (2009-2018). The only industry which coefficient remains with relatively same coefficient value is industrial goods and services, while others' coefficient values drop substantially.

**Table 8. Two-factor model regression results divided by subperiods (NEER)**

$r_{i,t}$	1996-2008				2009-2018			
	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$
CHMCL	0,01 (1,503)	0,378** (3,204)	1,389*** (4,314)	0,231	0,01* (2,313)	0,808*** (7,125)	0,537** (2,935)	0,437
BRES	0,002 (0,258)	0,745*** (7,247)	0,453 (1,614)	0,33	0,004 (0,745)	0,734*** (5,442)	0,082 (0,375)	0,235
INDGS	-0,001 (-0,212)	0,719*** (11,903)	0,613*** (3,723)	0,597	0,012*** (3,886)	0,559*** (6,479)	0,628*** (4,519)	0,468
CNSTM	0,004 (0,996)	0,693*** (9,283)	1,414*** (6,951)	0,592	0,003 (0,750)	0,762*** (7,979)	0,632*** (4,106)	0,523
FDBEV	0,008** (2,830)	0,384*** (8,256)	0,504*** (3,975)	0,46	0,009*** (3,612)	0,434*** (6,578)	0,181' (1,706)	0,357
PERHH	-0,0002 (-0,046)	0,494*** (6,722)	0,757*** (3,780)	0,38	0,005 (0,154)	0,429*** (5,235)	0,255' (1,930)	0,281
RTAIL	0,011*** (3,465)	0,415*** (7,425)	0,807*** (5,305)	0,47	0,005' (1,761)	0,532*** (6,407)	0,479*** (3,583)	0,424
MEDIA	-0,002 (-0,427)	0,783*** (9,474)	0,367 (1,629)	0,446	0,001 (0,361)	0,488*** (5,146)	0,039 (0,254)	0,211
TRVEL	-0,0002 (-0,036)	0,504*** (6,608)	0,786*** (3,784)	0,375	0,005 (1,405)	0,389*** (4,408)	0,416** (2,924)	0,277
TELCOM	0,011* (2,532)	0,764*** (10,352)	0,101 (0,502)	0,462	-0,002 (-0,461)	0,562*** (5,586)	-0,088 (-0,543)	0,2195

$r_{i,t} = \alpha + \beta_1 r_{Mkt,t} + \beta_2 \Delta f x_t + \epsilon$ .  $r_{i,t}$  = the return on industry price index, the  $r_{mkt,t}$  the return on market price index and  $\Delta f x_t$  the change in the nominal effective exchange rates. Significance codes: \*\*\* = 0,1%, \*\* = 1%, \* = 5%, ' = 10%

In table 9 the same regressions are run using the USD/MXN exchange rate as the measurement of the exchange rates, and the results gotten show the same direction as when NEER is used as the measurement. Hence, regardless of the measurement of the exchange rate changes, a clear difference between the subperiods can be detected and it can be said that the fluctuations in exchange rates have affected the firm values more before the year 2008 and financial crisis. The same kind of results also indicate that

both measurements of the exchange rate can be used without them biasing the results, at least in this research.

