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Master Thesis

Exchange Rate Exposure, Use of Derivatives and Hedging Effectiveness. Case: Exporters in the Czech Republic

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Declaration of Authorship

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Abstract

This work is the result of great effort to find if exchange rate exposure is significant within Czech exporters. Moreover aim to disclose if the significance differs between those companies that use derivatives over the ones that do not. This study, differentiates from previous research in the field of exchange rate exposure by segregating companies that hedge with derivatives over the ones that do not, in order to compare significances in exchange rate exposure for both groups. Over the literature reviewed, it also finds relevant the usage of real exchange rate that within literature has not been used as largely as the nominal exchange rate.

Key Words: Exchange Rate Exposure, Hedging Strategies to Exchange Rate Risk, Exports, exchange rate determinants, competitiveness, effectiveness.

Klíčová slova: expozice směnných kurzů, strategie zajišťování kurzového rizika, vývozy, determinanty směnných kurzů, konkurenceschopnost, efektivita.

Contents

I. Introduction

In a worldwide economy exchange rate exposure is widely study, this is because exchange rate movements matter as companies choose not only to trade in the domestic market but also internationally. On the other hand, if significant, the exchange rate risk deteriorates cash flow and therefore liquidity which is crucial so that companies operate. This document's main target is to answer if companies that hedge with derivatives manage better exposure to exchange rate than the enterprises that do not use derivatives. In order to accomplish the purpose, this work revises broadly theory regarding exchange rate risk in combination to the Czech Republic's context and statistical analysis of sample for the period 2012-2016 for Czech companies.

This study appears in the light of the Czech Republic being a highly open economy - its exports and imports sum 145% out of the total GDP- yet with the use of the Czech Crown as official currency.

In addition, this research arises because of the resent monetary context in the country: In November 2013 the Czech National Bank (CNB) announced that will use the exchange rate as monetary instrument and set a one side floor of 27CKZ/EUR for the Czech Crown. After the announcement, the exchange rate depreciated and CNB's interventions were not needed. Nonetheless, in July 2015 the crown started to appreciate rapidly and the central bank had to intervene largely in the foreign exchange market to meet its commitment. These interventions resulted in a crown equal to 27CZK/EUR from July 2015 to April 2017.

The policy may had some impact in the real effective exchange rate, as it depreciated accordingly during this period, Consequently, this depreciation in real terms may had impacted exporters, augmenting their competitiveness in this period. In fact, from the imposition of the floor to the end of 2016 the real effective exchange rate depreciated in 7.54. Nonetheless, upward correction (appreciation change) is present in the year 2015.

Many similar studies within this field have tried to answer the question if companies are expose to exchange rate movements. Some of them tried to answer the question by doing research in the industry as a whole and others by focusing on one sector only.

However, when analyzing the industry as an aggregate the significance of exchange rate exposure is low as industries net the positive and negative effects when; for example, within a sample there are exporters and importers. On the other hand, when estimating one sector, such as exporters, may happen that exposure is not found, this because companies in the sector selected are exactly those that are more interested on hedging risk and do so. Thus, exchange rate exposure is hard to estimate due to its complexity. This work tries to solve this issue by analyzing manufacturer exporter companies segregated by the ones that relatively hedge more than others.

This document efforts to demonstrate that the companies that use derivatives mitigate better the exposure to exchange rate. Literature revised suggests that in general, the use of financial hedging works in complement with operational hedging, therefore a relative advantage in managing exposure may be found in those that use derivatives over those which do not. To this, two partial targets are derived: Disclose that exposure to exchange rate exist in the companies that do not use derivatives and that exposure is lower for those that do not.

To answer the hypothesis, this study attempted to use Panel Data regression technique -however simple linear regression provided similar results-. The regression was performed for two groups: the companies that use derivatives and the companies that do not use derivatives. In the regression, the real effective exchange rate is the independent variable tested against three financial results (dependent variables): sales, operative profit and total profit. This study found that for those that use derivatives the real exchange rate proves not to be relevant to explain the financial results, whereas for the ones that do not use derivatives proves the contrary, however exchange rate explains to very little extent the financial outcomes and results vary when using different real exchange rates.

For better understanding of this topic, theory regarding determinants of exchange rates, definition and measurement of exposure to exchange rate, hedging strategies, determinants to hedge, importance of hedging, effectiveness of hedging and currency arrangements; is revised. Furthermore, within the chapters Czech framework has also been studied as well as other countries' findings.

II. Scope and Hypothesis

This document revises theory related to exchange rate exposure, its determinants and strategies to fight it. Most importantly seeks to understand how companies, especially Czech exporters are related to exchange rate exposure. Moreover, aims to find if the exchange rate exposure is relatively more significant in those companies that chose derivatives as hedging strategies over the ones that do not.

The hypothesis worked in this research is that those companies that use derivatives fight better the exchange rate exposure in comparison to those that do not use derivatives. Hedging with derivatives can respond to partial hedging –all the risk is not expected to be hedge by the derivatives-. Nevertheless, this characteristic –using derivatives, or not- plays a role to differentiate between those companies that hedge more than others.

III. Theoretical Framework

1. Determinants of Exchange Rate:

The exchange rate determination is highly complex, as it depends not only on one single economic factor but also on a conjunction of many as well as expectations induced by policy makers. The exchange rate movement may be present in short and long terms. As of continuous variations around the globe at different timing, short-term fluctuations are connected to market sentiment and short-term supply or demand, as markets in different parts of the world function at different schedules. The long-term fluctuations are connected more to fundamentals of the economy.

Furthermore, exchange rates may be controlled to some extent through central national banks by monetary policy makers who would purchase or sell foreign exchange currencies to strengthen or weaken their value. Hence, central banks would purchase (sell) foreign (local) currencies when the value of the local one is too high or sell (purchase) foreign (local) ones if the value of the national currency is too low. In addition, central banks can also change the monetary policy rates that have in most cases some impact on exchange rates.

Overall, exchange rate determination may be explained by the following approaches: Relative Prices (Purchasing Power Parity), Balance of Payments, Monetary and Assets Market Flows Approach (Eiteman, Stonehil, & Moffett, 2007).

1.1.Long Term Determination

The long-term exchange rate is determined by the **Purchasing Power Parity (PPP)** (Mendoza, 2015)**.** This theory states that a specific basket of goods must have the same price in the local country and abroad if there is free trade and international transaction costs are equal to zero. The principle is summarized in the single aggregate-price law equation as follows: $P=EP^*$[1].

The PPP has two versions: **the Absolute Version** and the **Relative Version**. Being subject to the **Absolute Version**, the real exchange rate must be equal to one, e=1=EP*/P. That is to say, the actual long-term exchange rate is a constant. Should be there any difference, the arbitrage process would solve it. On the other hand, the **Relative Version** states that any nominal appreciation or depreciation is determined by the difference in inflation between both the national and the foreign country, $\%E= \pi - \pi^*$[2]. Thus if the domestic inflation rate is 2% higher than that of international inflation, the nominal exchange rate will also increase by 2% as the real exchange rate is maintained at its long-term parity level. Given the international inflation rate, the higher the domestic inflation, the local currency depreciation rate is to be higher.

Under the PPP theorem, exchange rate risks and hedging are not a matter of concern as prices of all different economies are to converge into the same one in the long run. However, PPP does not hold in the real world due to market imperfections such as transportation costs and trade restrictions (e.g., import, tariffs), sunk costs (e.g., renting a place for business results more expensive in China than, for instance, in The USA), and inconsistent information (traders without information about price differences will lose profitable opportunities and prices will never be equalized) (Wang, 2009) . The theorem does not hold because of risk aversion and uncertainty either (G. Arghyr & Andro, 2011).

[1] E, stands for Exchange rate in equilibrium, P*, the price abroad and P, the local Price.
[2] π = home inflation, π^*= inflation abroad.

Empirical studies have proven that the actual exchange rate tends to get the value specified by the PPP approach in the very long term, that is, there is a certain convergence in the basket of goods price between countries -at least among the most developed ones. However, the actual exchange rate in the current period may differ from the long-term actual exchange rate in the short term and the PPC may not be met. The reasons for such a fact are, among others, as follows (Mendoza, 2015):

2. The transaction costs in international trade are not null due to the presence of transport costs, tariffs and taxes.
3. The existence of goods and services considered not internationally tradable. The countries not only produce tradable goods but also totally or partially non-tradable ones.
4. Domestic prices may show a certain degree of rigidity in the short and medium term so that adjusting them towards equality by means of an international arbitration process may take time.
5. Goods and services produced by countries are not identical in general; there are usually major differences in their quality and presentation.

1.2. Short Term Determination

Exchange rates may also be affected by the demand and supply of the local currency not only by national holders but also by foreign investors. In the same way, the demand of financial assets that Central Banks would offer in local currencies or hold in other ones may be affected as well. Investors and speculators, for instance, may affect the exchange rate price, especially in the short term. As taken by the **Asset Approach**[3], investors may consider two important variables when deciding between domestic and international investment: Relative levels of interest rates and expected changes in exchange rates. Investments counted in the asset approach are all financial assets such as government bonds denominated in different currencies, (Pugel, 2016).

In addition, uncovered interest parity holds that a currency is expected to appreciate (depreciate) by as much as its interest rate is lower (higher) than the interest rate in the

[3] For more theories regarding the Asset Approach see: International Monetary Relations, Robert Carbaugh p. 404

other country. Thus expected appreciation in the local currency is equal to the difference between foreign and local interest rate, $e^{ex} = i^* - i$[4]. Furthermore, the condition also indicates that expected uncovered returns of foreign investments equal returns in the domestic country investment, $e^{ex} + i = i^*$. Hence returns converge to be equal and any differences cause internationally financial investors to relocate their portfolios.

Being in accord with the aforementioned, the conditions of uncovered internationally financial investment[5] and uncovered interest parity[6] prove that investors determine expectedly total returns on uncovered investments in a foreign-currency bond by using:

- The return on the bond itself (the interest rate)
- The expected gain or loss on currency exchanges (the expected appreciation or depreciation of the foreign currency).

To sum up, interest parity aligns domestic interest rates, foreign interest rates, current spot exchange rates and expected future spot exchange rates. Changes in any of these four variables imply adjustments will occur in one or more of the other three.

1.3. Balance of Payments (BOP) Approach

The Balance of Payments (BOP) is another method for explaining the fluctuation of exchange rates. The BOP is the cash flow that records monetary transactions between any given country and the rest of the world. Transactions may be the exchange of real assets, that is, exchanging goods such as machinery, cacao, oil as well as cellphones, electrical household appliances, among others. Furthermore, it also registers flows of services such as banking, consulting, supporting, etc. On the other hand, transactions may also be related to financial assets, e.g., purchasing or selling of companies, setting up

[4] Where i=local interest rate, i*= foreign interest rate, e^{ex} =expected exchange rate, e= current exchange rate.
[5] Uncovered internationally financial investment involves investing in a foreign-currency financial asset without hedging or covering the future proceeds of the investment back into one's own currency. For more information see (Pugel, 2016) p.419
[6] In which the Expected Uncovered Interest Differential (EUD) equals zero, where EUD= $(1+i)\, e^{ex}/e - (1+i^*)$ whilst i=local interest rate, i*= foreign interest rate, e^{ex} =expected exchange rate, e= current exchange rate.

foreign operations in the stock market, trading of foreign bonds (Intenational Monetary Fund, 1993)

The flow of the Balance of Payments is of vital importance to explain the pressures on exchange rates, as it tracks down inflows and outflows of foreign currencies.

In order to clarify how the Balance of Payments is composed of: The accounts that compose it (Current Account, the Capital Account and the Financial Account) are explained below. The accounts have to balance in the BOP, this means, that he sum of the current and capital account balances is equal to the balance of the financial account. This can be understood as: The net balance of the current and capital accounts defines the exposure of an economy to the rest of the world, on the other hand, the financial account describes how it is financed. Ideally, the net balance of the current and capital accounts equal the total net of the financial account, if not, net errors and omissions are recorded[7].

Current Account

The Current Account is an account in which a certain number of operations are done. In fact, all exports and imports of goods as well as services are recorded, incomes are received whilst dividends are given to parent companies apart from paying wages and salaries to non-residents. Furthermore, current transfers are tracked down such as money flows from one country to another to provide gifts or grants. It consists of the Goods and Services Account, the Primary Income Account and the Secondary Income Account.

The Goods and Services Account is composed of Goods that are "*…physical, produced items over which ownership rights can be established and whose economic ownership can be passed from one institutional unit to another by engaging in transactions..*"[8]; some knowledge-capturing products such as computer software and other intellectual-property products are also included. The account also contains services that are "*…the result of a production activity that changes the conditions of the consuming units, or facilitates the exchange of products or financial assets…*"[9]. The Primary Income Account is

[7] Eurostat, Statistics Explained, Balance of Payment Statistics web site: http://ec.europa.eu/eurostat/statistics-explained/index.php/Balance_of_payment_statistics
[8] Balance of Payments and International Investment Position Manual, Sixth Edition. IMF last updated 2013, p. 149
[9] Idem

made up of flows between residents and non-residents as well as income associated with the production process such as compensation of employees, apart from income associated with the ownership of financial and other tangible assets such as dividends, reinvested earnings. Finally, the Secondary Income Account mostly contains general government current transfers, such as for example payments of current taxes on income and wealth, social contributions and benefits[10].

According to the Current Account Approach, the current account provides an explanation of the exchange rate in the **Medium Term,** (Black, Hartzenberg, & Standish, 2004). This means, that the exchange rate adjust to the point in which the demand for foreign exchange rate to buy imported goods or services and the outflows from the primary and second income account matches the supply and inflows of foreign exchange rate from sold exports and other receipts.

Capital Account

The capital account shows: capital transfers receivable and payable and the acquisition and disposal of non-produced, non-financial assets between residents and nonresidents. Such as acquisition or disposal of natural resources, contract, leases and licenses and marketing assets, debt forgiveness, Investment grants, among other capital transfers (IMF, 2013).

Financial Account

Direct investments, portfolio investments, financial derivatives among others are part of the Financial Account. Direct investment is related to the acquisition of a national firm by a foreign one to operate in a given country. Portfolio investment is related to the acquisition or sale of financial assets, e.g., corporate or treasure bonds and different stocks, among other purely profit-targeted instruments.

2. Foreign Exchange Exposure

[10] Eurostat, Statistics Explained, Balance of payment Statistics, Web Site: http://ec.europa.eu/eurostat/statistics- explained/index.php/Balance_of_payment_statistics#Current_account

2.2.Definition

Foreign Exchange Exposure in a company is defined as the risk of profitability, cash flow, or market value to change because of variations in exchange rates (Eiteman, Stonehil, & Moffett, 2007).It can also be explained as the risk of movement in exchange rates over financial results when a company has assets or liabilities denominated in a different currency than the local one (Brian, 2000). In general, foreign exchange exposure is explained as the risk that variations in exchange rates will affect a company's performance (Madura, 2007). The movement can impact upon the company's performance through: reducing its cash income, increasing cash expenditures, reducing its reported profits, valuing foreign assets, increasing the value of foreign currency liabilities, damaging its competitive position in its domestic and foreign markets to the advantage of foreign rivals (Brian, 2000).

The exposure to risk does not always have a negative effect on the firm; it may also derive on positive results. However, the gains are not considered the fundamental activity of the enterprise neither the core of non-financial business. Furthermore, exposure to exchange rate risks may be significantly negative for exporters and a significantly positive exposure for importers, (Pritamani, Shome, & Singal, Foreign exchange exposure of exporting, 2004). It is unlikely that literature will support opportunities to be considered because of variations in exchange rates. In fact, managers would never mention potential gains when being inquired about exchange rate risks (Rodriguez, 1974). Nonetheless option strategists disagree over such reasons as they reveal that enterprises may also seek opportunities to gain some profits providing that the effect is positive (Capel, 1997).

Theory and studies in this field distinguish mainly three types of exposure (Papaioannou, 2006), (Brian, 2000) (Eiteman, Stonehil, & Moffett, 2007) (Madura, 2007): Transaction Exposure, Economic Exposure (or Operating) and Translation Exposure (or Accounting Exposure).

First, **Transaction Exposure** is defined as the sensitivity of transactional accounts exposure (for instance, receivables, payables or dividends) to variations in exchange rates. This exposure is related to selling or purchasing between foreign partners. Depending on

the contract, it may arise when a negotiation takes place in different time than the payment and the delivering. In this sense, the importer faces the risk to pay more in its own currency to make the foreign payment and the exporter faces the risk to receive less on its own currency from foreign currency receipts. However, it can also arise from financial transactions (interest and capital payments). Thus it has a direct connection to cash flows and profits. Transaction exposure may have a significant impact on the firm's value, the bigger the exposure the bigger the risk profits will diminish. Consequently, exchange rate management is mainly centered on transaction exposure (Papaioannou, Exchange Rate Risk Measurement and Management: Issues and Approaches for Firms, 2006), (Belk & Glaun, 1990).

> According to Shapiro (1998); transaction exposure measurement has a fundamental flaw: local currency cost and revenue stream remain contanst when exchange rate changes -there is close relation between nominal exchange rate and inflation as express in purchasing power parity-.

Second, **Translation Exposure** refers to the impact of converting foreign subsidiary balance statements stated in foreign currencies to a local currency so that a consolidated statement -usually established in the local currency- may be prepared. Likewise, the number of executives managing transaction exposure started to grow after the closure of Bretton Woods System. Many other survey-based studies reveal that transaction exposure is considered more material to managers than translation exposure (Nathan, 2000), or that managers are unconcerned about it (Gholamreza, 2003) (Dhanani, 2001). For some firms, nevertheless, it may be the foremost currency risk they would like to control, especially for those who care about their reputation and, therefore, the performance of stock prices. They would monitor the release of outcomes from the company`s assets, equity or income (Prindl, 1976).

Third, the **Economic Exposure** refers to changes in the current value of the firm as for the variations in exchange rates. In fact, it quite often arises when the firm's future cash flows are affected by variations in exchange rates. As being related to cash-flow and exchange rate movement forecast, this risk may be the most difficult to measure and managed since it is more related to long-term possibilities. Therefore, financial techniques

to protect current cash flows are limited to hedge future performance and other strategies rather than the need for financial ones (Capel, 1997).

The economic exposure is also call competitive exposure and it is related to future cash flows that are potentially changing international competitiveness (Beenhakker, 2001). Furthermore this exposure is related to long term risk, meaning that this exposure is related to relative price changes or, equivalently, to real exchange rate changes.

The distinction between the nominal and the real exchange rate is important when considering this risk. If the real exchange rate changes dramatically, it will cause relative prices to change drastically as well affecting the relative competitiveness. More importantly, firms may face more exchange risk if nominal exchange rates do not change, hence, "*A company's operating exposure is affected only by changes in the real exchange rates."*[11] (Shapiro, 1998).

There are other types of exchange exposure which are not always mentioned in the literature. Such as: **pre-transaction exposure and tax exposure**. The first one arises when firms commits themselves to a foreign-currency price, e.g., subject to a price list, before the negotiation is closed. Such exposure will arise when the contract is signed under the conditions of commitments previously arranged. The second one refers to deductible realized foreign exchange losses and therefore changing results in calculating income tax.

2.3. Foreign Exchange Exposure: Measurement

Several studies have tried to find empirically the relation between exchange-rate variations and changes in the company performance. Most of them have come out with mixed results for American firms and with more conclusive ones for those directed towards Europe or other continents. One valid explanation, as for the mixed results concerning American firms, is that The United States of America is a big closed economy in terms of trade. On the other hand, others may explain that the lack of relation is due to hedging being present among corporations.

11 Foundations of Multinational Management Shapiro, 1998, Wiley, pág. 238

Nevertheless almost all the researchers in charge of such empirical studies worked hard to find the relation between performance and exchange rate changes. Among the most interesting ones, it is worth mentioning "*What Lies Beneath: Foreign Exchange Rate Exposure"* (Bartram, 2007), in which it is emphasized the importance of measuring exposures for different cash flows such as operating cash flow, financing cash flow as well as investment and total cash flow. It is also stated therein that if a company chooses to hedge therefore the exposure of operating the cash flow and the financing one have opposite signs. Furthermore, the researcher concluded that many previous studies had failed to prove exposure to exchange rate risks due to the fact that managers would successfully reduce the level of exposure, but at the level of total cash flow (or either total profit or share value). As a result, exposure cannot be detected at this level (especially when companies hedge). Finally, the author decided on a firm with important foreign business activities and analyzed its different cash flows. The findings show that the significance of exchange rates to operating cash flows is higher than that of total cash flows, thus concluding that the heeding effect is revealed in these results.

The research utilizes an OLS regression as the method of measurement with dependent and independent variables. Thus the dependent variable is given by different cash flows (operative, financial, investig and total cash flows) and the independent one is given by relevant exchange rates. In fact, the research utilizes monthly cash flow data from the information on derivatives and foreign- currency debt for the 1996-1999 period in order to measure exposure; the data was provided by the treasury department of the firm being assessed. With respect to the independent exchange-rate variable, the research herein utilizes several log-differences (the national currency in relation to the foreign currency) in exchange rates, as the company sells in different currencies such as USD, GBP, JPY,SEK and NOK to many different countries.

Other studies have strongly focused on finding a correct methodology for the means to measure exposure within a firm, e.g., Šperanda (2013) tries to measure exposure to exchange-rate risks as an EBIT response to exchange-rate risks. The author approaches two models in his study. In fact, the first one refers to the sensitivity of EBIT to exchange rates; it utilizes two variables, a quarterly EBIT of an American firm from 1998 to 2008 and a

USD/KN exchange rate for the same period and frequency. It did not have a proper fit (low R^2), as exchange rates did not elucidate EBIT well. The second approach seeks to construct a model to measure exposure to exchange rate risks, the so-called improved model, where the author proposed that EBIT and the exchange rate variables were changed into their logarithm variables. Such improved model showed that the logarithm of exchange rates explained better the relation between EBIT and exchange rates than the model without logarithms. Finally, he concluded the paper by the construction of a hedge-necessity |z| indicator which is basically the R^2 of the model times β (the resulted coefficient of the independent variable). In conclusion, the hedging necessity ratio is important for firms to be able to measure how exposed they are to exchange rates.

