Jahangirnagar University Journal of Business Research (JUJBR), Vol. 21, June, 2020
ISSN 1681-9748

The Administration of Foreign Exchange Risk for Sinaloa's Micro Industries that Purchase Imported Inputs: A Case Study

JUJBR

Bernal -Domínguez Deyanira, Dra[*]
Vargas-Hernández, José G., M.B.A.; PhD[**]
Frías -Sánchez Jéssica, MAE[***]

Abstract: *The management of exchange risks occurs regularly with the acquisition of hedges of derivative products in the financial markets, according to the theoretical review in publications of scientific articles, books and theses. The objective of this article is to measure the maximum probable loss with the value-at-risk method in the period 2014 to 2016 to analyze the alternative of managing exchange risks through hedging in an industrial micro-enterprise in Sinaloa. The methodology is qualitative with a case study. The contribution of this research work is to measure the maximum probable loss of a micro-industrial company that invests in raw materials inventories that vary according to the peso / dollar exchange rate, since there is an absence in this type of publications. The VaR model is applied with real data from the unit of analysis for exchange risk management. The main result confirms that the micro industrial company is not profitable to invest in hedges as an alternative to minimize its exchange risks.*

Keywords*: Business risk, coverage, VaR.*

JEL: *F310, F370, G150.*

1. INTRODUCTION

In Mexico, the situation for newly created companies is complex, various internal and external factors afflict entrepreneurs. According to Gascón (2012), between 350 and 400 thousand Small and Medium Enterprises (SMEs) are created annually in the country, of which half close during the first year, and only, 10% continue in the next five years. The National Institute of Statistics and Geography (INEGI), through the Statistical Directory of Economic Units (DENUE), published in 2014 that a total of one million 584 thousand 927 businesses closed or suspended activities. In addition, for every 10 companies that open in Mexico, 8 correspond to micro-sized companies.

[*] Facultad de Contaduría y Administración; Universidad Autónoma de Sinaloa, deyanirabernaldominguez@gmail.com

[**] Research professor, Department of Administration, University Center for economic and Managerial Sciences. University of Guadalajara, México, josevargas@cucea.udg.mx

[***] Facultad de Contaduría y Administración; Universidad Autónoma de Sinaloa, Sinaloa. jessicafrias89@hotmail.com

The importance of micro and small companies lies in that they constitute an important contribution to the national economy, a situation expressed in the country's Gross Domestic Product (GDP), with a 52% share in 2010 (OECD, 2013, p. 4). The INEGI economic census, in 2014, shows that 94.3% of companies in Mexico were micros. If the Mexican economy is objectively analyzed, it is largely supported by the participation of these units as generators of employment sources and providers of goods and services.

Now, regarding the state of Sinaloa, according to data provided by the National Statistical Directory of Economic Units (DENUE, 2016), 91.51% of state companies employ up to 10 employees. In the city of Culiacán, Sinaloa, the trend persists given that 90.18% of economic units have fewer than 11 employees and only 9.82% of companies are more than 11 (INEGI, s / f). Regarding the personnel employed in 2013, in Mexico, the total occupation was 21,576,358, of which 8,580,027 - that is, 39.79% - corresponded to people who worked in micro-enterprises (INEGI, 2015, p. 19).

In this context, where the economic and social importance of micro-sized companies is observed, it is decided to study this business stratum. Specifically, that of the manufacturing industry sector of manufacturing of integral kitchens and modular bathroom furniture in Sinaloa. According to a consultation in DENUE of INEGI there are 156 economic units of this line.

On the other side**,** according to the National Statistical Directory of Economic Units, in the state of Sinaloa, 572 companies were identified, of which 559 are micro-companies dedicated to the manufacture of integral kitchens and modular bathroom furniture. Likewise, it was found that in Culiacán 98.59% of the total companies are of micro size. In other words, of the total, only one is small (DENUE, 2016).

Based on the foregoing, the object of study of this research is a micro industrial company dedicated to the manufacture of wooden furniture and serves as a livelihood for five families from Sinaloa. The company was founded in 2005 under the name of Carpintería Caldera, supported by a financial resource granted by the Aguilar Padilla government in Sinaloa. Through the development secretary in charge of C. Jesús Vizcarra Calderón with an amount of $ 47,000.00 in materials and equipment for the manufacture of wooden furniture in favor of the three owners: Martha Graciela Lizárraga Morales, Ramón Caldera Castro and Luis Fernando Caldera Lizárraga settled on the 4th of March colony in the city of Culiacán.