**Table 9. Two-factor model regression results divided by subperiods (USDMXN)**

$r_{i,t}$	1996-2008				2009-2018			
	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$	$\alpha$	$\beta_1 r_{Mkt,t}$	$\beta_2 \Delta f x_t$	$R^2$
CHMCL	0,01 (1,541)	0,331** (2,818)	1,267*** (5,002)	0,259	0,01* (2,525)	0,735*** (6,218)	0,503*** (3,512)	0,453
BRES	0,002 (0,328)	0,716*** (6,916)	0,482* (2,156)	0,338	0,004 (0,781)	0,718*** (5,032)	0,09 (0,519)	0,236
INDGS	-0,001 (-0,307)	0,71*** (11,616)	0,504*** (3,821)	0,6	0,012*** (3,780)	0,541*** (5,797)	0,43*** (3,801)	0,444
CNSTM	0,002 (0,433)	0,727*** (9,063)	0,881*** (5,093)	0,54	0,003 (0,79)	0,73*** (7,155)	0,464*** (3,753)	0,513
FDBEV	0,007* (2,494)	0,395*** (8,234)	0,316** (3,050)	0,438	0,008*** (3,404)	0,456*** (6,473)	0,059 (0,692)	0,344
PERHH	-0,002 (-0,378)	0,519*** (6,820)	0,438** (2,671)	0,352	0,005 (0,149)	0,422*** (4,853)	0,172 (1,637)	0,275
RTAIL	0,01** (2,952)	0,436*** (7,421)	0,496*** (3,920)	0,43	0,005 (1,604)	0,541*** (6,010)	0,272* (2,491)	0,393
MEDIA	-0,004 (-0,727)	0,821*** (9,730)	0,083 (0,454)	0,438	0,001 (0,327)	0,495*** (4,937)	0,007 (0,057)	0,211
TRVEL	-0,001 (-0,266)	0,513*** (6,560)	0,538** (3,189)	0,359	0,004 (1,29)	0,397*** (4,184)	0,236* (2,054)	0,251
TELCOM	0,01* (2,363)	0,789*** (10,537)	-0,047 (-0,288)	0,461	-0,002 (-0,454)	0,564*** (5,293)	-0,057 (-0,444)	0,219

$r_{i,t} = \alpha + \beta_1 r_{Mkt,t} + \beta_2 \Delta f x_t + \epsilon$ .  $r_{i,t}$  = the return on industry price index, the  $r_{mkt,t}$  the return on market price index and  $\Delta f x_t$  the change in the USD/MXN exchange rates. Significance codes: \*\*\* = 0,1%, \*\* = 1%, \* = 5%, † = 10%

## 7 FINDINGS

The object of the research conducted was to investigate the existence and the possible direction and volume of the exchange rate exposure on Mexican firms' value on industry level. In this chapter the findings of the study are related to the existing theories and empirical findings, this way also reflecting the contribution of this thesis to the existing literature. Furthermore, the managerial implications are presented as well, and finally the limitations of this study and the suggestions for future research are presented.

### 7.1 Main Findings of the Study

The main findings of the study can be divided below the following factors: cross-sectional differences between the industries, between the sample periods, and between the estimates of exchange rate measurement. As well, the possible relationship between the results and the market investigated are discussed in relation to the previously conducted researches.

Positive correlation between the exchange rate changes and firm values on industry level is found in seven out of then industries investigated. Clear cross-sectional differences between the level of exposure within industries are found when running the regression which results are presented in table 1. Three of the investigated industries, telecommunications, media and basic resources, result with insignificant coefficients for the exchange rate changes, thus indicating that in these industries the firms are not exposed to the fluctuations. The rest of the industries result with significant positive coefficients reflecting the exposure faced by the firms operating in the industries, hence whenever the Mexican Peso appreciates, the firm value also increases. When relating the gotten results to the existing researches, we could assume that the industries that result with a higher coefficient are more involved in international trade. The industries with the highest value coefficients, industrial goods and services, chemicals and construction materials, are amongst the most traded industries Mexico has with the USA, thus we could say that these results go along with the existing results about the relationship between the share of international trade and

the level of exposure. The significant and higher values of the coefficients could also reflect more competition on the industries as stated by many previous researches.

In order to evaluate nominal effective exchange rates as the measurement of exchange rates in the regression, a new regression is run for the same time period, the only change being the usage of USD/MXN exchange rate as the measurement. Table 5 presents the results gotten, and it can be analyzed that the same coefficients remain statistically significant, however the level of exposure decreases systematically throughout all the industries. The biggest falls are detected in the construction and materials, personal and household goods, retail and travel industries, where the percentage difference is more than 20% when compared to the exposure level when using nominal effective exchange rate as the measurement.