According to Hsiao (2017), exposure to exchange rates may be measured as the impact of exchange rates on performance ratios as ROE and ROA in one economic sector. Hsiao (2017) stated that exposure to exchange rates may be measured as the impact of exchange rates on performance ratios such as ROE and ROA in one economic sector. In his study he selected a sample of twelve tourism companies in Taiwan. Thus the data regarding ROA and ROE (the dependent variable)[12] are taken from financial statements in the stock market from Taiwan Stock Market (TWSE), the period considered is 2000(Q1) - 2015(Q3) and the exchange rate (the independent variable) is a set of different currencies, USD, GBP, EURO, JPY, AUD, among others. In addition, the regression tool utilized is an ARIMA[13]. This study proved that exchange rate movements are statistically significant to explain financial performance ratios within the Taiwanese tourism industry[14].

Other researchers have answered the question concerning how to measure exposure to exchange rates as the way variations do affect returns on stocks. More studies can be found aimed at this approach, especially for those countries where the stock market is quite big. Pritamani et. al (2004), for instance, focuses on proving that exposure to exchange rate variations affect importers and exporters in different directions, which means that the exposure effects or signs are to be positive for exporters and negative for importers. This study examines 68 export-oriented and 28 import-oriented firms. In addition, it measures

[12]The author takes the first differential of the ratios, this is ROA_1-ROA_0
[13] Econometrical Model Base.
[14] The exchange rates that resulted significant are USD for ROA ratio, EUR and SGD for ROE ratio.

total exposure as the elasticity of the stock returns to variations in exchange rates (euro-area currencies, mainly). Sensitivity measured by simple regression in such case, where the monthly data dated from 1975 to 1997. It found insignificant exposure to exporters and significant exposure to importers. Such fact proved that when it is not possible to find exposure due to hedging strategies in exporters, it is possible to find it in import-oriented firms.

Exposure measurement techniques differentiate from each other on the basis of the sample utilized by any given study, for instance, studies may choose to focus on one set of firms -mostly those with high exposure to exchange rate risks, e.g. multinationals or exporters. Other studies may prefer to analyze data at an aggregate level. They do so due to the importance of measuring the exchange-rate-risk impact on the industry as an aggregate. The first approach mostly focuses on firms which are expected to be exposed to exchange rate risks; however, those firms are exactly the ones least likely to be exposed, as they may utilize financial or operational strategies to face with risks. The issue concerning the first approach is that the sample chosen may not be homogeneous and firms may have opposite signs towards exchange-rate risks at individual levels (Dominguez & Tesar, 2001). In addition, in the study *"A Reexamination of Exchange Rate Exposure"* by Dominguez & Tesar (2001), the CAPM model is adjusted to measure the exchange-rate exposure to in a sample composed of more than 1000 companies in different countries (Chile, Taiwan, Japan, United Kingdom, Germany, Italy, Netherlands and Thailand). The CAPM model suggested is as follows: $Rit = \beta_{oi} + \beta_{1rmt} Rmt + \beta_2 \Delta st$

Where: Rit = firm's return, Rmt = return on the market portfolio,β_1 = the $firm's\ beta$ Δst = variation in the relevant exchange rate, β_2 = exposure to exchange rate[15].

In this sense, if β_2 is equal to 0, it implies that the firm has the same exchange-rate exposure as the market portfolio. If it is different from 0, then exposure to exchange rate is evident. The interpretation on results focuses on the proper reading of R^2 over the regression and significance of betas. In this case, the regression is made for each company so that a percentage of companies exposed to exchange risk may be calculated, for instance,

[15] Multiple exchange rate chosen.

60% to 70% of firms in France, Japan, Netherlands and the United Kingdom exhibit positive exposure.

It is worth mentioning that when companies are assessed as an aggregate, e.g., considering exporters, importers and industrials, among other disaggregation altogether, the relation significance is reduced compared to the scenario when each group of firms is tested separately (Muller, 2006). Likewise, samples suitably exclude firms in the financial sector in such studies, as they may choose to be exposed to exchange rates to gain some profit. Furthermore, the studies may also opt for selecting an econometrical approach to measure exposure of either one company or many. In addition, there is evidence of time horizons being assessed as important variables when explaining exposure. Thus in the research conducted by two financial specialists (Gordon & Wong, 2003), it is stated that the longer the time horizon of exposure is, the more exposed companies are.

3. The Hedging Strategy

3.2.Management Strategies to Exchange Rate Exposure

According to the Finance Risk Management Theory, companies may utilize financial contracts and operational techniques to hedge better. Thus companies may decide to diversify their market in order to hedge economic exposure (among other techniques). Translation exposure may also utilize derivatives.

There are various Financial Techniques for hedging transaction exposure[16]: ***Forwards Hedge:*** it is the most popular and direct way of hedging, the company sells (purchases) its foreign-currency receivables (payables) to eliminate exchange-rate exposure. ***Option Market Hedge:*** even though its main objective is hedging, it enables firms to benefit from favorable exchange rate results. ***Swap Contracts:*** it is an agreement to exchange a currency into another one at a predetermined rate.

16 Definitions mostly taken from: International Financial Management- Eun-Resnick-Fourth Edition-McGrill

Money Market Hedge: the firm is subject to this instrument when it may borrow (lend) a foreign currency to hedge its foreign-currency receivables (payables) so that assets and liabilities are equaled. Several studies suggest hedging the exchange rate exposure with foreign-currency debts, especially for small and medium firms. In addition, it is considered as important as derivatives and represents a relevant option among managers; however, it is both related to economies of scale and considered a complement to the use of derivatives (Otero-Gonzalez, Fernandez Lopez, Duran Santomil, & Vivel-Bua, 2013). According to this viewpoint, many studies have tried to find the relation to exchange rate risks, but they failed to find it due to the fact that companies do hedge the risk either with derivatives or mostly debts (Allayannis & Ofek, 2001).

Selective Hedging: it consists in actions taken when the currency is expected to impact negatively on the firm's results. In the study conducted by Famblin & Grimes (2014), it is stated that firms' hedging strategies respond to trends only if they seem to continue. Likewise, similar results are found in the study conducted by Brown & Crabb (2006) whereby it was concluded that firms decide whether to hedge or not subject to lagging prices of underlying indicators. This type of hedging is most likely utilized by companies with informational advantages in comparison to their counterparts (Slutz, 1996). Nonetheless if firms have wrong predictions, losses will impact negatively on their results and value. Within the literature revised, even though it could be considered as speculative -since managers may have wrong predictions-, this practice is classified as hedging.

Additionally, judging the market (or selective hedging) is a suggested course of action towards exchange rate risk. According to this strategy, it is advisable to first establish the trend of the relevant exchange rate. If the trend is favorable, there is no need to hedge, however the exchange rate must be monitored daily in order to notice any change in the trend. When a change n the trend is perceived, the hedging has to be establish immediately (Stephens, 2003). When an appreciation trend is detected and companies are affected negatively, they also may take other measures such as mode production abroad, increase diversification, increase natural hedging, pay wages in euros or increase efficiency and innovation.

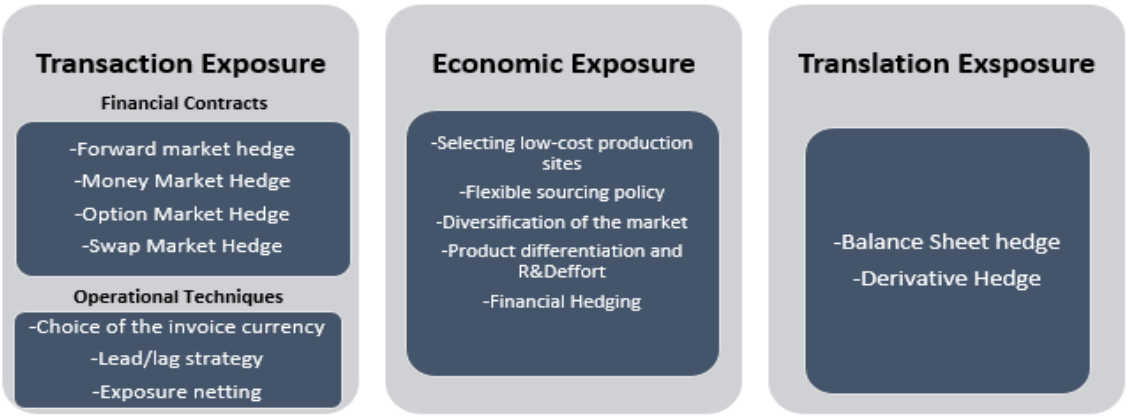
Hedging none of the exposure: it deals with the firm's management, which may also be considered a technique to control risks. However, this strategy is mostly applied by well diversified firms.

With regard to operational instruments, companies could utilize: ***hedging through invoice currency:*** whereby firms choose the appropriate invoice currency so that exposure is shifted to the other party; however, firms may agree to share the exposure, which means, for instance, half of the invoice is printed in another currency. **Lead/lag strategy**: whereby firms may pay or receive cash earlier or later, on a convenient basis. ***Exposure netting:*** whereby firms hedge only its net exposure, as they have both receivables and payables expressed in a given foreign currency.

Economic exposure can also be a hedge. Thus economic exposure is related, as aforementioned, to long-term risks and the solutions to minimize it should be long-term-oriented as well. Firms may select operation techniques such as Low-Cost Production Sites and Flexible Sourcing Policy. The former one refers to establishing subsidiaries where the currency is not as expensive as in relation to that of the parent company. The latter one involves purchasing material from other countries where the materials and additional components are cheaper, especially from those where the currency is not as strong as in the local country. Regarding financial techniques, firms may also choose the aforementioned financial techniques; however, they must be related to long-term periods.

Finally, the transaction exposure may be hedged by means of a balance sheet hedge, technique whereby the exchange rate translation exposure is completely eliminated by firms, as the accounting of parent companies and subsidiaries will be presented in the same currency. Nonetheless subsidiaries may be faced with transaction exposure when selling products or asking for debts fixed in the local currency within their country.

Graph III.3.2.1. -Summary of Hedging Techniques



Source: International Financial Management 4th Edition, McGrawHill.

To some degree, derivatives are utilized to hedge exchange rate risks on the basis of the type of exposure. In fact, companies that hedge may be classified as hedgers (a hundred percent of the exposure is hedged by derivatives) and partial hedgers (less than a hundred percent of the exposure is contracted by derivatives); market evidence suggests that partial hedgers adjust the use of derivatives so that it is prudent to their exposure (Savchenko, 2010). In addition, operational hedgers in conjunction with financial strategies are more effective to manage exchange rate risks than those with operational strategies only; unless there is evidence to the contrary, financial hedgers do succeed to reduce risks (Allayannis, Ihrig, & Weston, Exchange-rate hedging: Financial versus operational hedgers, 2001)[17]. Finally, according to a survey conducted in the Czech Republic (Čadek, Rottová, & Saxa, 2011), Czech companies would use operation hedging in less than 1% of the cases.

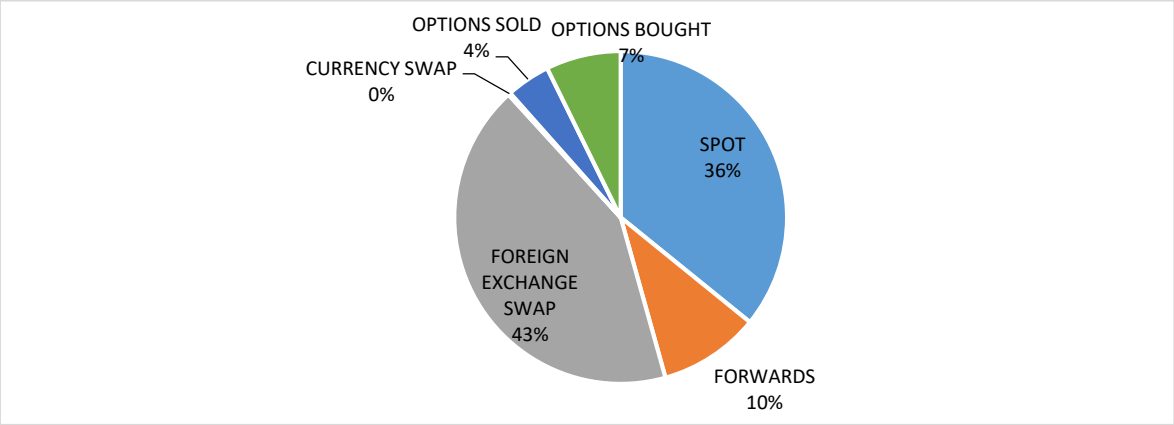
With regard to the use of derivatives, literature suggests that forward exchange rates are the most utilized hedging strategy. Thus an American surveying company, Wharton Surveys for Financial Risk Management, revealed in 1998[18] that 44% of the inquired firms were utilizing derivatives, 79% out of the total were hedging against currency risks and that

17 Financial Hedgers= it is related to companies that utilize financial strategies to protect from exchange rate exposure
Operational Hedgers= it is related to companies that utilize operational tools to diminish exchange rate exposure.

18 (Bodnar, 1998)

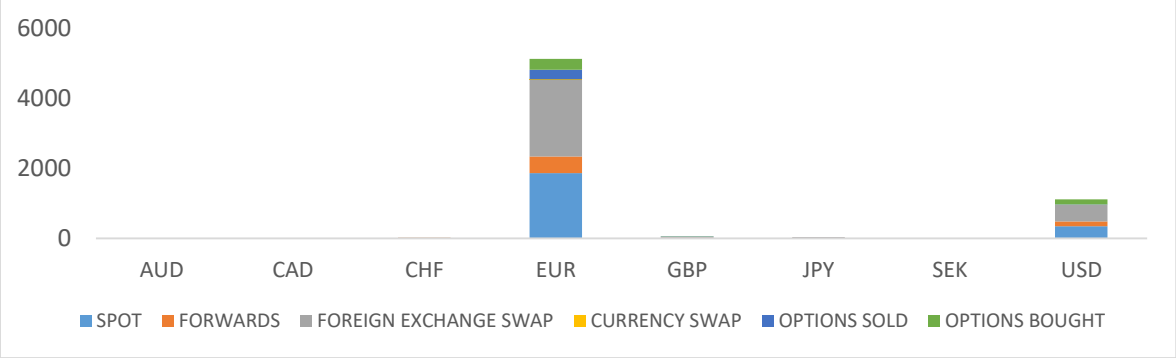
forward exchange rates were being utilized in most of the cases. Likewise, in the latest 2016 Triennial Survey[19], it is revealed that Forward and Foreign Exchange Swaps were among the most popular derivatives utilized by non-financial companies. The use of forward and foreign exchange swaps represent 53% out of all derivatives for non-financial companies in the Czech Republic whereas swaps and options represent 0.22% and 11% respectively. Furthermore the currency mostly hedged is the Czech Koruna against the Euro-Graph II.3.2.3.

Graph III.3.2.2. Currency Foreign Exchange and Derivatives -Non Financial Companies - Czech Republic 2016



Source: Triennial Central Bank Survey of foreign exchange and OTC derivatives markets in 2016

Graph III.3.2.3. Foreign Exchange Derivatives by Currencies-2016- Non-Financial Institutions



Source: Triennial Central Bank Survey of foreign exchange and OTC derivatives markets in 2016

19 Performed by the Bank of international Settlements: Triennial Central Bank Survey of foreign exchange and OTC derivatives markets in 2016. https://www.bis.org/publ/rpfx16.htm

In relation to hedging strategies in the Czech Republic, in a survey conducted to 184 Czech exporting companies in the period 2005-2009, Čadek et al. (2011) found that one third of the sample did not hedge at all, not with financial hedging neither with operational hedging. In addition, the same study found that approximately 23% of exporters were fully hedged, 60% of exporters hedged partially if not fully. It was also worth mentioning that 5% of the exporters answered that their exports were dealt in Czech Korunas. Furthermore, it was found in the same study that the most popular hedging instruments were natural hedging and outright forward ones. Finally, the preferred forward exchange rates were one-to-three-year-long ones.

Regarding preferred maturity for forex derivatives, it is preferable to have longer terms for the world market, e.g., terms longer than a year represent 2.5% out of the entire turnover of forward transactions. In fact, the most demanded maturity period is over seven days up to one year (58.9%), followed by up to a seven-day maturity forward transaction (38.9%)[20]. Even though such figures include financial institutions which may use derivatives to trade and gain some profit, it may be noticeable that forward transactions over one year are hardly ever chosen. The proportions are quite balanced concerning maturity preferences in forward transactions for the Czech Republic. Maturity up to seven days or to seven days up to one year is around 40% out of the total turnover of forward transactions in both cases. However, preferences are lower for the maturity over one year (around 16%) as for 2016[21] .

Finally, according to the Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity (2016), derivatives and exchange operations in the Czech Republic are nowadays far more important than ten years ago. For instance, in terms of turnover, the total of FX contracts of domestic currency was 55.7 USD millions in 2016 and the ones directed at non-financial institutions summed up 6.4 Million[22]. This survey suggested that 80% of the contracts directed at non-financial institutions were against euros. In contrast, the total turnover of exchange operations and derivatives were in total 18.5USD millions in 2004. Other neighboring countries are utilizing more foreign

20 Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity (2016)

21 Idem

22 www.cnb.cz/en/public/media_service/press_releases_cnb/2018/filter.jsp

exchange instruments than in the past, Poland utilizes 129% more; Slovakia, 100%; and Germany, 97% more; the Czech Republic utilizes 200% more than in 2004[23]. In absolute numbers, the Czech Republic had a turnover of 4 USD millions whilst Poland USD millions, Slovakia, 1.5 USD millions, and Germany 107.9 Million[24]. These figures suggest that there is an upward trend towards the use of exchange operations; however, there is a major difference in the development of other developed countries.

3.3.Determinants to Hedge

Studies related to the use of derivatives may focus on determining the variables that explain what companies utilize derivatives as a hedging option. Findings conclude that the firm's size, leverage, liquidity, dividend yield, Board of Directors composition, relations with banks and foreign business activities are determining factors to utilize derivatives. Moreover, on the basis of studies related to this field, the firm's size, leverage, relations with banks and foreign business activities are repetitively significant variables. Nuka's study (2012) provides empirical evidence of firms providing specific factors that determine their decision to utilize derivatives. He utilizes a *Probit-and-Tobit* regression model in the research and the factors tested are the size of firms, market to book value, bank-firm relationships and the firm's involvement in foreign business activities. They are measured as total assets, the ratio of equity market value to equity book value, bank loans to total liabilities and foreign sales to total assets respectively. The study takes annual data from the 2005-2009 periods.

Probit-and-Tobit regression models are based on dummy dependent variables. In fact, Nuka discriminated between hedgers and non-hedgers as 1 to the use of derivatives and 0 to the use of no derivatives for the purpose of his research. In the study it was found that the bigger the company, the greater the relations with banks (measured as main-bank loans to total liabilities); and the more foreign-related activities, the higher the probability of utilizing derivatives. On the other hand, the lower the liquidity and the more open to foreign activities, the bigger the probability of utilizing derivatives. Furthermore, in order

23 2016- Triennial Survey- Web Site https://www.bis.org/publ/rpfx16.htm

242016- Triennial Survey. - https://www.bis.org/statistics/full_data_sets.htm

to assess such results, the author segregated into hedgers and non-hedgers as from the use of derivatives or not, or as from the total value of derivatives per company as well.

Similar results can be found in *Why Firms Hedge with Currency Derivatives, an Examination of Transaction and Translation Exposure,* (NICLAS, 2003). This study was based on a survey conducted to Swedish firms where 101 observations were obtained. Many variables were tested to reveal what factors determine the likelihood of hedging among firms. The variables tested were as follows:

- Leverage: represented as value of debt over equity
- Liquidity: current assets to current liabilities
- Dividend yield: dividend per share divided by stock price per share
- Size of firm: log of market value of total assets
- Market to book: market value of total assets divided by book value of total assets
- Institutional ownership: percentage of each sample firm's shares owned by institutions
- Managerial stock ownership: percentage of the firm's shares owned by the CFO
- Managerial option ownership: dummy set to one if managerial option-ownership program exists
- Foreign revenues: percentage of revenues denominated in foreign currency
- Foreign equity: equity percentage derived from foreign affiliates denominated in foreign currency

This study utilizes statistical tests, e.g., Median tests, to determine if there are statistical differences between the variables in two samples, hedgers and non-hedgers. The study not only provides median tests but also a Logit regression analysis[25]. The size of the firm, high human capital, institutional ownership and foreign revenues are variables suggested as to how to discriminate well between hedgers and non-hedgers on the basis of

[25] Logit regression analysis utilizes dummies as dependent variables: for transaction exposure, hedgers were defined as the ones that utilize currency derivatives and non-hedgers, otherwise, as for translation exposure, which is positive in the question "hedge of translation exposure".

transaction exposure. With regard to translation exposure, no significance was found in the variables tested.

Likewise, the study conducted by Klimczak (2008) reported a positive relation between hedging and exposure to exchange rates. In this study hedging was measured as a dummy variable that differentiates hedgers and non-hedgers based on the accounting (or not) of assessment, gain or loss of derivative. Furthermore, the use of derivatives as a risk management instrument in this study is related to economies of scale, which suggests that the commencement of them requires high costs at the beginning. The study therein focused on testing theories rather than individual hypotheses, that is to say, it tested theories regarding risk management such as the Financial Economic Approach, Agency Theory, New Institutional Economics and the Stakeholder's Theory.

Regarding the first theory, three hypotheses are tested, thus a negative relation between hedging and stock-price volatility, a negative relation between hedging as a particular risk and stock-price exposure to the risk factor and finally, firms begin hedging when market value increases. In order to prove the second theory, the author suggests a hypothesis about why hedging is most often utilized by firms with high debt/equity ratios. The New Institutions Theory tests hedging as positively related to individual block ownership. The last theory is tested on the basis of size importance when considering hedging, e.g., firms hedge more with high market to book value. To sum up, this study basically tested several variables such as size, leverage, ownership structure (governmental, foreign and individual) as well as exposure[26] and grouped them into risk management theories, as aforementioned. This study concludes that exposure to exchange rates and higher foreign-currency assets and liabilities favor the use of derivatives for hedging as a percentage of sales apart from the fact that hedging is more popular among larger firms.

On the other hand, Choi and Kim (2003) conducted a research which concluded that firms with higher growth opportunities and lower liquidity are more likely to hedge in order to reduce exchange-rate exposure; it was also proved that there is interaction between financial and operational hedging. This study assessed 413 American companies over a sixty-month period. It was mainly aimed at finding the determinants of exposure to

[26] It was measured as variations in exchange rates affecting return rates with linear regression method.

exchange rate (measured as β, the coefficient resulted from the equation R=a + βE where R is the stock return and E the exchange rate). Therein the author utilizes lagged values for the exchange rate USD/YUAN. The determinants considered for the research were international operations -measured as ratio of exports to sales- and risk management -measured as research and development expenses to total sales and size, e.g., growth opportunities[27]. The study concludes that the higher the exports, the higher the growth opportunities and the lower liquidity, the more incentives to hedge.