In 2013 the company changed its address and business name, remaining as the property of a natural person named CarpiCal. The new sales office and

manufacturing workshop were domiciled in Lomas del Bulevar in the PEMEX neighborhood of the same city where they currently remain. Two sales agents work in the office, responsible for prospecting and following up on clients until the sale is effective. A manufacturing carpenter, cutter and painter are employed in the manufacturing workshop, with the same owner being responsible for coordinating both areas, as well as serving as company administrator. There are two transport vehicles, one destined for the hauling and installation of wooden furniture and the other for the quotation of jobs and the purchase of materials.

Its clients are emerging as young, newlyweds who are in the process of furnishing their home, childless or with young children. Its suppliers are national companies: Triplay Market. Conglomerate of ten Mexican companies that distribute products derived from wood. As well as BASA plates and hardware. Local company that distributes door plates, hardware and furniture accessories. Northwest Woods Group. Leading supplier of high-quality imported woods offering plywood, mahogany and cedar plywood for sale from Southeast Asia (Thailand, Malaysia and Vietnam).

Currently the mission is "To make our clients' ideas come true in wood, guaranteeing them quality in the personalized service we provide to each one of them and the happiness of having a fitted kitchen, closet or door to suit them." Where its three main products are listed, being the integral wooden kitchens the product with the highest sales.

Its vision is "To be distinguished as a leading company in the manufacture of integral kitchens, closets and wooden doors with a presence throughout Sinaloa" expresses the intention of opening branches in Ahome and Mazatlán to cover the length of the state, as services are currently provided to a distance of up to 300 km with reported sales in Mazatlán for $ 56,000.00 and in Ahome $ 29,000.00 in 2016.

It is worth mentioning that as they are micro or small size companies, they are usually managed by the owners themselves, who in most cases have little or no administrative knowledge that impacts the development of the company and the industry. The problem of this industry lies in the fact that the main input used in the elaboration of integral kitchens is of foreign origin, the finished products are made up of 80% imported wood.

Faced with this problem, the following general research question is posed:

How is the maximum probable loss of raw material purchases that varies according to the US dollar for the manufacture of integral kitchens in the CarPical micro industry measured in the period 2014 to 2016 for analyze the management of exchange rate risks?

The specific questions are:

a) How much is the maximum probable loss according to the Value at Risk (VaR) model of the peso / dollar exchange rate and the net purchases of supplies in the CarPical company?

b) How is the maximum probable loss of the net purchases of inputs and the peso / dollar exchange rate interpreted for making financial decisions?

c) Is it convenient to manage exchange risk with derivative products offered in financial markets?

General and specific objectives are:

General Objective: To measure the maximum probable loss of raw material purchases that varies according to the US dollar for the manufacture of integral kitchens in the CarPical micro-industry in the period 2014 to 2016 to analyze the management of exchange rate risks.

Specific objectives:

a) Calculate the maximum probable loss according to the VaR model of the net purchases of inputs and the peso / dollar exchange rate in the CarPical company?

b) Interpret the maximum probable loss of the net purchases of inputs and the peso / dollar exchange rate.

c) Analyze the convenience of investing in derivative products offered in financial markets for exchange risk management.

On the other hand, according to data provided by Banco de México, on January 1, 2014 the exchange rate of the Mexican peso / US dollar was quoted at 13,1011. In June 2016, a new resistance of 19.1283 was presented, outlining the dollar. Díaz and Venegas-Martínez (2001) affirm that a company whose main input is imported requires derivative instruments that allow them to manage risk. They propose the use of futures on agricultural products because despite the fact that Mexico has an organized market that offers hedging for all economic sectors, products from the deregulated or over the counter [OTC] market are used.

The exchange risk due to exchange rate fluctuations affects the value of companies. Therefore, it is invested mostly in instruments for hedging exchange risks with derivative products, asserts Vivel (2010). In contrast, Salazar-Garza (2012) argues that hedges with derivative products are very expensive for Mexican companies, so they suggest the use of the fuzzy logic

model to forecast exchange rates and manage this risk without contracting derivatives. Also, unlike the economic sectors analyzed by the authors cited in the previous paragraph, this study analyzes the impact of exchange rate risk in the economic line of manufacturing integral kitchens and modular bathroom furniture in Sinaloa in a unique case. that requires inputs that vary in price by the exchange rate of the Mexican peso / US dollar.

With the aforementioned, there is the following theoretical assumption that guides this research article, which is: The hedging derivative products offered by the financial market are not adequate to manage the exchange risk of micro-sized companies that acquire listed raw materials in dollars.

Finally, administration is the science that is in charge of planning, directing, organizing, implementing and controlling the resources of an organization. Its importance lies in the application or not of the scientific knowledge generated in the administrative area as a fundamental tool in all types of companies.

This study is directed to the analysis of exchange risk management through hedging alternatives with derivative products in the financial market. The single case study methodology is developed. The Risk Simulator Software was used to calculate the Value at Risk (VaR). It is composed of an introduction, theoretical framework, methodology, analysis and presentation of results, discussion and conclusions.