The robustness of the exchange rate measurement is also tested by running the same regression with lagged values. This regression is run since various existing studies have found out the significance of lagged values instead of the contemporaneous values as the regressor in the equation. The results of the regressions are presented using both NEER and USD/MXN as the exchange rate measurements respectively in table 6 and table 7. It can be with one voice affirmed that the value of Mexican companies is not exposed to the lagged values of exchange rates in neither of the cases, thus repealing the statement of various studies. This might have to do with the different market conditions dominating the Mexican markets, especially since as justified earlier, most of the studies have been focusing first of all on developed markets, and second, on greater, not so open economies.

Eventually, the sample period is divided into two sub categories, the object being to investigate whether the exposure levels remain equal throughout the time, thus being robust to the time. The results in table 5 and table 6 show that the exposure levels differ highly when divided into subperiods. When moving from the first subperiod to the second one, it is shown that not all the industries remain exposed to the changes in exchange rates, and the ones remaining, face a significant fall of the level, on the average around 50%. The industries remaining exposed are chemicals, construction and materials, retail and travel industries, but as showed the effect of the exchange rate

fluctuations falls significantly. In addition, the industrial goods and services industry remains exposed, and as the only one of the industries, its coefficient actually grows.

During the financial crisis, Mexico was one of the most affected economies in Latin America, which could explain also the significant change in the exchange rate exposures between the two time periods. Some researchers argue that as a result of financial crisis, companies started to pay more attention to the existence of the risks, which might have affected their awareness of the risk management as well, this way decreasing the level of the total exposure they face.

One of the reasons why numerous of the researches conducted have not been able to find significant relationship between the changes in exchange rates and firm value, also brought up by Bartov and Bodnar (1994), can be the relatively short history of floating exchange rates when compared to the years on which the majority of the studies have been conducted. Since the study conducted here starts decades after the so-called start of the floating exchange rate era, it can be considered as an advantage and support to the results gotten as well and it might also explain why significant coefficients are found in this study.

Even if not investigated in this study, based on the existing theories and previous researches conducted, it has been said that the financial markets in emerging economies remain less developed than in the developed countries. The higher level of exposure found supports this thought, since the usage of hedging activities and the ignorance of them while conducting the researches has been mentioned often as one of the reasons leading to the failure of finding significant coefficients for the exchange rate changes as an explanatory variable. Hence, it could be one of the reasons why the exposure levels are found significant in this study for almost all of the industries investigated.

## **7.2 Managerial Implications**

The results of this thesis provide an overview about the industrial differences of exchange rate exposure the firms face in Mexico. These findings may help the financial managers of the companies to understand in which industries it is more important to



be aware of the fluctuating exchange rates, possibly also pay more attention to the hedging activities against the risks arising from the fluctuations. Since the globalization keeps expanding without cease, companies should also be aware and able to understand the consequences of the phenomenon and the possible threats it might create for their business in the future.

The study enables the financial managers also to understand that the past changes in exchange rates do not expose the firm to the changes in its value, thus the future changes happening in the firm value cannot be predicted by the past changes in exchange rates. The high rates of exposure can also predict that the existing exposures are not hedged as effectively as they could be, hence giving the financial managers the initiative to hedge against the exposure. However, this study does not provide a wider investigation about the type of exposure faced by the industries, thus it cannot be said for sure that the level of exposure can be hedged against.

As Mexico keeps growing as an economic area and as an area of interest for foreign companies and foreign investors as well, the study can provide a general view about the effects the exchange rates might have on companies acting in a specific industry whenever currency appreciation or depreciation is faced.

Since the previous literature of the topic remains quite limited in the area of emerging markets and especially in the area of Latin America, this study provides an insight to the area and even though the more specific determinants of the exposure are not explored, the study sheds light to the different way emerging markets are affected by the exchange rate fluctuations, and as it is found, most of the industries are actually significantly exposed to the changes in exchange rates, challenging many of the existing studies conducted mostly on developed markets.