It is also worth mentioning that Rogers & Graham (2002) conducted an empirical research whereby they showed that most of all the disposable foreign-currency derivatives in the American market utilized the manufacturing sector; however, only half of this sector would choose to utilize them. In addition, literature also states that the more revenue is correlated to exchange-rate variations, the most likely firms will hedge and encourage more incentives for them to purchase or sell currency as well as enabling future contracts subject to positive or negative correlation (Pong Wong, 2015).

3.4.Importance of hedging

The purpose of hedging is not to improve the outcome of the company but to maintain cash flows stable and therefore predictable. It also reduces the need and expertise to forecast exchange rates, diminishes the volatility of profit, increases competitively as the company can focus on market strategies even when exchange rate risk are not in favor. To this, Gordon Bodnar (1998), found that for half of American companies the main reason for using derivatives is to minimize the variability of cash flow and in Germany for example the main priority if to minimize the variability of accounting earnings.

Companies may diverge in opinion towards hedging, those in favor of total hedging may state that if an institution is not hedge then a position is taken towards risk and, therefore they are expose to speculation. Some other companies, in favor of selective hedging, may declare that hedging is justified only under adverse moments.

[27] Measured as growth of assets

The approaches to fight risk are different regarding the type of attitude companies have towards risk: risk neutral, adverse of seeking. A risk neutral company will tolerate small exposure and would expect that negative and positive results offsets each other in long term. In this sense, management of exchange rate risk implies that a company is not risk neutral. A risk adverse company would not tolerate loses in the short term and will be serious about them. Risk seeking companies will exploit opportunities to take advantage of exchange rate movements and would hedge under adverse conditions.

On the other hand, theory suggests that the decision of hedging will depend if gain or loses are significant. If they are not significant then a risk neutral approach is enough to fight the risk. If significant, the next step would be to figure it out if the future exchange rate are more likely to be favorable or adverse. If the forecast is favorable for the firm it is advisable to accept currency exposure. If not, adverse scenario is expected and it is advisable to measure or control risk (Coyle, Introduction to Currency Risk, 2000).

In order words, if the exposure is small, risk neutral attitude is expected to be taken (meaning that no hedging action is needed). However, should the exposure be large, risk seeking approach is likely attitude to be taken for favorable exchange rate forecast and risk averse most probable if otherwise. Under risk adverse scenario a hedging action can be either partial or total. Finally, if the exchange rate is expected to be unchanged, risk neutral attitude may be taken (Coyle, Heding currency exposure, 2000).

As mentioned, hedging decreases the volatility of cash flow; however, hedging management is costly, it consumes resources such as money, time and labor. Therefore, those managers skeptical of hedging strategies may state that the increase of value gained by the decrease of volatility is net by the outflow pay for the hedging strategy. Consequently, as shareholders are more likely risk seekers, would like to have an open position if the exchange rate is favorable. In the contrary, managers are risk adverse and would prefer not to lo leave an open position. One of the reasons why financial managers are risk adverse is that they want to keep their job and reputation protected. Thus, mostly likely they would prefer to hedge (more than what stakeholders), (Damodaran, 2010)

Nonetheless, hedging is important. First of all because hedging reduces the probability of liquidity problems as the firm can have a predicted cash flow. Liquidity is crucial in a firm, without cash flow companies would struggle to operate.

Furthermore, markets are not always predictable, they usually operate in disequilibrium as for unexpected external shocks. In addition, management always has more in depth information about the company and its level of exposure than the shareholders. This information asymmetry makes shareholders to take better managerial decisions. Finally, in order to access to cheaper debt it is important to be less risky into the investor's eyes therefore a stable cash flow is important to make ratios look better and stable.

3.5. Effectiveness of hedging

As aforementioned, literature suggests that hedging strategies are a combination of financial and operational ones; derivatives and debts are counted among those financial. Furthermore, as mentioned in the former chapter, firms that utilize derivatives will most likely hedge with operative techniques. According to JP Morgan's latest creation, HEAT, the effectiveness to mitigate risks with derivatives is achieved when variations in the fair value of the derivative match completely or largely with variations in value of the underlying hedged item, e.g., cash flow, income, revenue, debt, so that the latter one is less volatile. In addition, in order to assess the calculation of effectiveness tasks, it must be identified a number of factors such as performance metrics, e.g., fair value or cash flow; the type of risk, e.g., exchange-rate or interest-rate risks; the amount of the underlying items being hedged, e.g., how much of the item is going to be hedged, (JP Morgan, 2003).

In theory, the firm's amount of production (or exports, imports, etc.) is not set by uncertainty as to exchange-rate risks (interest rate or commodity prices) or as to expectations if firms may access to futures markets. This, according to the separation theorem. According to the full-hedging theorem, firms may eliminate totally exchange-rate risks if currencies for futures markets are available (Oxfor University Press, 2015). Nowadays further theory suggests that when hedging decisions are made before the production, they prove to have effective strategic effects. Such results can be revised in the

theoretical study of Broll et al. (2008), as the authors show a comparison of one national exporting firm with futures available for being hedged to a foreign firm, in which case the exporting firm may access to futures at cero cost to eliminate exchange-rate uncertainties. Other studies state that the theorem also holds true for exporters who do not only purchase forward exchange rates but also options. Options would give firms some flexibility in the hedging decision and thus firms would be induced to produce more with a strong currency-option presence (WONG, 2003).

With regard to empirical researches, the measurement of effectiveness may be made by distinguishing two groups, hedgers and non-hedgers. The way how risks do affect financial results is separately tested for both groups. If cash flows (or other financial results, e.g., sales, net income, etc.) are less explained by variations in the risk fundamentals, it may then be inferred that the use of hedging instruments is effective. For instance, effectiveness was assessed as the reduction in exposure between hedgers and non-hedgers in a study conducted by Štulec (2016) in order to answer whether whatever derivative is effective to protect sales from whatever risk or not. Therein less sensitivity of sales on whatever risk was expected to be lower in firms that utilize derivatives and higher in those which do not. Similar studies -interested in the measurement of derivative effectiveness as well- may prefer to utilize a two-step regression model. Thus the first step is aimed at measuring exposure for each observation in a sample, the second step would therefore explain exposure as a function of a dummy variable concerning being a hedger or not. The result is expected to be that hedging dummy variables explicate less exposure than non-hedging dummy variables. Such methodology may be revised in Gomes et al. (2011), in which exposure is measured as the price fluctuation in the stock share due to variations in exchange rates, interest rates and commodity prices.

IV. Empirical Framework

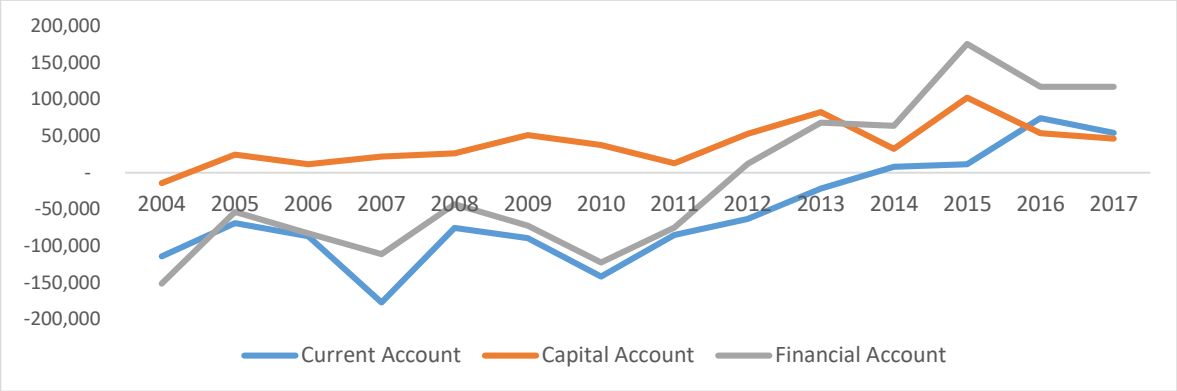
1. Dynamism on Balance of Payments

As mentioned in the theoretical framework the balance of payments create pressures on the exchange rate, this is to say, inflows create appreciation forces and outflows vice versa, for this reason its dynamism is the great importance to explain the exchange rate trend.

On the other hand, exchange rates are quite important for trade issues, e.g., for exporting is quite favorable to have a devaluated currency, as exporters may sell their products to the world at more competitive prices. In addition, it has always been speculated that exchange rate fluctuations may negatively influence trade, as company profits can be affected by exchange-rate movements. Nonetheless, trade grew rapidly across the world after the end of the Breton Woods, and the Czech Republic was no exception. In the last ten years, for instance, the net exports have grown 16% annually. Additionally, as shown in Graph IV.1.1. the net exports of goods and services have been positive in the last 15 years, previously net exports were recorded on negative balance, Graph IV.1.2.

The net Current Account has been negative since 2005 to 2013. The negative sign is explained by the Primary Income Account and Secondary Income Account. The current account turned positive in 2014 and up until 2017 remained so. The growth in this account is steady and important, since 2014 to 2017 it grew on average per annum 18,985 million Czech Crowns (whereas from 2005 to 2013 it grew per year and on average, 10,292 million CZK). This increment is explained mainly by a rapid growth in the net exports of goods and services. From 2014 to 2017 the Good and Services Account Balance grew on average 31,403 million CZK per year (and previously, 2004-2013, 24,830 CZK per year). More noticeably, just the net balance of goods grew annually on average 18,494 million CZK in the period 2014-2017 (although 29% less than the compering period, the growth was steady over the whole period). On the other hand, services net balance, changed from annual average growth of -1,261 million CZK per year from 2004 to 2013 to 12,909 million CZK per year in the period 2014-2017, see Chart IV.1.1. Same trend can be visualized when analyzing same results in euros, Graph IV.1.2.

Graph IV.1.1 Balance of Payments' Accounts. Millions CZK



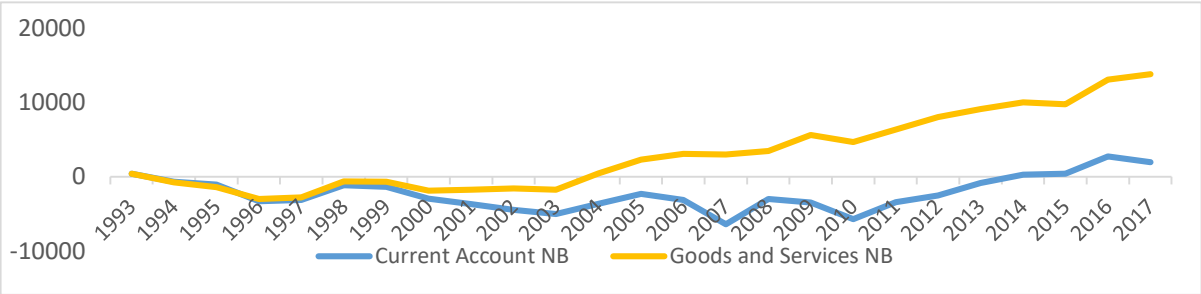
Source: ODIEE, CNB Balance of Payments Breakdown

Chart IV.1.1 Current Account and Good and Services Account- Increment - per year in Million CZK

Balance	2012	2013	2014	2015	2016	2017	Growth 17/14	Growth 13/05	Avg. Growth
C.Account	21,488	41,529	29,667	3,400	62,936	-20,062	18,985	10,292	12,967
Goods	48,320	43,175	52,978	-31,919	57,658	-4,741	18,494	26,091	23,753
Services	-3,655	-7,267	-14,709	22,387	29,571	14,385	12,909	-1,261	3,099
G. and S.	44,665	35,908	38,269	-9,532	87,229	9,644	31,403	24,830	26,852

Source: ODIEE, CNB Balance of Payments Breakdown

Graph IV.1.2. –Current Account and Gods and Services Balance- Millions EUR



Source: ARAD Data Series System -CNB

Exporter's dynamism in the Czech Republic seems to be affected negatively by other factors than exchange rate fluctuations. For example, in the study made by Šimáková (2014) for the period of 1997-2012 was not found any evidence of clear relations between the exchange rates and bilateral trade flows, therefore the international trade development

in the Czech Republic seemed to be influence mainly by other factors than a weakened crown. Nonetheless, a negative relation is noticeable when Goods and services Accounts versus the real exchange rate base on labor costs are plotted, as is shown later in the Graph IV.3.5.

Under fixed exchange regimes, it is expected the central bank to intervene when pressures to the exchange rate arises. This is to say, the central bank may sell the domestic currency if the pressures on the exchange rate are upwards and, if downward pressures, the central bank must sell foreign reserves (if the reserves are depleted, then the central bank has no option but to devalue the national currency).

During the period in which the CNB intervened largely (2015-2017), the CNB's foreign reserves have grown steadily upon alignment with the BOP behavior. In fact, the reserves grew on average 391,095.2 million CZK annually in this period. Previously, the reserves grew on average 6,634 million CZK per year in 2004-2014. Such growth is a result of CNB´s multiple interventions in order to prevent the exchange rate from appreciating.

Chart IV.1.3. Reserves- Increment per year in Million CZK

Balance Million CZK	2010	2011	2012	2013	2014	2015	2016	2017	Avrg. Growth 17/15	Avrg. Growth 14/05	Avrg. Growth 17/05
Reserve assets	41,425	-17,230	80,474	188,191	73,123	351,306	563,521	1,246,408			
Increment (t1-t0)	-19,222	-58,655	97,703	107,718	-115,069	278,183	212,216	682,887	391,095	6,634	95,356
Growth				133.9%	-61.1%	380.4%	60.4%	121.2%			

Source: ODIEE, CNB Balance of Payments Breakdown

In accordance to this, the financial account grew rapidly since 2012, this is mainly explained by the growth of the reserve assets. In 2011, net reserves where negative and equal to -17,229.7 million of Czech Crowns. In 2012 they turned to 80,473.5 million CZK and grew rapidly at an annual average rate of 127%[28] to 2017.

Regarding the foreign direct investment inflows, they represent 30% more than in 2004, and 46% more than 2008 (revealing great recovery after the financial crisis). However, 2015 presented a significant decline in FDIs inflows, mainly explained by the

28 Idem

disinvestment in debt instruments. Moreover, compared to 2013, in 2014 the FDI inflows declined greatly in Equity and Investment Funds Account (-41%). Nonetheless, this account grew 30% on average annually since 2004, this, mainly explained by the growth of Equity and Investment Funds (49% annual growth).

According to the Government Agency for Foreign Direct investment[29], the Czech Republic ranks as one of the first destinations for FDIs mainly because of investment incentives, the existence of skilled and unexperienced labor, and its location in Central Europe. Although, there is a shift from manufacturing services to strategic service centers.

Chart II.3 FDI Inflows - Million CZK

Millions CZK	2010	2011	2012	2013	2014	2015	2016	2017	Growth 17/04
DI Inflows	194,680	76,355	184,720	143,983	168,088	41,556	265,176	216,672	0.314
Equity and Invs. Funds	121,066	18,827	142,523	120,665	70,199	89,131	172,415	181,17	0.491
Debt Instruments	73,614	57,528	42,196	23,318	97,888	-47,574	92,760	35,500	-0.181

Source: ODIEE, CNB Balance of Payments Breakdown

Finally, interest rates and economic stability inflation may be good predicting factors in foreign exchange rates. As a general rule low inflation is related to high value of local currencies, as the purchasing power of local currencies increases in relation to other currencies. Interest rates and exchange rates are highly correlated because international investors seek countries where to invest their money by considering high interest rates. Likewise, investors may seek stable countries where to place their funds since a country with better conditions will attract higher number of investors; however this scenarios is less likely to have affected the exchange rate in the Republic as the tendency was downwards and interest rate close to zero. In fact, as shown in Chart II.3 investment in debt instruments declined greatly.

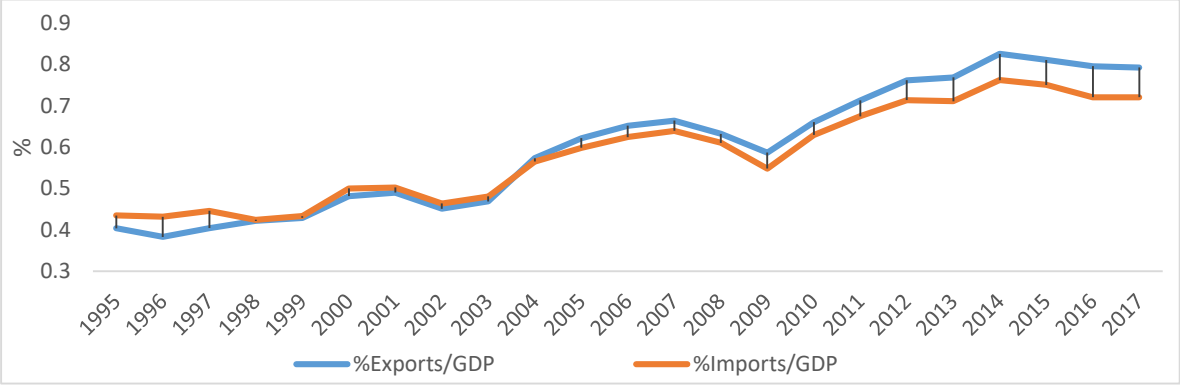
[29] https://www.czechinvest.org/en/Our-services/Sourcing

2. *Exports in the Czech Republic*

2.1. Concentration of Activities and Destinations

This country, as a small and open economy, is strongly influenced by international trade, the export sector is a driving force to the productivity and competiveness of the country. The republic is the 33rd largest exporter in the world as well as the 31st importer[30]. In fact, exports have represented in the last 10 years more than 78% of the GDP whilst imports have denoted higher than 68% for the same period. Two factors contributed on the success on exports in the Czech Republic: the great utilization of its location (in the middle of Europe) and the relative cheap but qualified labor force[31].

Graph IV.2.1.1 Exports and Imports of Goods and Services as %GDP



Source: ARAD Data Series System -CNB

The Czech Republic encounters an important concentration of exports to industries associated to car making industry and electronics (See Graph IV.2.1.2.). In effect, exports rely heavily on machinery and transport equipment, e.g., 55% on 2017 and 54% on 2016 out of total exports. Exports also depend importantly on: manufactured goods, about 20% of total exports is explained by this category (17.6% in 2017 and 18% in 2016); manufactured articles (about 12% in 2016 and 2017) and Chemical products (about 7% in 2016 and 2017). The proportions are consistent also in previous years, in the graph bellow it can be appreciated figures for the period 2005-2017. Within the manufactures, the top manufacturing industries are related to motor vehicles, computer, electronics and optical

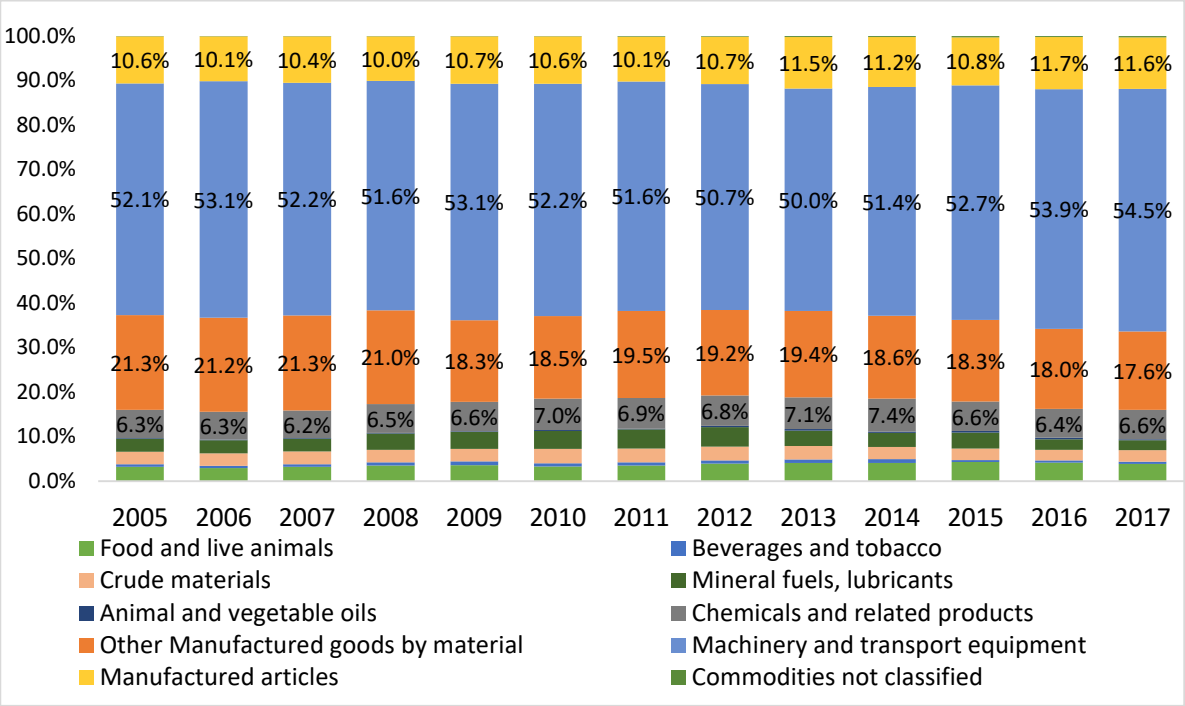
30 World fact book.

31 According to, Exports Strategy 2012-2020 of the Czech Republic- Ministry of Trade

products[32]. Services represent 16% of total Good and Services exports, the main services exporters are on transport (24% in 2017) and travel services (26% in 2017)[33].

Exports of Goods, grew rapidly and steady over the years, however, the speed of growth is changing the recent years. For instance, before the financial crises (2004-2008) the rate of annual grow was 15%, during the years of recovery 2010-2011, 13% on average per year and after 5.7%. Regarding exports of services, the figures are similar: annual growth on average of 13% before the crisis, 12% during the recovery period and 6% after that (See Chart IV.2.1.1).