2. THEORETICAL FRAMEWORK

This section presents a tour of the accepted theories. As indicated (Hernández, Fernández, & Baptista, 2014), the theoretical framework consists of theoretically supporting the study, once the research problem has already been raised.

Risk management is the process of establishing the strategic, organizational and management context. The risks for treatment, their measurement and control are then identified, analyzed and evaluated. In order for the organization to minimize risks and maximize opportunities (Giler, et al., 2016). Likewise, Avilés (2014) affirms that exchange risk management seeks to reduce the probability of unexpected reductions in cash flows in companies. Managing it causes an increase in the value of the company and its competitiveness. It shows that this management reduces exposure and identifies unanticipated changes in the exchange rate.

Likewise, Álvarez (2014) asserts that exchange risk managers identify and measure volatility and its causes. First, they recognize the problem, to predict

it and thus define an action plan. It is framed in the theory of financial management, decision theory, econometric and time series models, as well as the analysis of the impact of the identification and exposure of the exchange rate in companies. It is worth mentioning that the smaller companies lack up-to-date financial information and macroeconomic indicators to better manage exposure to comprehensive and foreign exchange risk in their organizations.

The risk management industry provides vital services to both speculators and risk managers. The decision to purchase currency hedges depends on exposure and risk aversion. According to Keat and Young (2004), the company is exposed to three types of currency risk: Operational, transaction and accountant.

The Value at Risk (VaR) was proposed by the G30, a group of specialists in economic and financial matters, as a model to carry out studies on financial derivatives. It is a basic tool for risk management with applications in the management of credit, market, liquidity and other fields according to (Zhao, Bai, and Shao, 2014). Plascencia (2012) defines VaR as the maximum loss that an investment portfolio can have in an established time horizon with normal market conditions. For its calculation according to the parametric method on historical volatility with the DELTA - NORMAL technique, the following expression is shown according to Rojas, M. (2012,4m32s):

$$VaR = S * \sigma activo * F * \sqrt{\Delta t}$$

Where:

S, Investment amount at market prices

$\sigma\ activo$, asset risk

F, Number of standard deviations for the given confidence level

Δt, Period of time given in days

The above formula can be developed in Excel Spreadsheets. The non-parametric method with the Montecarlo simulation technique is also proposed for a better probability distribution, it is applied to calculate the VaR with the use of Risk Simulator software (Rojas, M., 2018, 1m22s).

The process is:

1) Risk simulator
2) Create profile in the simulator
3) Analytical tools
4) 11- Simple distribution adjustment
5) Adjustments for continuous distributions

6) Kolomogorov-Smirnof criterion. Add a new sheet "distribution adjustment"
7) Consider input assumption the best distribution identified.
8) Define output forecast
9) Run the simulation
10) Consider the histogram obtained, (Rojas, M., 2018, 2m07s).

Special mention, decision-making based on risk management has always been important in everyday business life. Enterprise Risk Management - Enterprise Risk Management- is the approach that consists of managing the risks faced by an organization from the system perspective (Wu, Olson, & Dolgui, 2015). Budniks and Didenko (2012, p. 1171) state that decision-making in microenterprises presents a high degree of risk and uncertainty. In this regard, Flores Jiménez and Hernández Ortiz (s / f, p. 7) mention that there is no training in companies related to economic aspects that allow the employer to make decisions in this regard and to be competitive in this regard.

Foreign exchange risk is mostly managed in large companies that require considerable amounts of raw materials and whose price fluctuations directly affect their profitability. According to Berk and DeMarzo (2008), there are two ways to manage this risk, the first is to carry out a vertical integration in which a partnership is established with the supplier of the raw material to ensure the supply of the raw material even when the price is bullish. It is worth mentioning that with this management strategy the company minimizes one risk, but acquires many others, which is why it is not a perfect hedge.

The second strategy proposed by Berk and DeMarzo (2008), consists of acquiring large quantities of raw material and inventory it, in this way it freezes the price of the material while it has inventory, but increases storage costs, so this aspect should be considered at the same time. time to decide, as well as the large outlay involved in adopting this strategy.

On the other hand, hedging with long-term contracts is an alternative in which the company sets a price with the supplier in the long-term, anticipating price increases or falls. This strategy represents an advantage for financial planning, but at the same time a threat, because in the event that a 10-year price is agreed and that the price falls in the fifth year, it will have to be paid at a price higher than the market price. The inability to cancel the contract in case it is detrimental represents a disadvantage of this coverage.

Hedging with input futures contracts is an adaptation of the previous strategy in which both the buyer and the seller can cancel the contract at the moment they consider it appropriate, only selling this contract to a third party at market price without waiting for the expiration.