### **7.3 Limitations**

This study provides a wide overall picture of the effects of the exchange rate exposure on Mexican companies in an industry-level perspective. However, the perspective remains limited because there are still many questions that remain unanswered because of the availability of the suitable data.

The further determinants of the exposure are not investigated in this thesis. First, the hedging activities of the companies are not considered in any form in the study, even though they have been proved to affect the level of net exposure the firms face. Second, even though the study is conducted on industry-level, the size of the companies is not taken into account even though it has also been shown to explain changes in firm value in previous studies. Both of these limitations raise as a result of the limited amount of available data.

Finally, this study does not provide an answer to the describing question of why a specific industry is more exposed to the exchange rate fluctuations than another one. Some speculations are presented but the reasoning behind these statements is purely based on non-statistical facts and existing results.

#### **7.4 Suggestions for Future Research**

There remain still many scopes in exchange rate exposure for future studies to investigate. This study provides a very overall picture of how the Mexican companies are exposed to the exchange rate fluctuations, however the study does not go into details, thus leaving a lot of aspects to study furthermore.

A more detailed research regarding the hedging activities of the companies could complement the study conducted and provide a more detailed description of the determinants of the exposure. However, for these kinds of researches a deeper data-collection would be required in order to analyze the topics in a justified way.

As well, a comparative study between the developing economies, especially Latin American countries, could complement this study by stating whether the results gotten from Mexican markets can be generalized to other developing economies as well. Since other Latin American economies remain more closed than Mexico when compared by the export and trade ratios, a comparative study could also show whether the open economy macroeconomics theory holds in the area.

A wider research comparing the effects on developed and developing markets could also help to better understand the specific factors both types of the markets have and

which affect the level of exposure they face. Especially the effects of the unstable political conditions would be a significant topic to study, since it is a known fact already from the theoretical base provided by that whenever the economy is politically more unstable, it will not be attracting investors, thus the currency will be losing its value. Whether this has to do with the exposure could be investigated as well.

The other factors that have been found significant determinants of the level of exposure, such as the share of international trade and firm size could be added in order to divide the sample in different ways, thus investigating whether these differences also apply in Mexican market and whether the factors have same kind of effect as in the markets researched earlier.

## 8 CONCLUSIONS

As globalization and the need and ambition of firms to be involved in the international trade increases, also the risks associated with doing business between different currencies arise. The higher the share of firm's assets or liabilities in foreign currencies, the more volatile their future cash flows and wealth are as well.

The purpose of this study was to investigate whether exchange rate changes have effect on the stock prices in Mexico and whether the exposure is related to the industry in which the companies operate. In addition, other factors' effects were tested in order to obtain unbiased results. This chapter concludes the thesis by bringing together the main theoretical basis, previous research results and main findings of this study.

The existing literature and its drawbacks can be sum up as the so-called exchange rate puzzle, which represents the possible reasons behind the non-uniformed results gotten during the past decades. In this study the focus has been on investigating whether the developing market creates a different kind of environment for the companies, and whether different industries are exposed in a different way in this specific market. In addition, different measurements of exchange rates are used in order to find out whether the choice of the measurement acts as one of the explaining factors when it comes to the level of exposure and the robustness of the results for the different time periods are tested as well.

This thesis concentrated on answering the question whether Mexican companies are exposed to the risk arising from exchange rate fluctuations. The main research question to answer in this thesis was stated as follows:

*Do changes in exchange rates affect the stock prices of Mexican companies?*

In addition, the following sub-questions were stated in order to support the main research question and to get more detailed analysis:

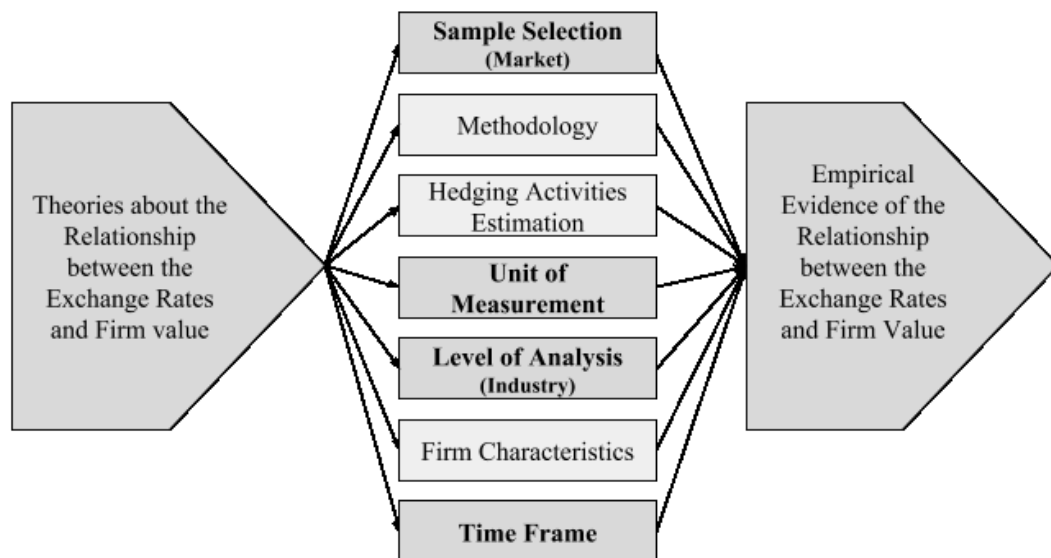
*Is the effect positive or negative?*

*Does the industry of the company affect the level of exposure they face?*

*Does the level of exposure vary within the time?*

*Does the measurement of exchange rate affect the level of exposure?*

In general, it is found out that exchange rate exposure has a meaningful role in return generation of the companies. The positive correlation between the exchange rate fluctuations and firm value indicate in this study that whenever the exchange rate increases, in other words when the Mexican Peso appreciates, also the firm value tends to increase.



**Figure 13. Exchange rate exposure puzzle pieces solved.**

In addition, more detailed results are found. Figure 13 presents the pieces of so-called exchange rate puzzle that get solved as a result of the research conducted in this thesis: the effects of sample selection (e.g. market), unit of measurement, level of analysis (industry) and the time frame on the level of exposure in Mexico.

It is made evident that the exchange rate fluctuations affect differently on firms operating on different industries. The industries which face more volatile changes in their firm value than the changes happening in the exchange rates are chemicals and construction industries, however when the regressions are run using the USD/MXN exchange rates, the correlation remains positive, but the firm values are not as volatile relative to the exchange rates anymore. The industries that do not seem to be exposed to the exchange rate risk are media, basic resources and telecommunication industries, which do not result with significant coefficients neither when the nominal effective exchange rates nor the USD/MXN exchange rates are used. These industries do not show up with significant coefficients when tested by the two sub time periods.

When the lagged exchange rates are used as explanatory variables, the results show us that none of the industries results with a significant coefficient. Thus, as an opposite to many existing studies, it is found during this research that actually the contemporaneous changes in exchange rates do affect the firm value, not the lagged changes.

In addition, significant differences between the coefficients of exchange rate changes between the time subperiods, the time before and after the financial crisis, are also found, stating that the exchange rate fluctuations have had higher effect on the firm value before than after the financial crisis on all the industries investigated.

Whether the findings of this thesis are related to the different market conditions of an emerging economy, to its openness and involvement in international trade, or to other factors, remains statistically unsolved. However, when connecting the gotten results to the previously conducted researches and suggestions, it can be at least to one level be argued that the research results from developed countries and from different time periods cannot be implemented to developing economies or to different time periods, at least in case of Mexico without a critical consideration. Also, the measurement of the exchange rate used has to be contemporaneous change in the value of the currency, and the industry-specific differences should be taken into account.

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