Graph IV.2.1.2. - Exports of Goods by Category

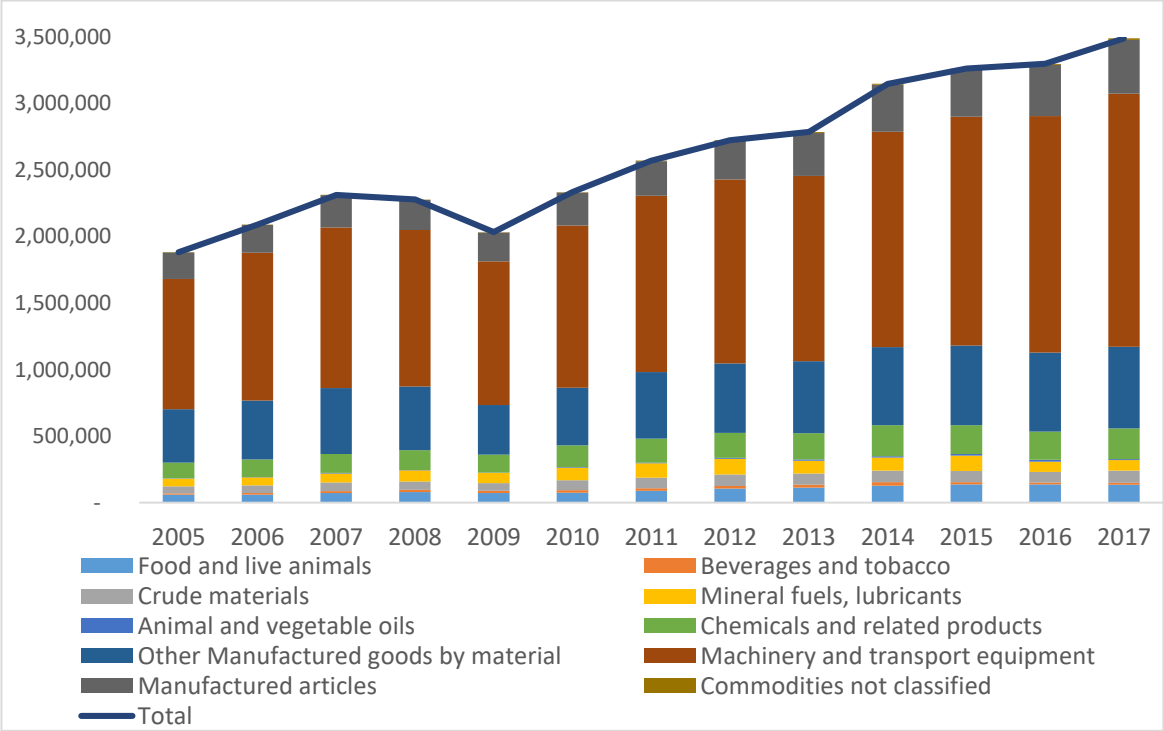


Source: Czech Statistical Office.

32 Czech Republic trade investment statistical country note, OECD 2017. http://www.oecd.org/investment/Czech-Republic-trade-investment-statistical-country-note.pdf

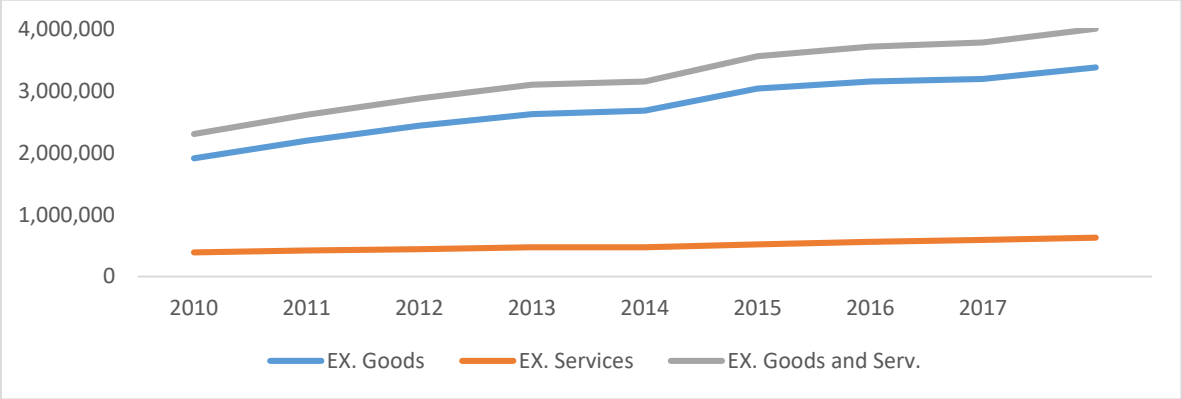
33 CNB statistics, Balance of payments, Credit/Asset.

Graph IV.2.1.3. - Exports of Goods by Category Millions CZK



Source: Czech Statistical Office.

Graph IV.2.1.4. - Export Evolution -Millions CZK



Source: Czech Statistical Office.

Chart IV.2.1.1- Growth Rates Exports Millions CZK

	2010	2011	2012	2013	2014	2015	2016	2017	Aver. Growth 07/04	Aver. Growth 10/11	Aver. Growth 17/11
EX. Goods	14.8%	11.1%	7.7%	2.2%	13.4%	3.7%	1.2%	5.9%	15%	13%	5.7%
EX. Services	7.4%	5.3%	7.6%	-1.0%	11.0%	7.9%	5.5%	6.1%	6%	6%	6.2%
EX. Goods Serv.	13.5%	10.2%	7.6%	1.7%	13.0%	4.3%	1.8%	5.9%	13%	12%	5.7%

Source: ODIEE, CNB Balance of Payments Breakdown

Regarding de exports destination, the exports to the European Union (EU) have represented 83% out of its total in the last year[34]. 33% out of the total exports was directed to Germany and 7% to Slovakia in 2017. These figures were a constant in the previous years as well[35]. Germany is considered the Czech Republic's main trade partner and the nation's development is quite important for the evolution of exports and thorough performance of that economy (Taušer, Markéta, & Pavel, 2015). The dependence on other countries is low, especially those out of the European Union, e.g., to The United States of America, exports represent 2.1%; to Canada, 0.2%; to Russia, 2%; and to Brazil, 0.2% - Chart IV.2.1.2.-.

Chart IV.2.1.2. - Exports by Country

Country	Exports 2017 %	Country	Exports 2017 %
Germany	32.8	Belgium	2.3
Poland	6.0	Romania	1.4
Slovakia	7.7	South Korea	0.3
China	1.3	Romania	1.4
Italy	4.1	Switzerland	1.3
France	5.1	Turkey	1.6
UK	5.0	Japan	0.4
Austria	4.4	Denmark	1.0
Netherlands	2.9	Ireland	0.4
Hungary	2.9	Ukraine	0.7
Spain	2.9	Thailand	0.1
USA	2.1	India	0.4
Russia	2.0	Brazil	0.2
Canada	0.2	Others	9.3

Source: Ministry of Industry and Trade CZ

[34] Ministry of Industry and Trade, Foreign Trade Statistics, https://www.mpo.cz/en/foreign-trade/foreign-trade-statistics/
[35] Idem

2.2. Czech companies in relation to exports: Characteristics

As mentioned in the theoretical framework, companies that hedge in comparison that the ones that do not, may have differences between each other, in the following lines some of the characteristics available in public data are exposed for Czech companies in relation to foreign currency transactions and exports.

The most notorious fact exposed to exchange rate risk is that either imports or exports are priced in foreign currencies. The exposure to foreign rates may, nevertheless, also arise from foreign-currency loans or deposits, given by subsidiaries or assets located abroad. In point of fact -according to a CNB's survey to non-financial companies- nearly both 17% of receipts and disbursements to suppliers are expressed in euros (Chart IV.2.2.1.). Likewise, loans granted to Czech non-financial companies are mainly given in Czech Korunas, e.g., nearly 70% of loans are enabled in the local currency; 28%, in euros; and 2%, in other currencies (Chart II.6).

Chart IV.2.2.1. - Proportion of payments in EUR in %

Date	Payments to suppliers	Receipts from purchasers
31.12.2017	17.1	16.8
31.12.2016	16.6	16.2
31.12.2015	18.7	18.8
31.12.2014	18.1	15.5
31.12.2013	13.8	13
31.12.2012	12.8	11.7
31.12.2011	14	7.1

ARAD Data Series System –CNB

Chart IV.2.2.2. - Loans Granted by Currency- Millions CZK

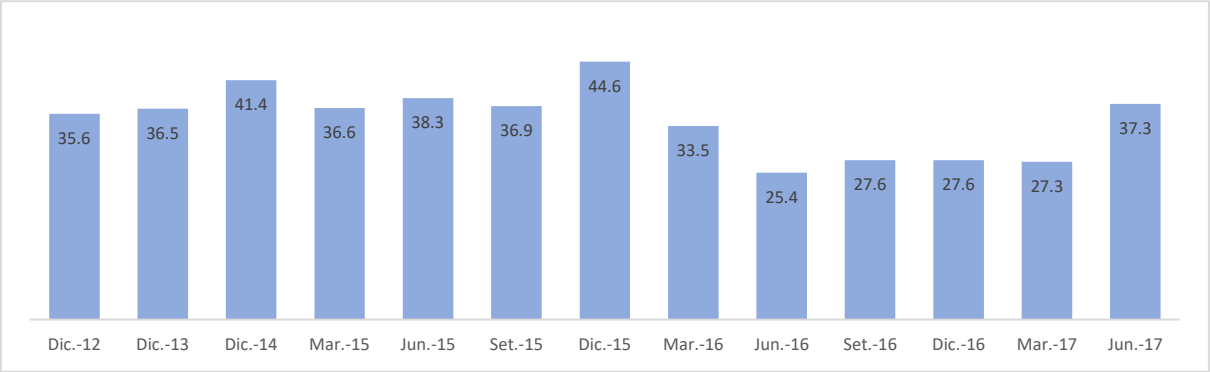
Millions CZK	Loans granted in FC- not EUR included	Loans granted in CZK	Loans granted in EUROS	Loans granted in FC- not EUR included	Loans granted in CZK	Loans granted in EUROS
31.12.2017	11,978	719,824	290,160	1.2%	70.4%	28.4%
31.12.2016	13,112	704,117	258,384	1.3%	72.2%	26.5%
31.12.2015	9,691	710,619	200,589	1.1%	77.2%	21.8%
31.12.2014	11,674	675,328	187,658	1.3%	77.2%	21.5%
31.12.2013	12,611	674,412	180,118	1.5%	77.8%	20.8%
31.12.2012	10,842	684,836	139,695	1.3%	82.0%	16.7%
31.12.2011	11,719	669,381	146,954	1.4%	80.8%	17.7%

ARAD Data Series System -CNB

Czech export firms often hedge against exchange rate risks; the tools often utilized for mitigating risks are natural hedging –managing the inflows and outflows with different currencies- and the use of forwards and zero-cost option structures (Čadek, Rottová, & Saxa, 2011). However, the majority of companies in the Czech Republic stopped hedging in 2016 due to the no fluctuation of the CZK/EUR exchange rate when the Czech Koruna firmed up 27 against the euro. A CNB's survey among non-financial corporations showed that exports hedged for a year decreased to 25% in the second and third quarters in 2016, from having been close to 40 percent in previous July –See Chart IV.2.2.1.-. By 2017, the trend turned the opposite way, the Czech Koruna is returning to its pre-intervention (the central bank's decision as a temporary respond to the inflow of international capitals) levels of 25.50-25.80 per euro. Such exchange change in rate volatility –after the end of CNB's commitments- represented a big business threats. According to the PwC survey over one hundred Czech CEOs, only one third believes they may mitigate the issue without hedging activities whilst one fifth has already started to hedge by the beginning of 2017[36]. Furthermore, the use of financial hedging against exchange rate risks is more popular among bigger-sized companies rather than among small or medium ones, as mentioned in the work of *Hedging Behaviour of Czech Exporting Firms* by Čadek, Rottová, & Saxa (2011). Finally, Company size increases the probability of hedging on financial markets, apart from the fact that hedging is not popular among SME (Hrubošová, Kameníková, Strouhal, Bonaci, & Filip, 2013).

36 PwS survey. Web Site https://www.britishchamber.cz/pwc-one-fifth-of-companies-started-hedging-due-to-the-end-of-interventions/ ,

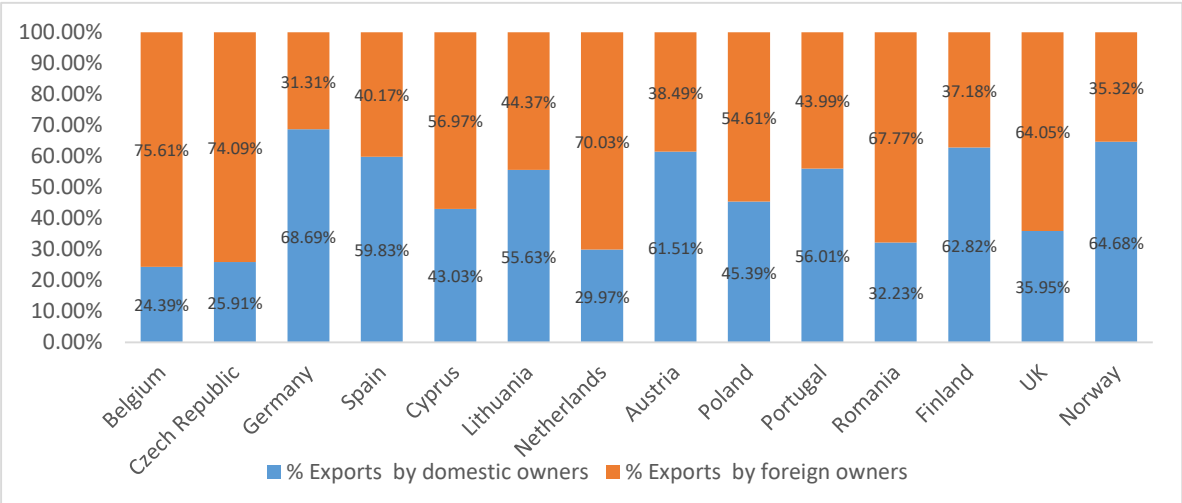
Graph IV.2.2.1. - Export Hedging against Exchange Rate Risks -over the next 12 months (Mean weighted in %) 2012-2017



ARAD Data Series System -CNB

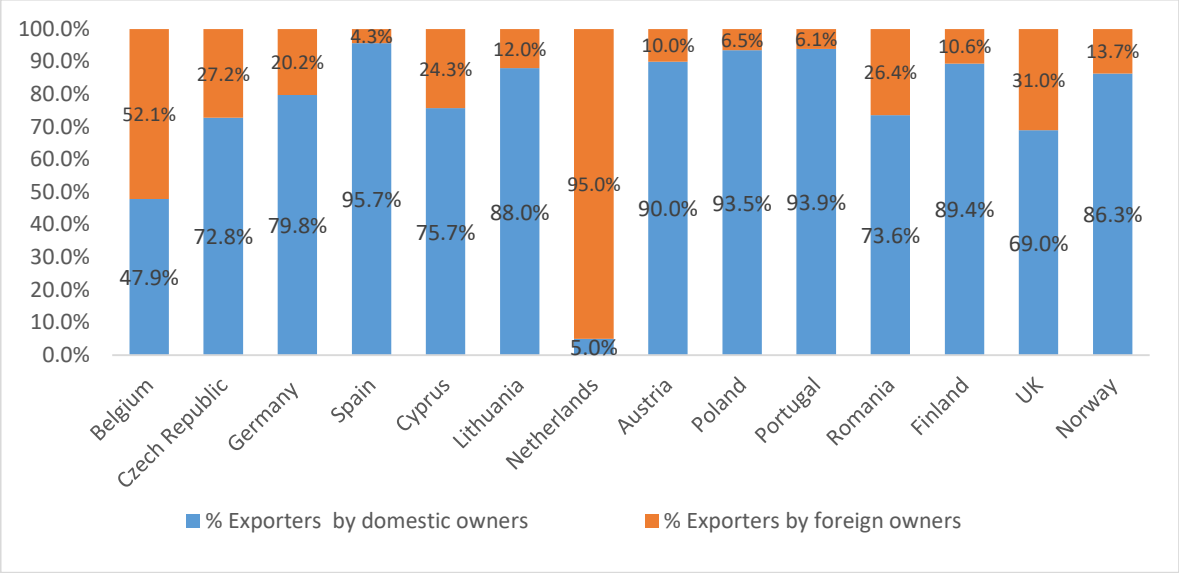
Trade made by international firms based in The Czech Republic is higher than that of national ones. In fact, 25% out of the exports registered in the year 2015 was made by national firms whilst 75% of exports were made by international firms (Graph IV.2.2.2.). These percentages include exports; however, figures change when taking into account number of companies. In 2015, 28% out of the number of firms involved in exports was international and the remaining 72% was national-Graph IV.2.2.3.

Graph IV2.2.2. Total Exports Divided By Companies' Ownership Type 2015



Source: Eurostat

Graph IV.2.2.3- %Enterprises divided by type of ownership



Source: Eurostat

About export intensity (share of exports on turnover), in 2015, 18% of the companies in the Czech Republic export insensitivity is 50% or more; this indicator has increased in the recent years, in 2012, 12% of companies, recorded 50% or more of export intensity.–Chart IV.2.2.3-.

Additionally, the exports are mostly performed by companies of big size. According to the statistics collected by the OECD for enterprises, 65% of the total exports are performed by companies with more than 250 employees, 20% by companies composed between 50 and 249 employees; 5% of the exports are traded by companies up to 9 employees, and 9% of exports is sold by those between 10 to 49 employees –Chart IV.2.2.4.-. The proportions had not change in the last 10 years and indicate that the total exports are concentrated in bigger companies.

Chart IV.2.2.3. - Export Intensity (Share of exports on Turnover)

2015			
Exporting up to 24% of the turnover	Exporting from 25 to less than 50% of the turnover	Exporting from 50 to less than 75% of the turnover	Exporting 75% or more of the turnover
67%	23%	10%	8%
2012			
Exporting up to 24% of the turnover	Exporting from 25 to less than 50% of the turnover	Exporting from 50 to less than 75% of the turnover	Exporting 75% or more of the turnover
75%	13%	7%	5%

Source: OECD statistics

Chart IV.2.2.4. - Exports by Company Size

Employees	2008	2009	2010	2011	2012	2013	2014	2015
0-9	5%	5%	4%	4%	5%	5%	5%	5%
10-49	8%	9%	8%	8%	10%	9%	9%	9%
50-249	21%	21%	21%	21%	21%	22%	21%	20%
250+	66%	65%	67%	67%	64%	64%	65%	65%

Source: OECD statistics

3. Competitiveness and Real Exchange Rates

The economy in the Czech Republic is still competitive for the global market, exports are strong and exporters continue to increase in world trade, especially exports on goods; in fact, the goods and services export market share in the world grew from 0.5% in 2004 to 0.76% in 2017, with a steady upward tendency, see Graph IV.3.1. Furthermore, the republic can be considered as cost-competitive manufacturing country, as qualified labor is cheap in comparison to other EU countries. For instance, technicians and professionals are paid less in Czech Republic, than in other developed countries –in the Czech Republic technicians and related professionals are paid 14, 059 euros on average per year whereas in Germany, 45,286 euros per year[37]. The scenario repeats for other countries, for instance, in Austria, technicians and professionals were paid 49,356 euros in 2014 per year on average. Productivity gap exist among countries, however, salaries in the Czech Republic are generally lower when compared to these two neighboring countries.

Compared to Slovakia and Poland, the Czech Republic is less competitive in terms of labor costs, in Slovakia professionals are paid 13,491 euros and in Poland 11,886 euros, on average, in 2014, though, Czech Republic shows higher productivity than Poland, Hungary and very similar to Slovak productivity[38].

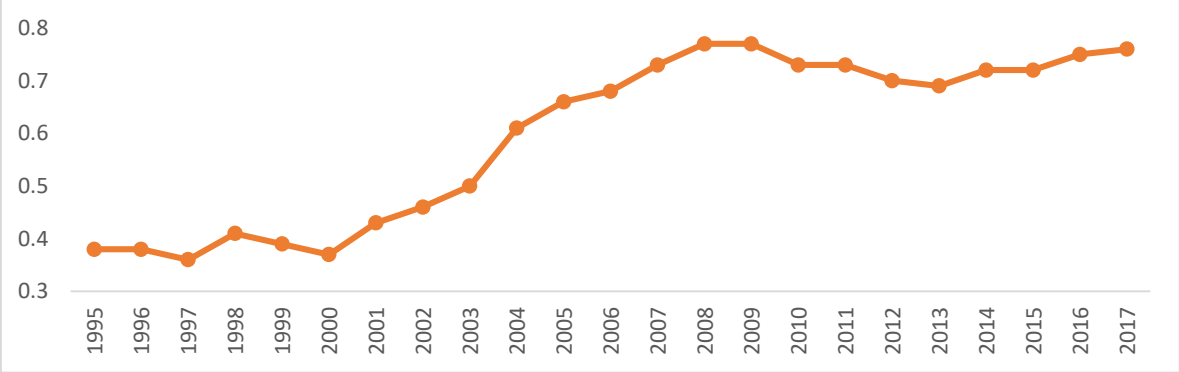
Although, productivity gap between countries exist which influences the differences in salaries, it is noticeable that productivity in the Czech Republic is growing as well as the salaries, see Graph IV.3.2. and Graph IV.3.3. In the long run, this impact the relative prices of local salaries compared to the rest of the world. This fact affects competitiveness,

37 EuroStat, Wages by Occupation

38 Idem

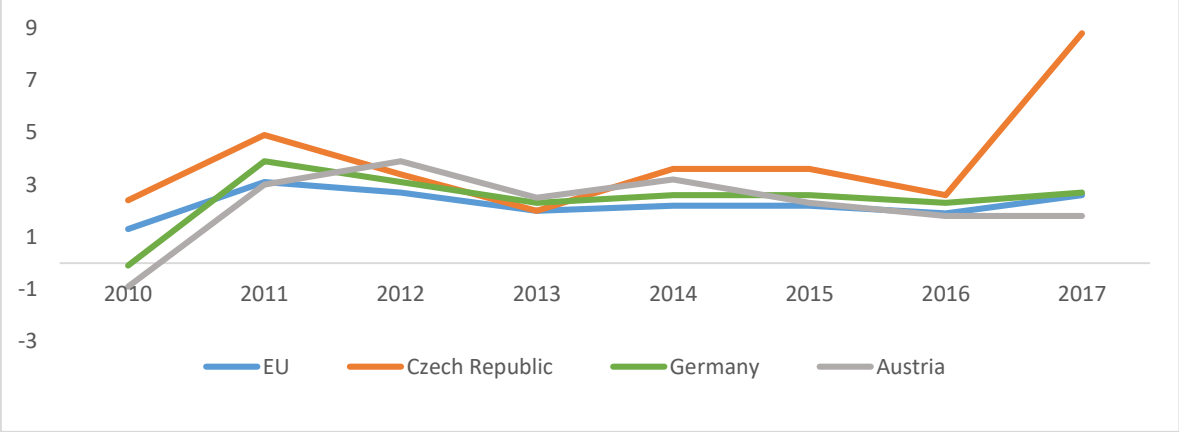
indeed, as it is appreciated in the next pages, the real exchange rate base on labor cost has appreciating tendency.