Futures contracts are designed to minimize the credit risk assumed by the two parties that the counterparty does not comply with the obligation to pay the price or deliver the good, for which there is a mechanism called market adjustment in which the discounting the change in price from a margin deposited by both, that is, "the gains or losses of the contract are calculated each day based on the change in the price of the futures contract" (Berk and DeMarzo, 2008, p. 937).

The correct use of hedges reduces the variability of the company's cash flows, which reduces the chances of closing the business. The objective of a hedging program should be that currency hedges increase the expected value of cash flows in national currency and reduce their variability (Kozikowski, 2013).

It should also be mentioned that the renowned economist Paul Krugman & Obstfeld (2006) indicate that due to their strong impact on the current account and other macroeconomic variables, exchange rates are one of the most important prices in an open economy, as is the case in Mexico. It should be noted that exchange rates play a fundamental role in international trade, since they allow comparing the prices of goods and services produced in different countries.

The currency market, according to Kozikowski (2013) is the largest and most liquid financial market in the world, it is known as the exchange or forex market. In this market, banks, companies and individuals buy and sell currencies. According to Mansell (1996), a currency is a currency freely converted into another in the forex market, the exchange rate is determined by the law of supply and demand in this same market.

Once purchasing a product is required to manage risk, the appropriate one is sought in the derivatives market. The international derivatives market can obtain contracts to manage risk, which and the way in which they are organized, either Over the counter OTC (without regulation) or, in the case of Mexico, in the Mexican Derivatives Market, which is regulated and its products are futures and options contracts.

3. METHODOLOGY

The unique case study methodology of the CarPical Micro industry located in Culiacán, Sinaloa, Mexico is carried out with the collection of qualitative

data through an open interview with the business owner and with the collection of monthly financial information from 2014 to 2016 with the purchase invoices of the raw material inventories that its price varies according to the US dollar, which is cedar plywood plywood in 15mm presentation. Secondary data published by the Bank of Mexico of the exchange rate between pesos per U.S. dollar were also used. to settle obligations denominated in foreign currency, date of publication in the D.O.F. Average prices from January 2014 to December 2016.

In the second stage, with the data already organized, the Pearson correlation was performed to determine if the variable "material price" is related to the variable "exchange rate" and to show the degree of correlation that exists between these two variables, with the SPSS version 25 software application.

The value at risk (VaR) model was used to measure the maximum probable loss. To quantify the amount of money that the CarpiCal company can lose as a result of currency risk; The VaR was applied by the non-parametric Montecarlo simulation method for a better probability distribution with the Risk Simulator Software for both net purchases and the peso-dollar exchange rate.

4. ANALYSIS AND PRESENTATION OF RESULTS

In the first place, an open interview was applied to the owner of the company who identified himself by the name of Luis Fernando Caldera Lizárraga, claiming to be the administrator and responsible for the purchases of raw materials since the company began with the CarPical name since 2013. The key informant was asked what impact he considers the exchange rate has on the purchase of raw materials. The interviewee replied that the impact has been high, since the price of cedar has fluctuated between 980 and 1200 pesos in a single year from 2016 to 2017. He mentions that in 2015 he bought it for 800 pesos. The raw material of cedar is the one that is most affected by variations and increases in the dollar.

The informant affirms that the effect of currency risk, price variation and quality are related. When there is variation in the prices of materials as an effect of exchange risk, the quality of the materials used in manufacturing decreases. Likewise, the interviewee comments that the changes in the price of cedar plywood are constant and are on the rise, in addition to not presenting a significant decrease in them that help to restore the flows expected by the company. The company's customers give up their purchase expectations when they find prices that are not within their reach.

According to Krugman, Olney, and Wells (2008, p. 62) “people's consumption expectations can increase or decrease the demand for a good”. The informant was questioned about the strategies to deal with the problem of cedar raw material priced in dollars, which has increased due to exchange rate risk. His response was that as consumers' purchase expectations for products made with cedar plywood decrease, the demand for the business is reduced and to offset this decrease in the interest of CarpiCal customers, the company offers products based on Lower priced materials than cedar to maintain its sales.

The characteristics of consumers of cedar products change, they go from being middle class to being only customers with high purchasing power, directly reducing the sales of cedar products. According to David (2013), the company has some power over customer decisions, but there are variables that remain outside the manipulation of companies. The characteristics of the consumer cannot be controlled by whoever offers the product, but can work with the marketing mix to try to influence the consumer to acquire the product that the company markets as the CarpiCal company does.

In the analysis of the interview with the key informant, it is observed that the company in question experiences a state of uncertainty derived from the exchange risk that causes the rise in the inputs used in the transformation of final products; which could be reduced due to the possibility of importing the materials by fixing the dollar price and also potentiating the increase in the quality of the material used.