Graph IV.3.1. -Export market shares - % of world total Czech Republic



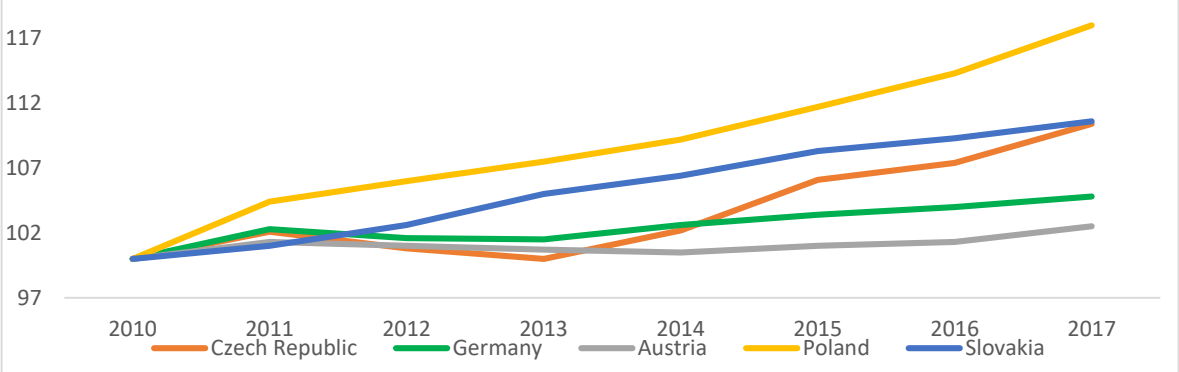
Source: Eurostat-International Trade Statistics

Graph IV.3.2. -Wages and Salaries % Change on previous period – Total Industry



Source: Eurostat-Database-Labor Cost Index

Graph IV.3.3. - Real Labor Productivity - Index 2010=100



Source: Eurostat-Database-Unit Labor Cost

One measurement to international competitiveness is by the capture of Real Effective Exchange Rates (REER) which aims to measure competitiveness relative to its competitors in the international market. When this index increases (decreases) means that the country loses (gains) competitiveness in relation to its competitors.

The REER is based on official statistics: exchange rates, trade data, and deflator. In order to calculate it, some specifications have to be made; such as the choice of deflator and selection of the basket of countries in the calculation. The general calculation is as follows:

Formula IV.3.1- Real Effective Exchange Rate

REER[39]: $$100 \prod_{i=1}^{n} \left(\frac{P}{S_i P_i} \right)^{W_i}$$

Where *P*: the consumer price index in the home country, *Pi* is the price in foreign country *i* (price, depending on the deflator), *Si* =the home currency price of currency *i* (or nominal exchange rate); and *wi** is the weights of different countries.

Chart IV.3.1. - Weights of Monetary Areas

Monetary Area	%
Euro Area	64.1
China	8.7
Poland	6.9
UK	4.6
Hungary	3
Russia	1.7
USA	2.9
Switzerland	1.5
Korea	1.6
Romania	1.4
Sweden	1.5
Japan	1.2
Denmark	0.9
Total	100

Calculated by share of total trade turnover of the Czech Republic total trade turnover of the Czech Republic
Source: CNB, ARAD Data Base, Methodology REER

39 The ARAD time series database, CNB, REER Methodology

In order to measure competitiveness, in the Czech National Bank statistics it can be found different types of Real Effective exchange rate according the different deflator used[40]:

- Labor cost index- for the whole economy (ULC)

The REER base on Unit Labor Cost weights the relative prices of labor (of the whole industry) in the home country in relation to is trading competitors. The result is one relative price. The formula applicable, for the Czech Republic is as follows:

Formula IV.3.2. - Real Effective Exchange Rate-ULC

$$REER_{CPI} = 100\prod_{i=1}^{n}\left(\frac{P}{S_i P_i}\right) = 100\left[\left(\frac{ULC_{cz}}{\frac{CZK}{EUR} * ULC_{Euroarea}}\right)^{64.1\%} \dots \left(\frac{ULC_{cz}}{\frac{CZK}{DKK} * ULC_{Denmakr}}\right)^{0.9\%}\right]$$

- Labor cost index for - manufacturing sector (ULCM)

Similarly, the REER base on Unit Labor Cost on manufacturing sector, calculates one price that represents how much the labor in the home country in the manufacturer sector cost when comparing it to the rest of the other trading competitors. For the Czech Republic the formula is as follows:

Formula IV.3.3. - Real Effective Exchange Rate-ULCM

$$REER_{CPI} = 100\prod_{i=1}^{n}\left(\frac{P}{S_i P_i}\right) = 100\left[\left(\frac{ULCM_{cz}}{\frac{CZK}{EUR} * ULCM_{Euroarea}}\right)^{64.1\%} \dots \left(\frac{ULCM_{cz}}{\frac{CZK}{DKK} * ULCM_{Denmakr}}\right)^{0.9\%}\right]$$

- Consumer Price Index (CPI)

The REER base on Consumer Index Price, calculates one price that represents how much the consumer prices in the home country cost in comparison to the consumer prices in the other foreign economies. For the Czech Republic the formula is as follows:

40 CNB ARAD data base, real effective Exchange rate, Methodology.

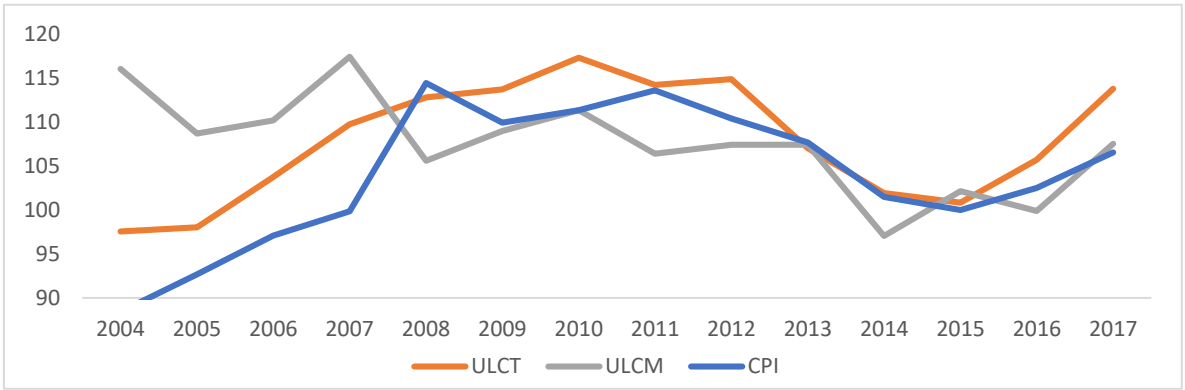
Formula IV.3.3. - Real Effective Exchange Rate-CPI

$$REER_{CPI} = 100\prod_{i=1}^{n}\left(\frac{P}{S_i P_i}\right) = 100\left[\left(\frac{CPI_{cz}}{\frac{CZK}{EUR} * CPI_{Euroarea}}\right)^{64.1\%} \ldots \left(\frac{CPI_{cz}}{\frac{CZK}{DKK} * CPI_{Denmakr}}\right)^{0.9\%}\right]$$

Intuitively, this exchange rates reflect how costly is the deflator when compared to other countries, for example, if the REER base on Consumer Price Index rises, means that in comparison to countries considered in the basket of competitors the Consumer Prices are more expensive in this country. Similarly, if the REER based on labor cost index in the manufacturing sector rises, means that the cost of labor for the manufacturing sector in the home country are more expensive in relation to other countries considered in the index.

In recent years the exchange rate is appreciating, productivity growth declining and labor cost increasing. Therefore, a real appreciation in terms of production costs and consumer price level is being experienced in recent years. For instance, from 2004-2017 the Real Effective Exchange Rate increment on average per year 1.25, 0.66, and 1.39 for ULCT, ULCM, and CPI- real effective exchange rate, respectively. For the years in which the one-side floor for the exchange rate was impose 2013-2017, all the exchange rates declined: for instance, the real exchange rates based on ULCT, ULCM, PPI and CPI declined in 1.29, 7.54 and 5.17, respectively[41]. During the period of CNB's high interventions, it is also reveal some important variations, see Graph IV.3.4

Graph IV.3.4. - Real Effective Exchange Rates



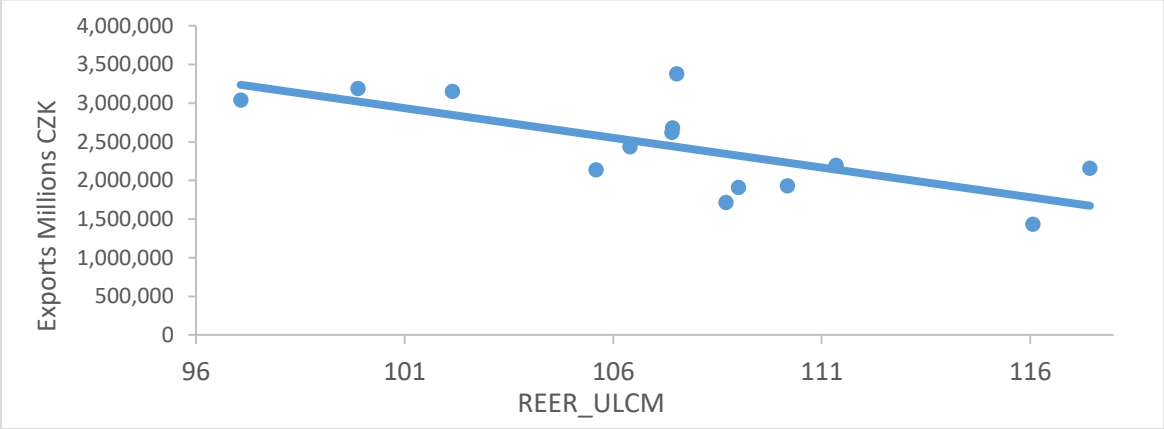
Source: ARAD Data Series System -CNB

[41] Czech National Bank- ARAD data series

On the other hand, quality and sophistication of Czech exports has been increasing. This is revealed by the export sophistication index of Rodrik[42]. According to this index, the Czech economy compares relatively well to the neighboring competitors.

Finally, in the effort to relate real effective exchange rates to exports, it can be seen that the real exchange rate base on labor cost index for manufacturing sector has clear negative relation with the evolution of exports. The Graph IV.3.5. shows a simple scatter plot which relates REER base on Unit Labor Cost in Manufacturer sector to exports. The relation is slight, however is clearly negative and linear. When trying to relate other real effective exchange rates to export in a simple scatter plot graph, the relation is not found, see Graph IV.3.6., Graph IV.3.7. This because, as explained before, the Czech Republic concentrates its exports in the manufacturer sector, therefore a relation between the REER based on labor manufacturer costs is easy to find.

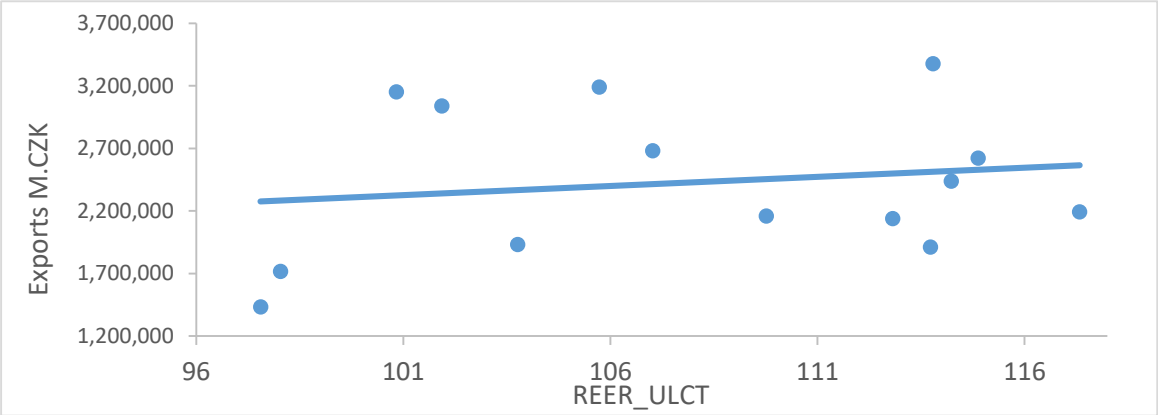
Graph IV.3.5. - Scatter plot Exports and REER_ULCM- 2004-2017



Source: ARAD Data Series, CNB-Exports and Real effective exchange rates

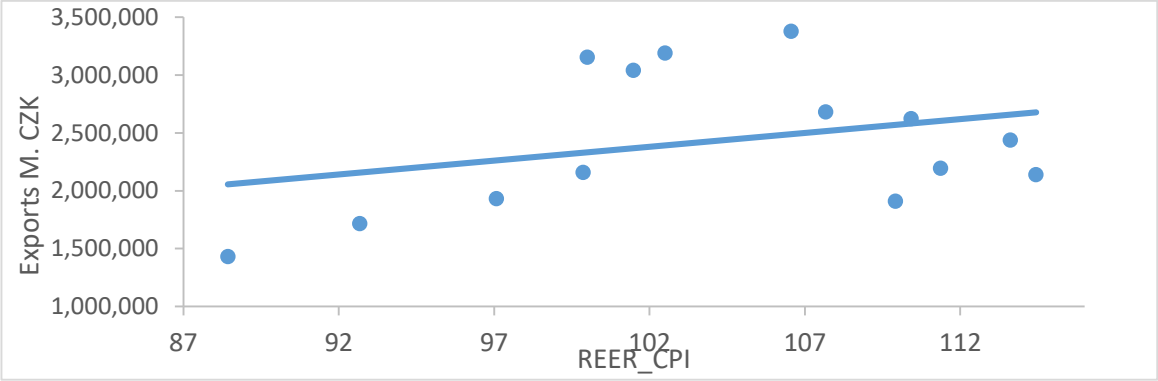
42 Czech Republic: 2017 Article IV Consultation Press Release; Staff Report and Statement by the Executive director for the Czech Republic, IMF 2017, annex21

Graph IV.3.6. - Scatter plot Exports and REER_ULCT- 2004-2017



Source: ARAD Data Series, CNB-Exports and Real effective exchange rates

Graph IV.3.7. - Scatter plot Exports and REER_CPI- 2004-2017



Source: ARAD Data Series, CNB-Exports and Real effective exchange rates

4. Monetary Policy and Exchange rate

Despite of being member of the European Union, the republic has not used the Euro yet but the Czech Koruna as the legally national currency, which implies that taxes, wages, and so forth, are paid with it and the entity responsible for its management is the Czech National Bank (CNB). With regard to the monetary policy, the CNB decided to introduce one-side 27CZK/EUR floor in order to respond to deflation in the country[43].

Since the introduction of free floating regime, 1997, there has been only two interventions, the first one in 2002 and the second one in November 2013. During this

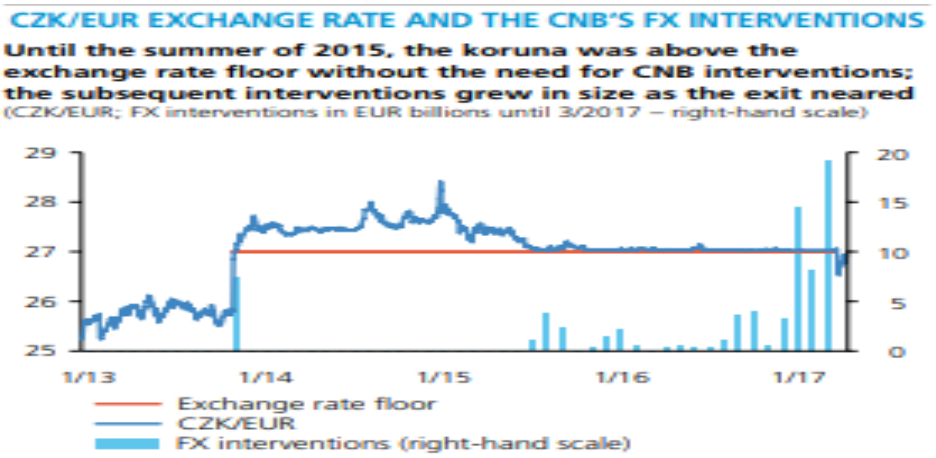
43 There are two instruments that central Banks can use to fight deflation interest rate and Exchange rate

period, the tendency was appreciation against euro. However, the tendency changed in November 2013 when the Czech National Bank (CNB) announced that will use the exchange rate as monetary instrument and set a one side floor of 27CKZ/EUR.

In November 2013; the exchange rate CZK/EUR was 25.8 by then, and it jumped to 27 CZK/EUR following an official announcement. The CNB had limited participation in 2013; however, interventions became stronger in the middle of 2015, as the Czech Koruna started to strengthen and reached the 27CZK/EUR[44]-limit. Afterwards, in April 2017, when the measure was abandoned and the interest rate was utilized as a main monetary instrument, the exchange rate appreciated back to 25.45 as for January 2018.

Aligned with the massive interventions in 2015-2017, the exchange rate variance moved accordingly, for instance, taking monthly average exchange rates into consideration, the Czech Koruna depreciated 2.26% in 2012, 3.36% in 2013, 5.95% in 2014, -0.9% 2015 and 2016 and -2.62% in 2017[45] in relation to euros. Furthermore, because of the interventions the exchange rate CZK/EUR monthly variance was close to zero during this period: from July 2015 to March 2017 the variance is 0.05%. Whereas from the imposition of the floor – November 2013 to July the variance was 4%. During 2013 to the period before the official announcement, the variance was 2%.

Graph IV.4.1 - CZK/EUR Exchange rate and NB'S FX Interventions Jan2013- Jan2017

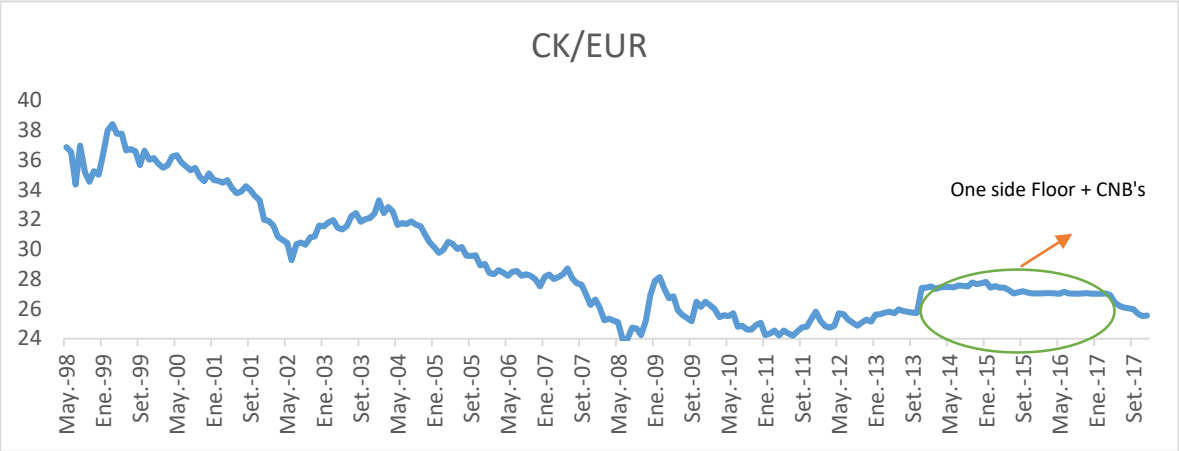


Source: CNB, Inflation Report 2017 I

44 Graph IV.2.2.1.

45 CNB Arad Databse_ CNB

Graph IV.4.2 - CZK/EUR Exchange rate 1998-2017



Source: Source: ARAD Data Series System –CNB

5. Currency Arrangements and Hedging Strategies

The structure of classification of currency arrangements ranks exchange rate arrangements on the source of their degree of flexibility to the exchange rates. A fixed exchange rate means that the nominal exchange rate is firmly set by the monetary authority with respect to a foreign currency or a basket of foreign currencies. On the other hand, a floating exchange rate is determined by the market, and it generally fluctuates constantly[46].

Regarding the exchange rate in the Czech Republic, the Czech crown was pegged to a basket of currencies until early 1996, now the Czech economy functions under managed floating regime, i.e. the exchange rate is floating, but the central bank may turn to interventions should there be any extreme fluctuations. As will be explained in the following lines during the period of November 2013 to April 2017, the Czech Republic set a floor to the Czech Crown, and in order to comply with this commitment, large interventions were needed in the period July 2015- April 2017.

46 What is the difference between a fixed and a floating exchange rate? CNB, Internet article: https://www.cnb.cz/en/faq/what_is_the_difference_between_a_fixed_and_floating_exchange_rate.html

In November 2013, the CNB decided to establish one-side exchange rate commitment at 27CZK/EUR to respond to deflation in the Czech economy. The interventions to fit in with the commitment were limited up to July 2015, when the Czech Koruna started to rapidly appreciate. Before the floor was announced, the Czech Koruna was valued at 25.66CZK/EUR and afterwards 26.93CZK/EUR (+4% -change within a month), the Koruna remain above 27CZK/EUR for the later year suggesting that the koruna was potentially over-valued. From the beginning of 2012 to November 2013, the variance counted as 25%. From the time when the commitment was established, the variance registered was 6%-until the summer of 2015 however, the Czech Koruna started to appreciate sharply close to 27 CZK/EUR. As a result, interventions were more unaffected and the Koruna remained to 27 CZK/EUR until April 2017, when the commitment was ended.