The determination of the exposure to exchange risk was carried out in two sections. On the one hand, a simple linear regression was carried out to correlate the two variables and verify that, in effect, purchases are related to the exchange rate. Subsequently, the value at risk was developed to determine the maximum amount of loss in CarpiCal purchases as a consequence of the exchange risk and finally the calculation of the VaR of the peso-dollar exchange rate in the analysis period. For the collection of documentary data of the CarpiCal company, the owner was requested all the fiscal receipts of raw material purchases, taking up only the prices of 15mm cedar plywood and the volume in units, the periodicity and quantity in the variation of prices.

According to the interview with the key informant of the CarPical company, he affirms that the price of its main input varies according to the peso / dollar value. For this, it is demonstrated with the calculation of the Pearson correlation index in the SPSS version 25 program, which resulted in 0.953,

which indicates the existence of a high relationship between the unit price of the plywood and the peso / dollar exchange rate. These calculations were made with the following data. See tables 1 and 2 below.

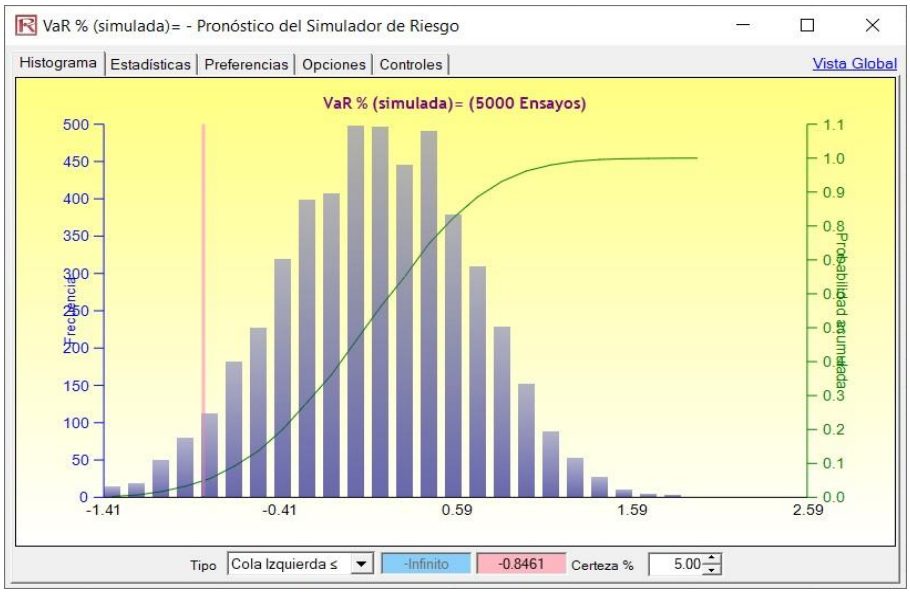
Table 1: Unit price of raw material (Mexican Pesos)

Month	Unit price plywood 2014	Unit price plywood 2015	Unit price plywood 2016
January	759.60	979.28	1,120.75
February	879.00	980.00	1,190.20
March	881.98	980.00	1,193.60
April	881.98	987.50	1,099.99
May	785.25	987.50	1,115.20
June	890.00	987.50	1,115.20
July	890.00	994.60	1,150.15
August	890.00	999.90	1,150.15
September	890.00	989.70	1,197.33
October	895.06	989.70	1,197.33
November	895.06	1,015.25	1,208.00
December	979.28	1,100.00	1,208.00

Source: Own elaboration based on purchase invoices from the case study.

The data from Table 1 were captured in an Excel Spreadsheet, in a second column the growth of net purchases was calculated, dividing the current month with respect to the previous month multiplying the result by the natural logarithm. Continuing with the use of the Risk Simulator add-in in Excel, a profile is created with a number of 5000 tests, and with the sequence of random numbers of 123456.

Next, analytical tools are selected in the simple distribution adjustment option, as Kolmogorov Smirnov criteria. As a result, the best probability distribution that explains the profitability of the asset is Weibull Shifted by 57.96% with an adjusted assumption of -0.00805; Subsequently, this setting is selected to calculate the output forecast to run the simulation, resulting in a VaR% of 5000 trials, a factor of -0.8461 (See figure 1); This factor measured in percentage is multiplied, which remains as -84.61% by the total accumulated net purchases during the analysis period, the amount of $ -378,273.03.



Source: Own elaboration.

Figure 1: Simulated VaR (%) of the maximum probable loss of net purchases

The result of the VaR was -378,273.03, which is interpreted as the maximum divestment of the plywood raw material inventory, since the strategy followed by the analyzed company is the substitution of cedar with other lower-priced materials.

On the other hand, the calculation of the VaR of the peso / dollar exchange rate variable, the same steps of the risk simulator Excel add-in were followed. The non-parametric Montecarlo simulation method was also applied to identify the best probability distribution of the profitability of the asset, in this case the exchange rate with a confidence level of 95%, and a time horizon of 1 month.