Firms adjust their behavior subject to exchange rate regimes, this is to say, companies have incentives to hedge under flexible exchange rate regimes but not to hedge under favorable predicted scenarios. For instance, they tend to reduce (or increase) foreign currency debt under flexible (pegged) regimes. Hence companies choose to be faced with more exposure to exchange rate risks under fixed policies and less exposure under floating exchange rate risks (Kamil, 2012), (Rosse , 2011). Rodriguez (1974) finds out in interviews made to financial executives not only that they prefer to eliminate completely exposure to exchange rates under higher uncertainty times but also that hedging is managed in accord with expectations of exchange rate risks. Therefore, changes in strategy are sharp when: changing from certainty to uncertainty and moving from uncertainty to the highest degree of certainty will change strategies from no exposure to exposure position

Czech exporters are not unconcerned about the decision made by the Central Bank. In fact, as a response to the period of massive interventions by the CNB, many companies exporters decided to abandon financial hedging, e.g. after six months of fixed rate, the percentage of export hedging against exchange rate risks dropped from 44.6% to a minimum of 25.4% (one year after intense interventions). It is concluded that the market reacted after realizing that the one-side floor policy was lengthened during 2016 and decided to unhedged. To such behavior, it is important to add that the Czech National Bank

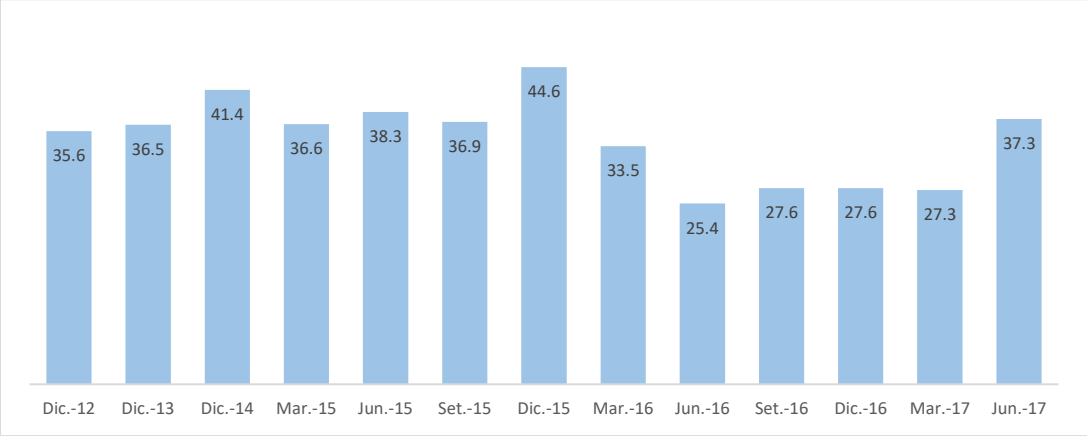
always announces publicly its plans regarding policies undertaken so that the market may predict them as well as the currency trend. For example, in the autumn of 2012 the CNB stated that if necessary the Czech Crown will be utilized as additional instrument to easy the economy[47]. Later, in December 2013, the bank announced that it will be keep the floor at least until the beginning of 2015. The next year (2014) the Central Bank declared that the floor will not be removed before December 2016. Finally, in February 2017, the bank announced that the policy will not be discontinued in the first quarter of the same year[48].

The percentage of companies hedging exchange-rate risks with derivatives was, nevertheless, about 40% up to December 2015 -it actually reached a peak of 44.6% in Dic-2015 (Graph IV.5.1.). In order to understand this outcome, literature details the concept of *selective hedge*, in which, basically, firms may select whether to hedge or not and when, thus the decision depends on the outcome of the underlying process (whether it is favorable or not). Such concept would be open to discussion within the Czech exporters' union and their behavior. However, the number of derivatives utilized to hedge currency risks only reduced when the currency was pegged –just when the one-side-floor was imposed. There is evidence that selective hedge is a practice for some companies, which means firms' hedging decisions are based on a lag of exchange-rate variations (GRIMES & RICHARD, 2014). Furthermore, Czech firms would decide to hedge when the koruna is weak in comparison to historical data; only a 7% of firms would hedge when the koruna is strong compared to historical performances, which suggests that exporters in the Czech Republic may take action towards the exchange rate behavior, e.g., 53% out of the sample taken do hedge steadily whilst 24% would take action when the koruna is weak compared to historical data. Interestingly enough, those who decided not to be consistent and selective had bad outcomes when the koruna appreciated in 2009 (Vlastimil, Rottová, & Saxa, 2011).

47 CNB / Public Media/ Exports https://www.cnb.cz/miranda2/export/sites/www.cnb.cz/en/public/media_service/conferences/speeches/download/singer_20150512_zurich.pdf

48 CNB, Monetary policy, CNB decisions 2017

Graph IV.5.1 - Export Hedging against Exchange Rate Risks -over the next 12 months (Mean weighed in %) 2012-2017



CNB's Statistical Survey

V. Description of Sample

The study herein involves collecting data from three sources, Albertina-Bisnode, Magnus Web-Bisnode and the Czech National Bank. The selected sample refers to companies in the manufacturing sector. The first source provided information on operative profits, total profits and sales as well as a report on *"Revenues from reevaluation of securities and derivatives* and *Reevaluation of securities and derivatives expenses".* The two last sources are aimed at segregating between companies which utilize derivatives from the ones that do not. The data range is annual and extends over the 2012-2016 period.

The *share-of-exports-over-turnover* variable was taken form Magnus-Bisnode database in order to select exporters within the sample. The criteria utilized was aimed at obtaining *the share of exports over turnover* for companies with complete data in this field -without imports being larger than exports- or with information on exports sold to other countries. According to the *Magnus-Bisnode* firm, the *share of exports over turnover* is taken mostly from annual reports.

The sample selection criterion was to choose those companies with complete information on operative profits, total profits and sales for the five years of analysis, 2012-2016 (each year upon completion). In addition, it was considered that information on *share*

of export over turnover was available[49] in the selection. Likewise, the financial statements selected were those audited under Czech GAAP or IFRS Standards. Under these conditions, the final selected sample consisted of 963 companies, which were divided into two groups, hedgers -194 companies- and non-hedger -769 companies. The group of hedgers stored records on the account *Revenues from revaluation of securities and derivatives or Reevaluation of securities and derivatives expenses* within any year between 2012 and 2016. Non-hedgers companies included any records in this field throughout any of the years over that period. Even though such criterion selects only hedgers of those which utilize derivatives, the reviewed literature suggests that financial and operative hedging techniques are utilized as complements to each other, i.e. it is expected that the group of hedgers – those utilizing derivatives- also utilize more hedging strategies in relation to its peers. Thus, as mentioned herein in the *Determinants to Hedge and Effectiveness* chapter, previous researches utilized these criteria for segregation.

With regard to the independent variable, i.e. exchange rate, the research herein establishes two, *Real Effective Exchange Rate Based on the Unit Labor Cost in the Manufacturing Sector (REERULM)* and *Real Effective Exchange Rate Based on the Consumer Index Price* (REERCIP)[50]. Those involved are annual exchange rates.

VI. *Methodology*

The applied regression model was Panel Data[51] and the *Stata 11* software was employed, as it is highly utilized for data arranged in panels.

There are many variations within the Panel Data Modeling to be utilized, e.g., Ordinary Least Squares –OLS- as well as the *Fixed-Effects* and *Random-Effects Models.* There are also very interesting models suitable to large N, i.e., individuals or corporations, and small T, i.e., time variables. Thus the Two-Way Fixed Effect Model is one of those. Unfortunately, the Two-Way Fixed Effect Model cannot be applied in the sample provided

[49] Or it was stated some information on exports to other countries.
[50] Hence it is considered the approach to how real exchange rates affect not only labor costs but also prices.
[51] Panel Data Modeling- Christopher F Baum 2006 – *An Introduction to Modern Econometrics Using Stata,* p.219, was taken as a guide as for this chapter.

because this technique is not advisable for proper micro-data that includes dependent macroeconomic variables, as they will not differ among individuals but through time.

The most popular Panel Data models are the One-Way Fixed-effect and Random Effect Model. Fixed effect Model assumes that there are differences in the independent variables within individuals (which is not the case this study's sample, as the dependent variables are macroeconomic variables). On the other hand, differences among individuals affected by the dependent variable may be better explained by the Random Effect Model. Nevertheless, Haussmann statistical Test[52] can be implement to define which the more appropriate model for the sample is.

As there are two dimensions taken into account: time and companies, there may be presence of heteroskedasticity across panel units, thus OLS solution is not often consider practical (nonetheless *Breaush Pagan test*[53] can be performed to conclude if to OLS model is appropriate, or not).

IV.1 Variables

In order to analyze the exposure of the exporters to exchange rate variations, six variables were used: Total Profit, Profit from Operations, Sales, Real Exchange Rate Base on CPI and Real Exchange Rate Base on Unit Labor Cost in the manufacturer sector. All the variables were transformed to their differences as follows[54]:

TPROFTD	Dependent variable	=	*Total profit_t - Total profit_t-1*[55]
POD	Dependent variable	=	*Profit from operations_t - Profit from operations_t-1*
SalesD	Dependent variable	=	*Sales_t - Sales_t-1*
REERCPI_D	Independent Variable	=	*Real Effective Exchange Rate CPI_t - Real Effective Exchange Rate CPI_t-1*
REERUCLM_D	Independent Variable	=	*Real Effective Exchange Rate Labor Unit Cost_t - Real Effective Exchange Rate Labor Unit Cost _t-1*

52 Ho: Random Effect model is better; H1: Fixed effects model is better

53 Ho: βpool=βfixed ; H1: βpool≠βfixed

54 In order to measure Exposure, previous studies in this field have used logarithm of variables, in this study differences were used.

55 Net Income

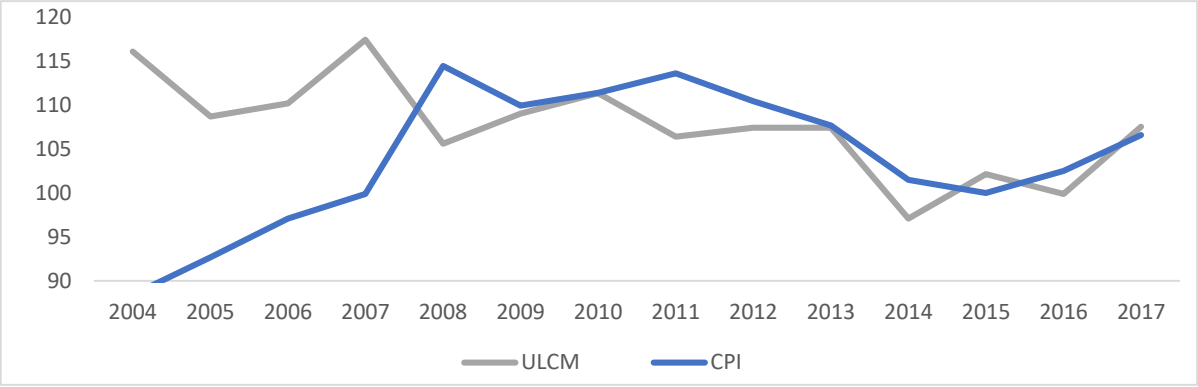
Literature suggests taking cash-flow accounting to measure exchange-rate exposure; however, such variable was not available. Thus the process went on by taking other variables from the income statement such as sales, operative profits and total profits, which may be affected by loss or gain of competiveness. On the other hand, the nominal exchange rate showed some drawbacks to measure exchange-rate exposure, as it was almost fixed in the 2015-2016 period. Hence *real effective exchange rates* were under consideration, as they do reflect gain or loss of competitiveness in firms.

Chart IV.1.1 REER Series

Date	REER			
	ULCM	CPI	ULCMD T1-T0	CPID T1-T0
2012	107.41	110.42		
2013	107.42	107.67	0.01	-2.75
2014	97.07	101.48	-10.35	-6.19
2015	102.14	100	5.07	-1.48
2016	99.88	102.5	-2.26	2.5

Source: ARAD-CNB

Graph VI.1. - Real Effective Exchange Rates



Source: ARAD Data Series System –CNB

In order to prove the hypothesis if hedgers (defined as the companies that applied derivatives[56]) are relatively less exposure to exchange rate changes, six regression models are going to be constructed as follows, per group and per Panel Model, as follow[57]:

1. $TotProfD_{ijt} = ai + \beta REERikt + eit$
2. $Prof_OPD_{ijt} = ai + \beta REERikt + e$it
3. $Sales_{ijt} = a + \beta REERikt + eit$

Where j= hedger or non-hedger; and k = CPI or UCL, i=company variable, t=time variable, e=error

Finally, differences in significance results may appear in the hypothesis conclusion in order to prove it. It is, for instance, more likely to expect a significant coefficient β for non-hedgers at 90% or 95% of confidence level. Furthermore, the β coefficient sign is expected to be negative -less competitiveness to a higher index-, as it is supposed to impact negatively on the exporters' dependent variables. On the other hand, it is expected that the variable $REER_i$ is statistically not significant for this group of hedgers at 90% or 95% of confidence level.

VII. Results and Analysis

1. Non-Hedgers: Dependent variable REERULCM

With regard to the impact of the real effective exchange rate base on labor costs in manufacturing sector (REERULCM) on operative profit, the OLS model shows a statistical significant relation at 5% as p-value = 0.005. The coefficient sign is negative, which is consistent, as it was expected, i.e. exporters experience reduction in operative profits when the REER appreciates. However, the independent variable explains slightly the variations in Operative Profits as R-squared is very low, i.e. equal to 0.0026, which means that 0.0026% of the dependent variable variability has been accounted by the independent variable. Thus

56 Note that non- hedgers can also applied other hedging techniques, but it is expected that the ones that use derivatives do hedge relatively better than those who do not.

[57] For more details see Appendix

the real exchange rate predicts 0.0026% of total profits and, therefore the predictive power of such model is not possible unless other variables that explain operative profits are added.

Regarding total profit, similar results are found, the OLS model of the second equation, shows that the REERULCM has statistical significant variable at 95% of confidence, as p-value records lower than 5%, P-value=0.028 and the sing is aligned with the reasoning that real exchange index increment affects competitiveness of exporters Nonetheless, the predictive power is also low 0.0009.

Finally, for the third equation the sales differential was regressed by the REER ULCM differential, the results also show a statistical significant explanatory variable, as p-value is lower than 0.05 (p-value=0.009). The sign is also consistent with the general rule that a higher REER affect negatively exporters. Again, the R-squared is low 0.0029, but higher than the two previous ones.

REERULCM reflects directly competitiveness on labor costs. The results reflect that *real changes in relative prices on labor cost* do affect profit results in companies when labor prices became more expensive. This means that companies that do not hedge are more expose to appreciation in the real exchange rate. Companies as such do not experience any income from reevaluation of derivatives, from depreciation of foreign exchange debt or other strategies oriented to long term solutions: as moving operations abroad. Thus, do not have tools to fight appreciation in the cost and therefore are exposed to exchange rate movements. The relation on sales is not that evident as sales are not straight forward, directed with labor costs.

Chart VII.1

Independent variable REER_UCLM					
NON-HEDGERS					
1.Operative ProfitD		***Profit Prof_OPDnh=c_{it}+ϐREER_UCLM$_{it}$+e_{it}***			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	-887.147	**0.005**	0.0026	1	-
FE	-887.147	**0.008**	0.0031		
RE	-887.147	**0.005**	0		
2.Total ProfitD		**Total Profit TOTPROFDnh=c_{it}+β REERD_UCLM$_{it}$+e_{it}**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	-540.31	**0.028**	0.0009	1	-
FE	-540.31	**0.130**	0.001		
RE	-540.31	**0.102**	0.000		
3.SalesD		**SalesDnh=c_{it}+βREERD_UCLM$_{it}$+e_{it}**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS	-2891.4	**0.081**	0.0014	0	1
FE*	-2891.4	**0.009**	0.0029		
RE	-2891.4	**0.009**	0		

/* Best model, APPENDIX A provides results from the Stata

2. Hedgers: Independent variable REERULCM

As for hedgers, the results are as follow: for the first equation, ***Prof_OPDit=cit+βREER_UCLit+eit.*** The REER shows no statistical significance to explain the operative profit. The p-value in this case is greater than 0.05 (p- value = 0.433), additionally the R-squared 0.0004.

Same results can be observed for the second regression, which relates REERULCM with Total profit. In the results of this regression it is observed also a rejection of statistical significance of the REER to explain the Total profit, the p-value = 0. 514. Finally, regarding the finding of statistical significance of REER to explain Sales, for hedgers, this variables is not statistically significant.

In accordance to the literature, companies that hedge can fight exchange rate exposure better, in this case if salaries became less competitive in the home country companies may use other strategies to fight it, such as: change their price list to local currency, negotiate better contracts or in the long term companies may move some

operations other countries. A covered position using hedging strategies may present some beneficial advantage to fight appreciation.

Chart VII.2

Independent variable REER_UCLM:					
HEDGERS					
Operative Profit		***Profit Prof_OPD$_{it}$=c$_{it}$+βREERUCLM$_{it}$+e$_{it}$***			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	-1176.194	**0.433**	0.0004	1	-
FE	-1176.194	**0.614**	0.0004		
RE	-1176.194	**0.596**	0		
Total Profit		**Total Profit TOTPROFD$_{it}$=c$_{it}$+β REERD_UCLM$_{it'}$+e$_{it}$**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	-803.4589	**0.514**	0.0002	0.9986	-
FE	-803.4589	**0.701**	0.0003		
RE	-803.4589	**0.69**	0		
Sales		**SalesD$_{it}$=c$_{it}$+βREERD_UCLM$_{it+}$e$_{it}$**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS	-2252.894	**0.742**	0	0	1
FE*	-2252.894	**0.56**	0		
RE	-2252.894	**0.56**	0		

/* Best model, APPENDIX A provides results from the Stata

3. Non-Hedgers: Dependent variable REERCPI

The real exchange rate base on consumer index price showed to be not significant to explain operative profit and total profit, this is to say that the companies that do not use derivatives are not affected by changes in the relative prices that affect consumers (REER_CPI). However, sales show to be a significant variable and with a theoretical correct sign. P-value is equal to 0.007 and, nonetheless the independent variable explains very little the development of sales.

One of the reasons why the real exchange rate base on consumer index price is significant on sales and not on total and operative profit is that the sales of exporters became more expensive abroad as of an appreciation of the local prices. The real exchange rate base on consumer index price reflect how the prices in the local economy behave in comparison to the other country competitor.

In contrast to the REER base on labor unit cost in manufactures, the real effective exchange rate base on consumer index price may fail to explain operative profit and total profit. One of the reasons is that its relations with cost (such as salaries) is not as clear as the real exchange rate based on labor costs.

Chart VII.3.

Independent variable REER_CPI					
NON-HEDGERS					
Operative Profit		$Prof\_OPD_{it}=c_{it}+\beta REER\_CPI_{it}+e_{it}$			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	389.409	**0.542**	0.0002	1	-
FE	389.409	**0.512**	0.0002		
RE	389.409	**0.491**	0.00000		
Total Profit		**Total Profit TOTPROFDit=a+β REERD_CPI$_{it}$+e$_{it}$**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	139.64	**0.83**	0.000	1	-
FE	139.64	**0.827**	0.000		
RE	139.64	**0.813**	0.000		
Sales		**SalesDnh=a+βREERD_CPI$_{it}$ +e$_{it}$**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS	-5338.5	**0.032**	0.0015	0	1
FE*	-5338.5	**0.007**	0.0031		
RE	-5338.5	**0.007**	0		

/* Best model, APPENDIX A provides results from the Stata

4. Hedgers: Dependent variable REERCPI

The real effective exchange rate base on consumer index price fails to explain operative profit, total profit and sales.

In comparison to the previous result, in which the REER based on CIP was significant to explain sales for non-hedgers, the results for non-hedgers are the contrary: REER based on CIP is not significant to explain sales for hedgers. This outcome suggest that exporters in the Czech Republic that use derivatives for hedging may also have some managerial strategies base on operative hedging that minimized exposure at the level of sales. Although this conclusion was not in the scope of this study is interesting and can be explore further in following studies.

Chart VII.4.

Independent variable REER_CPI					
HEDGERS					
Operative Profit		***Profit Prof_OPD$_{it}$=c$_{it}$+ɓREER_CPI$_{it}$ +e$_{it}$***			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	1216.435	**0.608**	0.0001	1	-
FE	1216.435	**0.7771**	0.0001		
RE	1216.435	**0.759**	0.000000		
Total Profit		**Total Profit TOTPROFD$_{it}$=c$_{it}$+β REERD_CPI$_{it}$+e$_{it}$**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS*	1574.819	**0.453**	0.0002	0.9986	-
FE	1574.819	**0.674**	0.0003		
RE	1574.819	**0.662**	0.00000		
Sales		**SalesD$_{it}$=c$_{it}$+βREERD_CPI$_{it}$+e$_{it}$**			
	B	**p-value**	**R2**	**Breusch-Pagan**	**Hausman-Test**
OLS	-2252.894	**0.742**	0.0001	0	1
FE*	-2131.949	**0.758**	0.0002		
RE	-2131.949	**0.758**	0		

/* Best model, APPENDIX A provides results from the Stata

VIII. Conclusion

The Czech Republic is regarded as a cost-competitive manufacturing country since qualified labor is cheap in comparison to other countries. Nonetheless actual exchange rates have shown appreciation in recent years and firms in the country may be losing competitiveness when compared to other countries. The appreciation effect on labor costs and actual prices was not that evident for companies as the CNB had to face with deflation and utilized the exchange rate as an alternative tool of monetary policy -instead of interest rate-, however the negative consequences of appreciation, especially for exporters, may be evident in subsequent periods.

Even though the research herein started with a simple hypothesis…"firms that utilize derivatives are less exposed to exchange rates than those which do not", it was established that this topic is quite more complex, especially in The Czech Republic. The Czech economy is one in which actual exchange rates may appreciate and therefore affect competitiveness. However, such appreciation was not so apparent due to the fact that the CNB imposed a one-side floor to the Czech koruna as for the Nov-2013-April2017 period. Its complexity is also evident, as exchange rates may affect sales, financial debt and other costs not only in the short but also in the long run.

Strategies to face with it are diverse; however, on the basis of previous surveys carried out in The Czech Republic, it was proven that 30% of firms did not hedge at all. In addition, 23% out of those which do prefer to hedge totally. This scenario may have changed from 2011 on, however it provided some lights for what to expect.

However, studies in other countries found out that companies which make use of financial strategies are more likely to utilize operative techniques as well. On the other hand, if not financial strategies were found, less likely companies would also utilize operative strategies. How effective it is to hedge or not with derivatives may provide some knowledge of how firms which do not hedge with derivatives are more exposed to exchange rates risk. Their managerial techniques to face with exchange rates are expected to be lower than those of their peers.