Table 2: Average peso / dollar exchange rate. Period: 2014-2016

Month	Exchange rate 2014	Exchange rate 2015	Exchange rate 2016
January	13.2097	14.6808	18.0255
February	13.2881	14.9231	18.4777
March	13.2042	15.2136	17.6923
April	13.0691	15.2208	17.4905

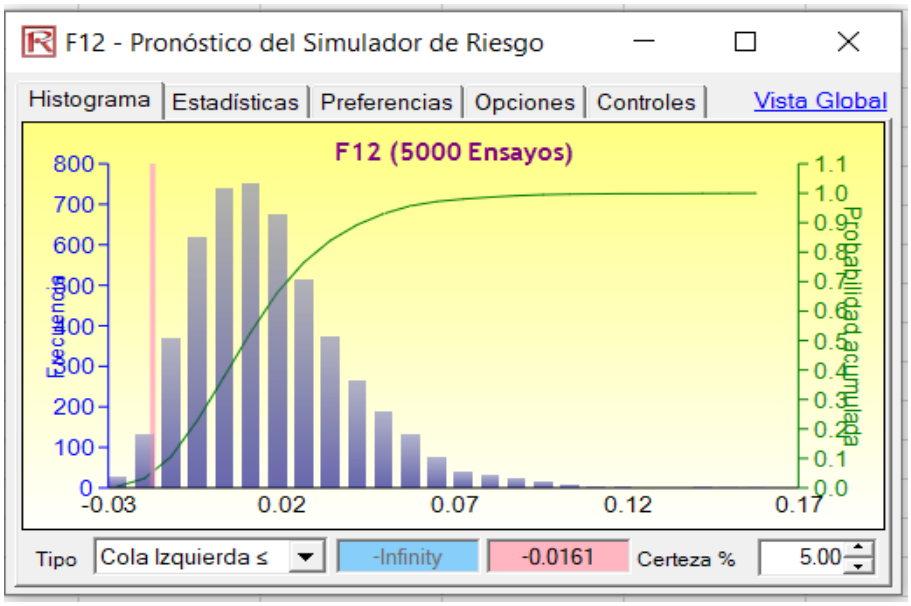
Month	Exchange rate 2014	Exchange rate 2015	Exchange rate 2016
May	12.9356	15.2640	18.0980
June	12.9905	15.4692	18.6506
July	12.9793	15.9225	18.5862
August	13.1478	16.5032	18.4715
September	13.2182	16.8519	19.1678
October	13.4743	16.5813	18.9157
November	13.5995	16.6325	20.0371
December	14.4727	17.0365	20.5156

Source: Prepared based on data published in Banco de México's Economic Information System (2017). Recovered from

https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=6&accion=consultarCuadro&idCuadro=CF86&locale=es#contenidoPrincipal

The model was run with the data from table 2, also in an Excel spreadsheet; in a second column, the growth of the exchange rate yield was calculated with a natural logarithm, a profile is created with a number of 5000 tests, and with the sequence of random numbers of 123456. Analytical tools are selected in the distribution adjustment option simple, as Kolmogorov Smirnov criterion. The best probability distribution that explains the profitability of the asset is Gumbel Maximum at 99.93% and the adjusted assumption of 0.01258.

The simulation is run, and the simulation forecast is -1.61%, (See figure 2), multiplied by 565,189 pesos, the total amount of the market value, which results from multiplying 27, 529.24 dollars invested in the period, multiplied by $ 20.5156 as the value of the dollar as of December 2016 The total VaR, that is, the maximum probable loss expected for the following month is -9,099.54 pesos. Finally, the achievement of the proposed objectives is observed, since the VaR was calculated for both raw materials and the exchange rate, clearing the non-parametric Monte Carlo simulation method.



Source: Own elaboration.

Figure 2: VaR (%) simulated of the maximum probable loss of the peso / dollar exchange rate

It was identified that the maximum divestment of the raw material, cedar plywood, for the next month was -378,273.03 pesos and the maximum probable loss expected for the following month of the peso / dollar exchange rate was -9,099.54 pesos. It is interpreted that it is not advisable to invest in derivative products such as hedges of futures and options offered in the financial market.

5. ASSUMPTION TESTING

It is noted that the theoretical assumption made "the hedging derivative products offered by the financial market are not adequate to manage the exchange risk of micro-sized companies that acquire raw materials priced in dollars" has been empirically verified in the CarPical company since the size of the futures contract is US $ 10,000, hence the analysis company could not agree to manage its exchange risk using this alternative (MEXDER, 2017). It coincides with what was stated by Salazar-Garza (2012) who affirms that risk management through derivatives is expensive for Mexican companies. Unlike Stover and Biafore (2014) indicate that microenterprises have the option of contracting derivative financial instruments in order to “insure” against exchange rate movements.

This would allow them to price the dollar at a certain amount and take advantage of those dollars to purchase a large quantity of material at the

international market price. The final decision to acquire coverage or not will depend on the strategy of the company and the profile of the entrepreneur in assuming the commitments to pay premiums in exchange for fixing the price of the international currency.

On the other hand, for the test of the assumption based on the hedging instruments offered by the international currency market such as futures and options contracts are adequate to face exchange risk for micro-sized companies in the acquisition of materials premiums in dollars, the Monte Carlo simulation method was used.

According to Stover and Biafore, (2014) it allows calculating probabilistic values to generate forecasts, which indicated that micro-enterprises have the option of contracting derivative financial instruments in order to "insure" against exchange rate movements. This would allow them to price the dollar at a certain amount and take advantage of those dollars to purchase a large quantity of material at the international market price. The final decision to acquire coverage or not will depend on the strategy of the company and the profile of the entrepreneur in assuming the commitments to pay premiums in exchange for fixing the price of the international currency.

6. DISCUSSION

Once the objective of this work was achieved, which was to know the impact of exchange risk management for decision-making in the acquisition of imported inputs for the improvement in cash flow management through an interview with a key informant who warns that there is a negative impact on the flow of the company when there is an increase in the peso / dollar exchange rate. The quantitative data analyzes also show this, with a correlation greater than 0.90 between the exchange rate and price of the imported input variables. The maximum amount of loss is calculated using VaR and projections with the Monte Carlo simulation method.

Now, what remains under discussion is to know the aversion to risk and the implicit costs of the proposed acquisition of futures and options contracts for the management of exchange risk in the micro-industrial companies of the unit of analysis that was studied. The alternative of creating a consumer cooperative is also considered for discussion, as it is considered an opportunity to reduce the obligations of the premium payments of the coverage contracts by sharing responsibility through the legal figure called the consumer cooperative society. This figure would serve as a bridge to acquire imported material at a preferential price, paying the import costs together. The capital that each partner contributes for the accumulated purchase of the material is gathered and the goods are subsequently distributed in relation to each contribution made.

7. CONCLUSIONS AND RECOMMENDATIONS

The exhaustive review of the literature showed that foreign exchange risk is studied in large international companies, leaving aside micro, small and medium-sized companies, so it was necessary to retake the management models of global companies and adapt it to micro companies., which are generators of economic well-being in Mexico, contributing 39.8% of formal jobs and representing 95.4% of companies throughout the country.

It was verified that there is a high impact between the peso / dollar exchange rate and the main product that the studied company consumes, with a Pearson correlation level of 95%, thus demonstrating that the Sinaloa micro industry that buys imported products is susceptible to currency risk.

The application of VaR allows the micro industry to identify its maximum probable losses for making timely financial decisions, as well as for the design of its investment and market strategies to increase its cash flows.

REFERENCES

Álvarez, G. (2014). Lógica borrosa, efectos olvidados y exposición al riesgo cambiario. Ediciones del Lirio, en coedición con Universidad de Occidente.

Avilés, E. (2014). La gestión del riesgo cambiario. Teoría y evidencia. México, 1994-2011. Avilés (Ed), Economía y Empresa. (pp. 17-43). Editorial Ediciones de Lirio-Universidad de Occidente.

Banco de México. (25 de Febrero de 2016). *Banco de México.* Recuperado el 22 de Junio de 2016, de http://www.banxico.org.mx/informacion-para-la-prensa/comunicados/sector-externo/balanza-de-pagos/%7B95C91B3E-E6F1-9E5E-7A9D-7C04A5ADD53C%7D.pdf

Berk, J., & DeMarzo, P. (2008). *Finanzas Corporativas* (Primera ed.). (P. M. Rosas, Ed.) México: Pearson educación.

Budņiks, L., & Didenko, K. (2012). SME Management Decision-Making Problems in Changing Market Conditions, Latvian Experience. *Economics and management, 17(3),* 1171-1177.

David, F. R. (2013). Conceptos de administración estratégica (Decimocuarta ed.). México: Pearson educación.

DENUE. (2 de Marzo de 2016). *Directorio Nacional de Unidades Económicas*. Recuperado el 2 de Marzo de 2016, de http://www3.inegi.org.mx/sistemas/mapa/denue/default.aspx

Diaz, J. T., & Venegas-Martínez, F. (2001). Política agrícola y contratos de futuros: un modelo de arbitraje. *Movimiento económico*(115), 2-21.