Several studies have tried to measure exposure to exchange rates; most of them utilize the same approach with slight variations. Thus they relate exchange rates to some financial results, i.e. some of them related the exchange rate to EBIT, operative cash flows, financial flows, total cash flows or others to stock prices. Some other studies have attempted to explain determinants of hedgers and non-hedgers by utilizing a discriminatory variable, the use of derivatives or not.

The research herein was aimed at disclosing whether exchange-rate exposure exists within Czech exporters in the manufacturing sector. For the purposes of such disclosure, it was established the use of real effective exchange rates since the economy –as aforementioned- has lost competitiveness in recent years. It was also intended to experience exposure for two groups, those which utilize derivatives and those which do not.

The use of different account: sales, operative profit and total profit help to explain in which level the exposure is present and at what level the hedgers are fighting it. In addition the usage of different exchange rates: *real exchange rate on labor* and *real exchange rate on consumer index price* also help to understand how companies are affected and provide some light of how they minimized it. For instance in this study was found presence of exposure on those companies that do not use derivatives at all levels (sales, operative profit, total profit) and no presence of it on those companies that use derivatives (again at all levels), when utilizing real exchange rate base on labor cost.

On the other hand when utilizing real exchange rate base on consumer index prices the only variable that was expose to exchange rate changes was sales for non-hedgers. This works in accordance to the fact that prices on goods affect more directly sales, but have little or no impact on costs. . In addition, it was established that hedgers do not account for existence of exposure at any level or even on sales when compared to real effective exchange rate based on consumer index prices. Hence it may suggest that these companies (those utilizing derivatives) also hedge at sale levels by utilizing operative techniques, assumption about which the research herein was not intended to, however it may be revised over further in-depth research.

Finally, the research herein showed some limitations and highlights. In fact, with regard to limitations, a longer period of sampling would have been advisable to study and a

larger amount of samples may have been suitable to the actual purpose of the research. However, information on how to distinguish exporters is not easy to obtain at second hand. The highlights refer to the fact that real exchange rates may be useful not only to measure competiveness but also to establish the way they may affect companies within an economy with an appreciation tendency.

IX. Bibliography

Allayannis, G., & Ofek, E. (2001). Exchange rate exposure, hedging, and the use of foreign currency derivatives. *Journal of International Money and Finance*. Retrieved from https://www.sciencedirect.com/journal/journal-of-international-money-and-finance

Allayannis, G., Ihrig, J., & Weston, J. (2001). Exchange-rate hedging: Financial versus operational hedgers. *The American Economic Review*.

Bartram, S. M. (2007). What Lies Beneath: Foreign Exchange Rate Exposure, Hedging and Cash Flows .

Beenhakker, H. (2001). *The Global Economy and International Financing.* USA: Quorum books.

Belk, P., & Glaun, M. (1990). The Management of Foreign Exchange Risk in UK Multinationals: An Empirical Investigation. *Accounting and Business Research; Winter 1990; 21, 81; ProQuest Central*.

Black, P., Hartzenberg, T., & Standish, B. (2004). *Economics Principles and Practice.* Great Britian: Pearson Education South Africa.

Bodnar, M. (1998). Wharton Survey of Derivatives Usage by U.S. Non-Financial Firms. *Financial Management*.

Brian, C. (2000). *Introduction to Currency Rsik.* UK: Financial World Publishing.

Broll, U., Welzel, P., & Kit Pong Wong. (2008). Export and Strategy Currency heding. *Open Economy Review*.

Brown, G., & Crabb, P. (2006). Are Firms Successful at Selective. *The Journal of Business*.

Čadek, V., Rottová, H., & Saxa, B. (2011). Hedging Behaviour of Czech Exporting Firms .

Capel, J. (1997). A Real Options Approach to Economic Exposure Management. *Limburg Institute of Financial Economics, University of Maastrich*.

Coyle, B. (2000). *Heding currency exposure.* USA: Financial World Publishing.

Coyle, B. (2000). *Introduction to Currency Risk.* UK: Financial World Publishing.

Damodaran, A. (2010). Risk Management: A Corporate Governance Manual. *New York University - Stern School of Business*.

Dhanani, A. (2001). The Management of Translation Exchange Rate Risk. *The Journal of Applied Accounting Research* .

Domingues, K., & Tesar, L. (2001). A Reexamination of Exchange-Rate Exposure. *The American Economic Review*, 396-399. Retrieved from http://www.jstor.org.zdroje.vse.cz/stable/pdf/2677796.pdf?refreqid=excelsior%3Acf0a7c27060538aefd88429af35d3a91

Dominguez, K. M., & Tesar, L. L. (2001). A Reexamination of Exchange-Rate Exposure. *The American Economic Review*, 396-399. Retrieved from http://www.jstor.org.zdroje.vse.cz/stable/pdf/2677796.pdf?refreqid=excelsior%3Acf0a7c27060538aefd88429af35d3a91

Eiteman, D., Stonehil, A., & Moffett, M. (2007). *Multinational Business Finance 11th Ed.* USA: Pearson.

G. Arghyr, M., & Andro, G. (2011). Risk aversion, exchange-rate uncertainty and the law of one price: insights from the market for online air-travel tickets. *The Canadian Journal of Economics*, 880-906.

Gholamreza, N. (2003). The Attitude of Top UK Multinationals towards Translation Exposure. *Journal of Management Research*.

GOMES AUGUSTO, M., & Joao Da Silva, J. (2011). financial risk exposures and risk management: evidence from european nonfinancial firms. (W. Bataglia, Ed.) *UNIVERSIDADE PRESBITERIANA MACKENZIE*.

Gordon Bodnar, G. G. (1998). Derivative usage in risk management by U.S. and German non financial Firms. *Nattional Bureau of economic research*.

Gordon, M., & Wong, M. (2003). Estimating Exchange Rate Exposures:Issues in Model Structure. *Financial Management*, 35-67.

GRIMES, A., & RICHARD, F. (2014). OVER THE HEDGE : DO E XPORTERS P RACTICE: SELECTIVE H EDGING? *The Journal of Futures Markets*.

HE, J., & K. NG, L. (1998). The Foreign Exchange Exposure of Japanese Multinational Corporations. *THE JOURNAL OF FINANCE* , 733-753.

Hrubošová, E., Kameníková, B., Strouhal, J., Bonaci, C., & Filip, C. (2013). Hedging Foreign Exchange Risk in SME in the Czech Republic. *INTERNATIONAL JOURNAL OF MATHEMATICS AND COMPUTERS IN SIMULATION*.

Hsiao, C.-M. (2017). ENTERPRISE RISK MANAGEMENT WITH FOREIGN EXCHANGE EXPOSURES : EVIDENCE FROM TAIWAN TOURISM INDUSTRY. *Asian Economic and Financial Review* .

IMF. (2012). Assessing Competitiveness Using Industry Unit Labor Cost: Application in Slovakia.

IMF. (2013). *Balance of Payments and International Investment Position Manual.* Washington USA: International Monetary Fund, Publication Services.

IMF. (2013). *Balance of Payments and International Investment Position Manual.* Washington USA: International Monetary Fund, Publication Services.

Intenational Monetary Fund. (1993). Balance of Payments Manual.

Jeong , W., Sunghee , A., & Sammo , K. (2016). Estimating Exchange Rate Exposure over Various Return Horizons: Focusing on Major Countries in East Asia. *East Asian Economic Review*.

JP Morgan. (2003). HEAT a framework for evaluating hedge effectiveness. *RISK Special Report (Incisive Media)*.

Kamil, H. (2012). How Do Exchange Rate Regimes Affect Firms' Incentives to Hedge Currency Risk? Micro Evidence for Latin America . *IMF Working Paper*.

Klimczak, K. M. (2008). Corporate hedging and risk management theory: evidence from Polish listed companies . *The Journal of Risk Finance* .

Madura, J. (2007). *International Financial Management 9th Edition.* USA: South Western -Cengage Learing.

Mendoza, J. L. (2015). *Macroeconomía en una Economía Abierta.* Lima: Fondo Editorial UNMSM.

Muller, A. (2006). European Foreign Exchange Risk Exposure. *European Financial Management*, Vol. 12, No. 2, 2006, 195–220.

Nathan, J. L. (2000). The choice of hedging techniques and the Characteristics of UK Industrial Firms. *Journal of Multinational Financial Management*.

NICLAS, H. (2003). Why firms hedge with currency derivatives,an examination of transaction and translation exposure. *Applied Financial Economics*.

Nuka Lantara, I. (2012). The Use of Derivatives as a Risk Management Instrument: Evidence from Indonesian Non-Financial Firms . *International Journal of Business and Economics*, Vol. 11, No. 1, 45-62 .

Otero-Gonzalez, L., Fernandez Lopez, S., Duran Santomil, P., & Vivel-Bua, M. (2013). Why hedge currency exposure with foreign currency debt? *Academia Revista Latinoamericana de Administracion*.

Oxfor University Press. (2015). *Investment Risk Management .* USA: Oxfor University Press.

Papaioannou, M. (2006). Exchange Rate Risk Measurement and Management: Issues and Approaches for Firms. *IMF Working Paper*.

Papaioannou, M. (2006). Exchange Rate Risk Measurement and Management: Issues and Approaches for Firms. *International Monetary Fund* .

Penny, R. (2017). *Hedgerbook- The Benefits of Hedging, and Managing FX Risk: Part 1*. Retrieved from www.hedgebookpro.com.

Pong Wong, k. (2015). EXPORT AND HEDGING DECISIONS UNDER CORRELATED REVENUE AND EXCHANGE RATE RISK. *Bulletin of Economic Research* .

Prindl, A. (1976). Guidelines for MNC Money Maagers. *Harvard Business Review* .

Pritamani, M., Shome, D., & Singal, V. (2004). Foreign exchange exposure of exporting. *Journal of Banking & Finance*.

Pritamani, M., Shome, D., & Singal, V. (2004). Foreign exchange exposure of exporting and importing firms. *Journal of Banking & Finance*.

Pugel, T. (2016). *International Economics.* New York: McGraw-Hill.

Rodriguez, R. (1974). Management of Foreign Exchange Risk in the U.S. Multinationals. *The Journal of Financial and Quantitative Analysis*, 849-857.

Rogers, D., & Graham, J. (2002). Is Corporate Hedging Consistent with Value Maximization? An Empirical Analysis. *Journal of Finance*.

Rosse , J. (2011). Exchange Rate Exposure, Foreign Currency Debt and the Use of Derivatives: Evidence from Brazil. *Emerging Markets Finance & Trade* .

Savchenko, O. (2010). Derivatives Use in the Partial Hedging of Currency Risk: A Firm-Specific Approach to Understand the exchnge rate exposure puzzle. *The Journal of Applied Business Research*.

Shapiro, A. (1998). *Foundations of Multinational Financial Management.* USA: John Wiley.

Šimáková, J. (2014). The impact of exchange rate development on Czech trade flows . *Procedia Economics and Finance 15*, 129 – 136 .

Slutz, R. (1996). Rethinking risk management. *Journal of Applied Corporate Finance*.

Speranda, I. (2013). The importance of sustaining and improving company's business success by using indicator the the degree of hedging necessity. *Montenegrin journal of Economis Vo9 No5*.

Stephens, J. J. (2003). Managing Currency Risk: Using Financial Derivatives. 195.

Štulec, I. (2016). Effectiveness of Weather Derivatives as a Risk:Management Tool in Food Retail: The Case of Croatia. *International Journal of Financial Studies*.

Taušer, J., Markéta, A., & Pavel, Ž. (2015). CZECH EXPORTS AND GERMAN GDP: A CLOSER LOOK. *PRAGUE ECONOMIC PAPERS*.

Vlastimil, Č., Rottová, H., & Saxa, B. (2011). Hedging Behaviour of Czech Exporting Firms. *WORKING PAPER SERIES 14 CNB* .

Wang, P. (2009). *The Economics of Foreign Exchange and Global Finance.* Springer.

WONG, K. P. (2003). EXPORT FLEXIBILITY AND CURRENCY HEDGING. *INTERNATIONAL ECONOMIC REVIEW*.

Yong-Cheo, k., & Jongmoo Jay, C. (2003). The Asian exposure of U.S. firms: Operational and risk management strategies. *Pacific-Basin Finance Journal 11*, 121-138.

X. APPENDIX A- Results

1. Non-Hedgers: Dependent variable ULCM

1.1.OperativeProfitD_it= cit +REERULCMit +eit

1.1.1. OLS-POOL

```
. reg opedprofitd  REERULCMD
```

Source	SS	df	MS		
Model	7.4903e+10	1	7.4903e+10	Number of obs =	3076
Residual	2.9119e+13	3074	9.4727e+09	F(1, 3074) =	7.91
				Prob > F =	0.0050
				R-squared =	0.0026
				Adj R-squared =	0.0022
Total	2.9194e+13	3075	9.4940e+09	Root MSE =	97328

opedprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-887.1469	315.4884	-2.81	0.005	-1505.736	-268.5575
_cons	-1647.776	1852.639	-0.89	0.374	-5280.312	1984.76

No heteroskedasticity found as Prob>chi2 >0.05.

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of opedprofitd

         chi2(1)      =     3.78
         Prob > chi2  =   0.0518
```

1.1.2. Panel Data-Fixed Effects

```
. xtreg  opeprofitd REERULCMD,fe

Fixed-effects (within) regression               Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0031                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0026                                       max =         4

                                                F(1,2306)          =      7.16
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.0075

------------------------------------------------------------------------------
   opeprofitd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    REERULCMD |  -887.1469   331.5356    -2.68   0.008    -1537.286   -237.0079
        _cons |  -1647.776   1946.873    -0.85   0.397     -5465.58    2170.028
--------------+---------------------------------------------------------------
      sigma_u |  40328.768
      sigma_e |  102278.24
          rho |  .13455582   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(768, 2306) =     0.62                 Prob > F = 1.0000
```

Test F for Breusch-Pagan states that OLS is better no need to test further random effects. Prob > F=1 is higher than 0.05. Thus reject Ho, under the hypothesis:

$$Ho: B_{agrupados} = B_{e.fijos}$$

$$H1: B_{agrupado} \neq B_{e.fijos}$$

1.1.3. Panel Data- Random effects

```
. xtreg  opeprofitd REERULCMD,re

Random-effects GLS regression                   Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0026                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      7.91
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0049

------------------------------------------------------------------------------
   opeprofitd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
    REERULCMD |  -887.1469   315.4884    -2.81   0.005    -1505.493   -268.801
        _cons |  -1647.776   1852.639    -0.89   0.374    -5278.881    1983.33
--------------+---------------------------------------------------------------
      sigma_u |          0
      sigma_e |  102278.24
          rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Hausman test:

Ho: $B_{e.aleatorios}$ es mejor

H1: $B_{e.fijos}$ es mejor

```
. hausman fixed random

                 ---- Coefficients ----
                 (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                 fixed        random         Difference          S.E.
-------------------------------------------------------------------------------
REERULCMD      -887.1469    -887.1469      -3.01e-11       101.8966
-------------------------------------------------------------------------------
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                        =          0.00
              Prob>chi2 =        1.0000
```

Ho, rejected as Prob Chi>0.05, Fixed would better, if had been accepted.

1.2.Total ProfitDit= cit +REERULCMit + eit

1.2.1. Pool Model

```
. reg  totalprofD REERULCMD
```

Source	SS	df	MS		
Model	2.7784e+10	1	2.7784e+10	Number of obs =	3076
Residual	3.1910e+13	3074	1.0381e+10	F(1, 3074) =	2.68
				Prob > F =	0.1019
				R-squared =	0.0009
				Adj R-squared =	0.0005
Total	3.1938e+13	3075	1.0386e+10	Root MSE =	1.0e+05

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-540.3146	330.2643	-1.64	0.102	-1187.876	107.2465
_cons	-601.2296	1939.407	-0.31	0.757	-4403.895	3201.436

Heteroskedasticity test

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of totalprofD

         chi2(1)      =    52.59
         Prob > chi2  =   0.0000
```

*Heteroscedasticity test, positive, solving heteroscedasticity:

Linear regression

Number of obs	3076
F(1, 3074)	4.85
Prob > F	0.0277
R-squared	0.0009
Root MSE	1.0e+05

totalprofD	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-540.3146	245.2972	-2.20	0.028	-1021.278	-59.35162
_cons	-601.2296	2002.596	-0.30	0.764	-4527.791	3325.332

1.2.2. Fixed effects

```
. xtreg totalprofD REERULCMD, fe
```

Fixed-effects (within) regression

Number of obs	3076
Number of groups	769
Obs per group: min	4
avg	4.0
max	4
F(1,2306)	2.29
Prob > F	0.1303

Group variable: id

R-sq: within = 0.0010
between = .
overall = 0.0009

corr(u_i, Xb) = 0.0000

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-540.3146	357.0385	-1.51	0.130	-1240.465	159.8355
_cons	-601.2296	2096.633	-0.29	0.774	-4712.713	3510.254
sigma_u	35784.706					
sigma_e	110145.86					
rho	.09547291	(fraction of variance due to u_i)				

F test that all u_i=0: F(768, 2306) = 0.42 Prob > F = 1.0000

Test F for Breush-Pagan states that OLS is better no need to test further random effects. Proob > F=1 is higher than 0.05. Thus reject Ho, under the hypothesis:

$$Ho: B_{agrupados} = B_{e.\,fijos}$$
$$H1: B_{agrupado} \neq B_{e.\,fijos}$$

1.2.3. Random Effects

```
. xtreg  totalprofD REERULCMD, re

Random-effects GLS regression                   Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0009                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      2.68
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.1018
```

totalprofD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
REERULCMD	-540.3146	330.2643	-1.64	0.102	-1187.621	106.9915
_cons	-601.2296	1939.407	-0.31	0.757	-4402.398	3199.939
sigma_u	0					
sigma_e	110145.86					
rho	0	(fraction of variance due to u_i)				

Hausman test:

Ho: $B_{e.aleatorios}$ es mejor

H1: $B_{e.fijos}$ es mejor

```
hausman fixed random
```

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
REERULCMD	-540.3146	-540.3146	-1.75e-11	135.6539

```
                b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =          0.00
            Prob>chi2 =        1.0000
```

Ho, rejected as Prob Chi>0.05, Fixed would better, if had been accepted.

1.3.SalesDit= cit+REERULCMit+ eit

1.3.1 Pool Model

```
. reg  salesd REERULCMD
```

Source	SS	df	MS
Model	7.9563e+11	1	7.9563e+11
Residual	5.5199e+14	3074	1.7957e+11
Total	5.5279e+14	3075	1.7977e+11

Number of obs	3076
F(1, 3074)	4.43
Prob > F	0.0354
R-squared	0.0014
Adj R-squared	0.0011
Root MSE	4.2e+05

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-2891.365	1373.604	-2.10	0.035	-5584.639	-198.0908
_cons	59980.62	8066.197	7.44	0.000	44164.94	75796.3

Heteroskedasticity Test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of salesd

         chi2(1)      =    43.24
         Prob > chi2  =   0.0000
```

Solving Heteroskedasticity

```
. reg salesd  REERULCMD, robust

Linear regression                               Number of obs =      3076
                                                F(  1,  3074) =      3.04
                                                Prob > F      =    0.0813
                                                R-squared     =    0.0014
                                                Root MSE      =   4.2e+05
```

salesd	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-2891.365	1658.259	-1.74	0.081	-6142.773	360.0435
_cons	59980.62	7841.954	7.65	0.000	44604.62	75356.62

*Accepted at 10%

1.3.2. Fixed effects

```
. xtreg salesd  REERULCMD,fe

Fixed-effects (within) regression               Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0029                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0014                                       max =         4

                                                F(1,2306)          =      6.74
corr(u_i, Xb)  = -0.0000                        Prob > F           =    0.0095
```

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERULCMD	-2891.365	1113.453	-2.60	0.009	-5074.839	-707.8905
_cons	59980.62	6538.519	9.17	0.000	47158.63	72802.61
sigma_u	301851.97					
sigma_e	343498.69					
rho	.43573417	(fraction of variance due to u_i)				

F test that all u_i=0: F(768, 2306) = 3.09 Prob > F = 0.0000

Test F for Breush-Pagan states that OLS is better no need to test further random effects. Proob > F=1 is lower than 0.05. Thus accept Ho, under the hypothesis:

$$Ho: B_{agrupados} = B_{e.fijos}$$

$$H1: B_{agrupado} \neq B_{e.fijos}$$

Fixed effects proved to be better, therefore hausman needed.

1*.3.3. Radom effect model*

```
. xtreg  salesd REERULCMD,re

Random-effects GLS regression                   Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0014                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      6.74
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0094
```

salesd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
REERULCMD	-2891.365	1113.453	-2.60	0.009	-5073.693	-709.0365
_cons	59980.62	11085.04	5.41	0.000	38254.34	81706.89
sigma_u	248227.26					
sigma_e	343498.69					
rho	.34306229	(fraction of variance due to u_i)				

```
. hausman fixed random

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+------------------------------------------------------------
    REERULCMD |  -2891.365    -2891.365      2.41e-11       .000144
------------------------------------------------------------------------------
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        0.00
                Prob>chi2 =      1.0000

.
```

Fixed Effect model is better than Random effect model as Ho is rejected.