Flores Jiménez, R., Hernández Ortiz, I., & Flores Jiménez , I. (s/f). Universidad Autónoma del Estado de Hidalgo. Recuperado el 11 de Marzo de 2016, de http://www.uaeh.edu.mx/investigacion/estl/LI_AdmninEst/Ruth_Flores/caracterizacion_gral_pymes.pdf

Gascón, V. (06 de Febrero de 2012). Crean 400 mil pymes; quiebra la mitad. Grupo Reforma Servicio Informativo.

Giler, K. & Mendoza, K. & Paredes, P. (2016).Gestión de riesgo empresarial Evaluación y mejoramiento del control interno de fundaciones. Estudio de caso. Editorial Universitaria Abya-Yala Quito Ecuador.

Hernández Sampieri, R., Fernández Collado, C., & Baptista Lucio, P. (2014). *Metodología de la investigación* (Sexta ed.). México D.F.: McGraw Hill.

INEGI. (11 de Febrero de 2016). *Instituto Nacional de Estadística y Geografía*. Recuperado el 11 de Febrero de 2016, de http://www.inegi.org.mx/est/contenidos/proyectos/ce/ce2014/

INEGI. (2015). *Micro, pequeña, mediana y gran empresa: estratificación de los establecimientos.* Instituto Nacional de Estadística y Geografía. México: INEGI.

INEGI. (s.f.). *Instituto Nacional de Estadística y Geografía*. Recuperado el 16 de noviembre de 2016, de http://www.inegi.org.mx/inegi/contenidos/investigacion/Experimentales/Esperanza/default.aspx

INEGI. (s/f). *Instituto Nacional de Estadística y Geografía*. Recuperado el 11 de Febrero de 2016, de http://www.inegi.org.mx/est/contenidos/proyectos/ce/ce2014/

Keat, P. G., & Young, P. K. (2004). Economía de empresa (Cuarta ed.). México: Pearson educación.

Kozikowski, Z. (2013). *Finanzas internacionales* (Tercera ed.). México D.F.: McGrawHill.

Krugman, P. R., & Obstfeld, M. (2006). *Economía internacional.* Pearson Educación.

Krugman, P. R., Olney, M. L., & Wells, R. (2008). *Fundamentos de economía.* Reverté.

Mansell Carstens, C. (1996). Las nuevas finanzas en México (Primera ed.). México: Milenio.

Mercado de Derivados Mexicano, MEXDER (2017). Contratos de futuros listados en MEXDER. México. Grupo Bolsa Mexicana de Valores. Recuperado de https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=6&accion=consultarCuadro&idCuadro=CF86&locale=es#contenidoPrincipal

OECD. (2013). (O. publishing, Ed.) Recuperado el 13 de Febrero de 2016, de http://www.keepeek.com/Digital-Asset-Management/oecd/industry-and-services/temas-y-politicas-clave-sobre-pymes-y-emprendimiento-en-mexico/desempeno-de-las-pequenas-y-medianas-empresas-y-el-emprendimiento-en-mexico_9789264204591-7-es#page1

Plascencia Cuevas, T. N. (2012). Value at risk using financial copulas: Application to the Mexican exchange rate (2002-2011).

Rojas, M. (10 de julio de 2012). *Valor en Riesgo (VaR) para un activo riesgoso. Parte 1 de 2*. [Archivo de video]. Youtube. https://www.youtube.com/watch?v=kZG7pLnxIdU&list=PLjMGPOR-8DMjBqUe216_XDLHime3zuU0u&index=1

Rojas, M. (16 de septiembre de 2018). Cálculo del VaR simulación Montecarlo sobre mejor distribución. Video 5 de 6. [Archivo de video]. Youtube. https://www.youtube.com/watch?v=A2iKOo2H9aM&list=PLjMGPOR-8DMjBqUe216_XDLHime3zuU0u&index=8

Salazar Garza, R. (2012). El peso mexicano: gestión de cobertura del riesgo cambiario mediante la Teoría de los Efectos Olvidados. *Journal of Economics, Finance & Administrative Science, 17(32)*, 53-73. Obtenido de http://www.redalyc.org/articulo.oa?id=360733612005

Vivel Búa, María Milagros (2010). EL RIESGO CAMBIARIO Y SU COBERTURA FINANCIERA. Revista Galega de Economía, 19(2),1-5. [fecha de Consulta 29 de noviembre de 2020]. ISSN: 1132-2799. Disponible en: https://www.redalyc.org/articulo.oa?id=391/39115730011

Wu, D., Olson, D., & Dolgui, A. (2015). Decision Making in Enterprise Risk Management. Omega, 57, 1-122.

Zhao, L., Bai, R., & Shao, Y. (2014). Exchange rate risk estimates of the foreign contracted projects based on the model of VaR. Applied Mechanics and Materials, 638-640, 2327-2331. doi:doi:10.4028/www.scientific.net/AMM.638-640.2327