Hausman test:

Ho: $B_{e.aleatorios}$ es mejor

H1: $B_{e.fijos}$ es mejor

Hausman rejected, fixed effects better

2. Hedgers: Dependent variable REERUCLM

2.1.OperativeProfitD_it= c +REERULCMit +eit

2.1.1. Pool Model

```
. reg opeprofitd REERUCLM
```

Source	SS	df	MS		
Model	3.3215e+10	1	3.3215e+10	Number of obs =	776
Residual	9.1264e+13	774	1.1791e+11	F(1, 774) =	0.28
				Prob > F =	0.5957
				R-squared =	0.0004
				Adj R-squared =	-0.0009
Total	9.1298e+13	775	1.1780e+11	Root MSE =	3.4e+05

opeprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-1176.194	2216.099	-0.53	0.596	-5526.471	3174.084
_cons	-23865.98	13013.57	-1.83	0.067	-49412.07	1680.105

heteroskedasticity test

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of opedprofitD

         chi2(1)      =    18.33
         Prob > chi2  =   0.0000
```

Solving heteroskedasticity

```
. reg   opedprofitD  REERUCLM, robust

Linear regression                               Number of obs =       776
                                                F(  1,   774) =      0.61
                                                Prob > F      =    0.4334
                                                R-squared     =    0.0004
                                                Root MSE      =   3.4e+05
```

opedprofitD	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-1176.194	1500.556	-0.78	0.433	-4121.836	1769.449
_cons	-23865.98	13501.13	-1.77	0.078	-50369.15	2637.19

2.1.2. Fixed Model

```
. xtreg opeprofitd REERUCLM,fe

Fixed-effects (within) regression               Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0004                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0004                                       max =         4

                                                F(1,581)           =      0.25
corr(u_i, Xb)  = -0.0000                        Prob > F           =    0.6143
```

opeprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-1176.194	2332.805	-0.50	0.614	-5757.951	3405.564
_cons	-23865.98	13698.9	-1.74	0.082	-50771.39	3039.424
sigma_u	141015.94					
sigma_e	361467.43					
rho	.13209074	(fraction of variance due to u_i)				

F test that all u_i=0: F(193, 581) = 0.61 Prob > F = 1.0000

Test F for Breush-Pagan states that OLS is better no need to test further random effects. Proob > F=1 is higher than 0.05. Thus reject Ho, under the hypothesis:

$$Ho: B_{agrupados} = B_{e.fijos}$$
$$H1: B_{agrupado} \neq B_{e.fijos}$$

```
. xtreg opeprofitd REERUCLM,re

Random-effects GLS regression                   Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0004                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.28
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.5956
```

opeprofitd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
REERUCLM	-1176.194	2216.099	-0.53	0.596	-5519.668	3167.281
_cons	-23865.98	13013.57	-1.83	0.067	-49372.12	1640.157
sigma_u	0					
sigma_e	361467.43					
rho	0	(fraction of variance due to u_i)				

*FE better no need to perform Hausman Test

2.2.TotalProfitD_it= cit +REERULCMit +eit

2.2.1 Pool Model

```
. reg  totalprofD REERUCLM

      Source |       SS       df       MS              Number of obs =     776
-------------+------------------------------           F(  1,   774) =    0.16
       Model |  1.5499e+10     1  1.5499e+10           Prob > F      =  0.6897
    Residual |  7.5192e+13   774  9.7147e+10           R-squared     =  0.0002
-------------+------------------------------           Adj R-squared = -0.0011
       Total |  7.5208e+13   775  9.7042e+10           Root MSE      =  3.1e+05
```

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-803.4589	2011.522	-0.40	0.690	-4752.144	3145.226
_cons	-19177	11812.24	-1.62	0.105	-42364.82	4010.818

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of totalprofD

         chi2(1)      =    26.48
         Prob > chi2  =   0.0000
```

Solving heteroskedasticity

```
. reg    totalprofD REERUCLM, robust

Linear regression                               Number of obs =       776
                                                F(  1,   774) =      0.43
                                                Prob > F      =    0.5142
                                                R-squared     =    0.0002
                                                Root MSE      =   3.1e+05
```

totalprofD	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-803.4589	1231.052	-0.65	0.514	-3220.055	1613.138
_cons	-19177	12357.13	-1.55	0.121	-43434.47	5080.46

2.2.2 Fixed Effect Model

```
. xtreg  totalprofD REERUCLM,fe

Fixed-effects (within) regression               Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0003                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0002                                       max =         4

                                                F(1,581)           =      0.15
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.7012
```

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-803.4589	2092.786	-0.38	0.701	-4913.806	3306.889
_cons	-19177	12289.44	-1.56	0.119	-43314.15	4960.146
sigma_u	135130.16					
sigma_e	324276.6					
rho	.14795682	(fraction of variance due to u_i)				

F test that all u_i=0: F(193, 581) = 0.69 Prob > F = 0.9986

Test F for Breusch-Pagan states that OLS is better no need to test further random effects. Proob > F=0.9986 is higher than 0.05. Thus reject Ho, under the hypothesis:

$$Ho: B_{agrupados} = B_{e.fijos}$$
$$H1: B_{agrupado} \neq B_{e.fijos}$$

2.2.3. Random Effect Model

```
. xtreg  totalprofD REERUCLM,re

Random-effects GLS regression                   Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0002                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.16
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.6896
```

totalprofD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
REERUCLM	-803.4589	2011.522	-0.40	0.690	-4745.969	3139.052
_cons	-19177	11812.24	-1.62	0.104	-42328.56	3974.558
sigma_u	0					
sigma_e	324276.6					
rho	0	(fraction of variance due to u_i)				

*Pool was better, thus no need for Hausman

2.3.SalesDit= cit +REERULCMit +eit

2.3.1 Pool Model

```
. reg   salesd REERUCLM

      Source |       SS       df       MS              Number of obs =     776
-------------+------------------------------           F(  1,   774) =    0.10
       Model |  1.2186e+11     1  1.2186e+11           Prob > F      =  0.7466
    Residual |  9.0301e+14   774  1.1667e+12           R-squared     =  0.0001
-------------+------------------------------           Adj R-squared = -0.0012
       Total |  9.0313e+14   775  1.1653e+12           Root MSE      =  1.1e+06
```

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-2252.894	6970.842	-0.32	0.747	-15936.89	11431.1
_cons	132842.4	40934.8	3.25	0.001	52486.02	213198.8

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of salesd

         chi2(1)      =    58.83
         Prob > chi2  =   0.0000
```

Solving heteroskedasticity

```
. reg   salesd REERUCLM, robust

Linear regression                               Number of obs =       776
                                                F(  1,   774) =      0.11
                                                Prob > F      =    0.7421
                                                R-squared     =    0.0001
                                                Root MSE      =  1.1e+06
```

salesd	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-2252.894	6843.432	-0.33	0.742	-15686.78	11180.99
_cons	132842.4	45449.62	2.92	0.004	43623.26	222061.5

2.3.1 Fixed Effect Model

```
. xtreg   salesd REERUCLM,fe

Fixed-effects (within) regression               Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0006                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0001                                       max =         4

                                                F(1,581)           =      0.34
corr(u_i, Xb)  = -0.0000                        Prob > F           =    0.5599
```

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-2252.894	3861.731	-0.58	0.560	-9837.547	5331.759
_cons	132842.4	22677.2	5.86	0.000	88303.13	177381.7
sigma_u	948808.21					
sigma_e	598374.09					
rho	.71544559	(fraction of variance due to u_i)				

F test that all u_i=0: F(193, 581) = 10.06 Prob > F = 0.0000

Test F for Breush-Pagan states that OLS is better no need to test further random effects. Proob > F=0.9986 is lower than 0.05. Thus accept Ho, under the hypothesis:

$$Ho: B_{agrupados} = B_{e.\,fijos}$$
$$H1: B_{agrupado} \neq B_{e.\,fijos}$$

2.3.1 Random Effect Model

```
. xtreg   salesd REERUCLM,re

Random-effects GLS regression                   Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0001                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.34
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.5596
```

salesd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
REERUCLM	−2252.894	3861.731	−0.58	0.560	−9821.747	5315.959
_cons	132842.4	68507.27	1.94	0.052	−1429.375	267114.2
sigma_u	900402.2					
sigma_e	598374.09					
rho	.69365246	(fraction of variance due to u_i)				

Hausman Test Rejected

3. Non-Hedgers: Dependent variable REER_CPI

3.1.TotalProfitDit= cit +REERCPIit +eit

3.1.1. Pool Model

```
. reg totalprofD   reercpi

      Source |       SS       df       MS              Number of obs =    3076
-------------+------------------------------           F(  1,  3074) =    0.06
       Model |  579383668      1  579383668             Prob > F      =  0.8133
    Residual |  3.1938e+13  3074  1.0390e+10            R-squared     =  0.0000
-------------+------------------------------           Adj R-squared = -0.0003
       Total |  3.1938e+13  3075  1.0386e+10            Root MSE      =  1.0e+0
```

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	139.642	591.3337	0.24	0.813	−1019.807	1299.091
_cons	692.4039	2179.107	0.32	0.751	−3580.25	4965.057

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of totalprofD

         chi2(1)      =    549.48
         Prob > chi2  =    0.0000
```

Heteroskedasticity: solving heteroskedasticity

```
. reg totalprofD  reercpi, robust

Linear regression                               Number of obs =      3076
                                                F(  1,  3074) =      0.05
                                                Prob > F      =    0.8298
                                                R-squared     =    0.0000
                                                Root MSE      =   1.0e+05
```

totalprofD	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	139.642	649.7541	0.21	0.830	-1134.354	1413.638
_cons	692.4039	2757.738	0.25	0.802	-4714.792	6099.6

3.1.2. Fixed Effect Model

```
. xtreg totalprofD   reercpi,fe

Fixed-effects (within) regression               Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between =      .                                        avg =       4.0
       overall = 0.0000                                       max =         4

                                                F(1,2306)          =      0.05
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.8271
```

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	139.642	639.3109	0.22	0.827	-1114.042	1393.326
_cons	692.4039	2355.906	0.29	0.769	-3927.512	5312.32
sigma_u	35784.706					
sigma_e	110199.4					
rho	.09538901	(fraction of variance due to u_i)				

F test that all u_i=0: F(768, 2306) = 0.42 Prob > F = 1.0000

*F-test rejected OLS model preferable, no need to test further

```
. xtreg totalprofD   reercpi,re

Random-effects GLS regression                   Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0000                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.06
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.8133
```

totalprofD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
reercpi	139.642	591.3337	0.24	0.813	-1019.351	1298.635
_cons	692.4039	2179.107	0.32	0.751	-3578.567	4963.375
sigma_u	0					
sigma_e	110199.4					
rho	0	(fraction of variance due to u_i)				

3.2.OperatiePorf D_it= cit +REERCPIit +eit

3.2.1 Pool Model

```
. reg opeprofitd   reercpi
```

Source	SS	df	MS		
Model	4.5055e+09	1	4.5055e+09	Number of obs	= 3076
Residual	2.9189e+13	3074	9.4956e+09	F(1, 3074)	= 0.47
				Prob > F	= 0.4910
				R-squared	= 0.0002
				Adj R-squared	= -0.0002
Total	2.9194e+13	3075	9.4940e+09	Root MSE	= 97445

opeprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	389.4086	565.3191	0.69	0.491	-719.0329	1497.85
_cons	793.3073	2083.241	0.38	0.703	-3291.379	4877.993

Heteroskedasticity test

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of opedprofitd

         chi2(1)      =   461.03
         Prob > chi2  =   0.0000
```

Presence of present, solving Heteroskedasticity

```
. reg  opedprofitd reercpi, robust

Linear regression                               Number of obs =      3076
                                                F(  1,  3074) =      0.37
                                                Prob > F      =    0.5421
                                                R-squared     =    0.0002
                                                Root MSE      =     97445
```

opedprofitd	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	389.4086	638.6525	0.61	0.542	-862.8203	1641.638
_cons	793.3073	2615.246	0.30	0.762	-4334.501	5921.115

3.2.1 Fixed Effects Model

```
. xtreg opeprofitd  reercpi,fe

Fixed-effects (within) regression               Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0002                         Obs per group: min =         4
       between =      .                                        avg =       4.0
       overall = 0.0002                                       max =         4

                                                F(1,2306)          =      0.43
corr(u_i, Xb)  = -0.0000                        Prob > F           =    0.5123
```

opeprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	389.4086	594.2222	0.66	0.512	-775.8572	1554.674
_cons	793.3073	2189.751	0.36	0.717	-3500.78	5087.395
sigma_u	40328.768					
sigma_e	102427.37					
rho	.13421684	(fraction of variance due to u_i)				

F test that all u_i=0: F(768, 2306) = 0.62 Prob > F = 1.0000

OlS is better as F test is =1

3.2.1 Random Effects Model

```
. xtreg  opeprofitd   reercpi,re

Random-effects GLS regression                   Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0002                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.47
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.4909
```

opeprofitd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
reercpi	389.4086	565.3191	0.69	0.491	-718.5965	1497.414
_cons	793.3073	2083.241	0.38	0.703	-3289.771	4876.385
sigma_u	0					
sigma_e	102427.37					
rho	0	(fraction of variance due to u_i)				

3.3.SalesDit= cit +REERCPIit +eit

3.3.1. Pool Model

```
. reg  salesd reercpi
```

Source	SS	df	MS		
Model	8.4679e+11	1	8.4679e+11	Number of obs	= 3076
Residual	5.5194e+14	3074	1.7955e+11	F(1, 3074)	= 4.72
				Prob > F	= 0.0300
Total	5.5279e+14	3075	1.7977e+11	R-squared	= 0.0015
				Adj R-squared	= 0.0012
				Root MSE	= 4.2e+05

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	-5338.526	2458.257	-2.17	0.030	-10158.52	-518.5331
_cons	54853.33	9058.852	6.06	0.000	37091.31	72615.35

Heteroskedasticity test

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of salesd

         chi2(1)      =   182.22
         Prob > chi2  =   0.0000
```

Heteroskedasticity accepted

Solving Heteroskedasticity

```
. reg  salesd reercpi, robust

Linear regression                               Number of obs =     3076
                                                F(  1,  3074) =     4.61
                                                Prob > F      =   0.0320
                                                R-squared     =   0.0015
                                                Root MSE      =  4.2e+05
```

salesd	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	-5338.526	2487.687	-2.15	0.032	-10216.22	-460.8277
_cons	54853.33	7552.044	7.26	0.000	40045.77	69660.9

3.3.2. Fixed Effects Model

```
. xtreg salesd  reercpi,fe

Fixed-effects (within) regression               Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0031                         Obs per group: min =         4
       between =      .                                        avg =       4.0
       overall = 0.0015                                       max =         4

                                                F(1,2306)          =      7.18
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.0074
```

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	-5338.526	1992.586	-2.68	0.007	-9245.974	-1431.078
_cons	54853.33	7342.822	7.47	0.000	40454.11	69252.56
sigma_u	301851.97					
sigma_e	343466.39					
rho	.4357804	(fraction of variance due to u_i)				

F test that all u_i=0: F(768, 2306) = 3.09 Prob > F = 0.0000

Fe better model than pool

3.3.3. Random Effects Model

```
. xtreg salesd  reercpi,re

Random-effects GLS regression                   Number of obs      =      3076
Group variable: id                              Number of groups   =       769

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0015                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      7.18
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0074
```

salesd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
reercpi	-5338.526	1992.586	-2.68	0.007	-9243.923	-1433.129
_cons	54853.33	11578	4.74	0.000	32160.87	77545.8
sigma_u	248238.44					
sigma_e	343466.39					
rho	.34312496	(fraction of variance due to u_i)				

```
. hausman fixed random
```

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
reercpi	-5338.526	-5338.526	-2.67e-10	.0001162

```
                b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                        =          0.00
              Prob>chi2 =          1.0000
```

Fe model better, as p-value Chi =1

4. Hedgers: Dependent variable REERCPI

4.1.SalesDit= cit+REERCPIit +eit

4.1.1. Pool Model

```
. reg   salesd  reercpi
```

Source	SS	df	MS	Number of obs =	776
				F(1, 774) =	0.03
Model	3.4069e+10	1	3.4069e+10	Prob > F =	0.8644
Residual	9.0310e+14	774	1.1668e+12	R-squared =	0.0000
				Adj R-squared =	-0.0013
Total	9.0313e+14	775	1.1653e+12	Root MSE =	1.1e+06

salesd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	-2131.949	12476.49	-0.17	0.864	-26623.71	22359.81
_cons	132862.2	45976.74	2.89	0.004	42608.32	223116.1

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of salesd

         chi2(1)      =    58.83
         Prob > chi2  =   0.0000
```

Solving heteroskedasticity

```
. reg   salesd REERUCLM, robust
```

Linear regression

				Number of obs =	776
				F(1, 774) =	0.11
				Prob > F =	0.7421
				R-squared =	0.0001
				Root MSE =	1.1e+06

salesd	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
REERUCLM	-2252.894	6843.432	-0.33	0.742	-15686.78	11180.99
_cons	132842.4	45449.62	2.92	0.004	43623.26	222061.5

4.1.2. Fixed Effect Model

```
. xtreg   salesd  reercpi,fe

Fixed-effects (within) regression               Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0002                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0000                                      max =         4

                                                F(1,581)           =      0.10
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.7579

------------------------------------------------------------------------------
      salesd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     reercpi |  -2131.949   6912.889    -0.31   0.758    -15709.25    11445.35
       _cons |   132862.2   25474.49     5.22   0.000     82828.91    182895.5
-------------+----------------------------------------------------------------
     sigma_u |  948808.21
     sigma_e |  598500.34
         rho |  .71535969   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(193, 581) =    10.05                 Prob > F = 0.0000
```

FE better model than Pool

```
. xtreg   salesd  reercpi,re

Random-effects GLS regression                   Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0000                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.10
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.7578

------------------------------------------------------------------------------
      salesd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     reercpi |  -2131.949   6912.889    -0.31   0.758    -15680.96    11417.06
       _cons |   132862.2   69481.98     1.91   0.056    -3319.959    269044.4
-------------+----------------------------------------------------------------
     sigma_u |  900381.22
     sigma_e |  598500.34
         rho |  .69355289   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Hausman rejected, FE better

```
hausman random fixed
```

	Coefficients (b) random	(B) fixed	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
REERUCLM	-2252.894	-2252.894	-7.28e-12	.000348

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.00
Prob>chi2 = 1.0000

4.2.Total ProfitD_it= cit +REERCPIit +eit

```
. reg totalprofD reercpi
```

Source	SS	df	MS		
Model	1.8590e+10	1	1.8590e+10	Number of obs	= 776
Residual	7.5189e+13	774	9.7143e+10	F(1, 774)	= 0.19
				Prob > F	= 0.6619
Total	7.5208e+13	775	9.7042e+10	R-squared	= 0.0002
				Adj R-squared	= -0.0010
				Root MSE	= 3.1e+05

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	1574.819	3599.994	0.44	0.662	-5492.091	8641.73
_cons	-14546.35	13266.24	-1.10	0.273	-40588.42	11495.72

4.2.1. Pool Model

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of totalprofD

         chi2(1)      =     9.14
         Prob > chi2  =   0.0025
```

heteroskedasticity accepted

Solving heteroskedasticity

```
. reg    totalprofD  reercpi, robust

Linear regression                               Number of obs =       776
                                                F(  1,   774) =      0.56
                                                Prob > F      =    0.4528
                                                R-squared     =    0.0002
                                                Root MSE      =   3.1e+05
```

totalprofD	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	1574.819	2096.469	0.75	0.453	-2540.62	5690.258
_cons	-14546.35	10859.87	-1.34	0.181	-35864.64	6771.94

4.2.2. Fixed Effect Model

```
. xtreg    totalprofD reercpi,fe

Fixed-effects (within) regression               Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0003                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0002                                       max =         4

                                                F(1,581)           =      0.18
corr(u_i, Xb)  = 0.0000                         Prob > F           =    0.6743
```

totalprofD	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	1574.819	3745.414	0.42	0.674	-5781.381	8931.02
_cons	-14546.35	13802.12	-1.05	0.292	-41654.47	12561.77
sigma_u	135130.16					
sigma_e	324268.4					
rho	.1479632	(fraction of variance due to u_i)				

F test that all u_i=0: F(193, 581) = 0.69 Prob > F = 0.9986

*Pool Model Better, no need for Hausman Test

4.2.3. Radom Effect Model

```
. xtreg    totalprofD reercpi,re

Random-effects GLS regression                   Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0002                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.19
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.6618
```

totalprofD	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
reercpi	1574.819	3599.994	0.44	0.662	-5481.04	8630.679
_cons	-14546.35	13266.24	-1.10	0.273	-40547.69	11455
sigma_u	0					
sigma_e	324268.4					
rho	0	(fraction of variance due to u_i)				

4.3.Operative ProfitD_it= cit +REERCPIit +eit

4.3.1. Pool Model

```
. reg     opeprofitd reercpi
```

Source	SS	df	MS		
Model	1.1091e+10	1	1.1091e+10	Number of obs	= 776
Residual	9.1286e+13	774	1.1794e+11	F(1, 774)	= 0.09
				Prob > F	= 0.7592
Total	9.1298e+13	775	1.1780e+11	R-squared	= 0.0001
				Adj R-squared	= -0.0012
				Root MSE	= 3.4e+05

opeprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	1216.435	3966.686	0.31	0.759	-6570.303	9003.173
_cons	-19243.26	14617.52	-1.32	0.188	-47937.94	9451.43

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of opedprofitD

         chi2(1)      =    18.23
         Prob > chi2  =   0.0000
```

Solving heteroskedasticity

```
. reg      opedprofitD reercpi, robust

Linear regression                               Number of obs =       776
                                                F(  1,   774) =      0.26
                                                Prob > F      =    0.6083
                                                R-squared     =    0.0001
                                                Root MSE      =   3.4e+05
```

opedprofitD	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	1216.435	2372.512	0.51	0.608	-3440.885	5873.755
_cons	-19243.26	11492.71	-1.67	0.094	-41803.83	3317.318

4.3.2. *Fixed Effect Model*

```
. xtreg      opeprofitd reercpi,fe

Fixed-effects (within) regression               Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0001                         Obs per group: min =         4
       between =      .                                       avg =       4.0
       overall = 0.0001                                       max =         4

                                                F(1,581)           =      0.08
corr(u_i, Xb)  = -0.0000                        Prob > F           =    0.7709
```

opeprofitd	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
reercpi	1216.435	4175.684	0.29	0.771	-6984.84	9417.71
_cons	-19243.26	15387.69	-1.25	0.212	-49465.54	10979.03
sigma_u	141015.94					
sigma_e	361520.1					
rho	.13205734	(fraction of variance due to u_i)				

F test that all u_i=0: F(193, 581) = 0.61 Prob > F = 1.0000

*Fe better than Pool, no need for Hausman Test

4.3.3. Random Effect Model

```
. xtreg     opeprofitd reercpi,re

Random-effects GLS regression                   Number of obs      =       776
Group variable: id                              Number of groups   =       194

R-sq:  within  = 0.0000                         Obs per group: min =         4
       between = 0.0000                                        avg =       4.0
       overall = 0.0001                                        max =         4

Random effects u_i ~ Gaussian                   Wald chi2(1)       =      0.09
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.7591
```

opeprofitd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
reercpi	1216.435	3966.686	0.31	0.759	-6558.127	8990.996
_cons	-19243.26	14617.52	-1.32	0.188	-47893.07	9406.559
sigma_u	0					
sigma_e	361520.1					
rho	0	(fraction of variance due to u_i)				