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Foreign Exchange Risk Management and Hedging Strategies: The Case of a Multinational Industrial Group

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Abstract: OCP and its affiliated companies hold a prominent position in their respective industries and conduct business across international markets. Against this background, this study examines foreign exchange exposure, with particular emphasis on the Centre d'Excellence Comptable (CEC), one of the Group's subsidiaries. The research aims to identify the approaches and instruments that can be used to forecast, assess, and control the financial consequences of exchange rate movements. It also explores suitable hedging mechanisms designed to reduce the potential impact of currency fluctuations. To conduct this investigation, qualitative data were collected through interviews with managers and staff members from different organizational levels within Financial Administration and Budgeting Division, the Internal Audit and Performance Monitoring Division, as well as several operational units at the Jorf Lasfar industrial site. Following the examination of the collected information, the study evaluates the findings by estimating the potential foreign exchange losses faced by JFC, an OCP Group subsidiary. This assessment relies on two approaches: the historical Value at Risk (VaR) method and the parametric VaR model. Both techniques are applied using confidence thresholds of 95% and 99%, over holding periods of one and ten days, respectively.

Keywords: Foreign exchange exposure; Currency fluctuations; Exchange rate risk; Value at Risk (VaR); Hedging strategies
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1. Introduction

In recent years, companies have expanded and diversified as a result of their increasing openness to international markets, through import and export transactions involving new markets, or through establishing a presence abroad by means of subsidiaries. Consequently, these companies are exposed to foreign exchange risk arising from fluctuations in exchange rates, which may affect their financial results and long-term sustainability. Foreign exchange risk arises from unfavorable exchange rate movements for importers when the exchange rate appreciates, while the opposite applies to exporters, whose risk results from the depreciation of the foreign currency.

In Morocco, the phosphate sector is a major sector involved in international transactions. It constitutes a key sector that contributes significantly to national exports. Phosphate accounts for 94% of Morocco's mining output, its contribution to national exports amounts to an annual average of 27%, and it also contributes approximately 6% of national GDP. OCP is considered the dominant player in the phosphate and phosphate-derivatives market, with a global market share of nearly 30%. It is regarded as one of the world's foremost suppliers of phosphate and phosphoric acid, while also holding a prominent position in the global fertilizer industry. It should be noted that OCP SA is highly exposed to international markets through commercial transactions denominated in foreign currencies, particularly the euro and the US dollar.

Since OCP SA holds assets and liabilities denominated in euros and US dollars, exchange rate fluctuations make its financial results particularly sensitive to currency movements. Indeed, as the company operates with daily exchange rates, an increase in the exchange rate applicable to the company's liabilities leads to an increase in its expenses, whereas a decrease in the exchange rate applicable to its foreign-currency assets results in a reduction in revenues received in foreign currency. Consequently, exchange rate fluctuations may affect the company's assets and liabilities, profit margins, and financial profitability.

Furthermore, it is essential to properly assess and manage foreign exchange risk in order to minimize the losses associated with this risk and its effects on the company's performance. The objective of this study is primarily to assess and manage transaction foreign exchange risk within OCP SA by presenting the foreign exchange position for each foreign currency. This is also achieved through the application of the Value at Risk (VaR) model to the company's portfolio of foreign-currency loans and borrowings, as this model represents one of the most widely used methods for assessing financial risk. It enables the assessment of the highest expected financial loss at a defined confidence level and within a predetermined period.

The objective of this study is therefore to assess and manage foreign exchange risk within OCP SA. In this context, we propose to assess foreign exchange risk using the **Value at Risk (VaR)** model, which is recognized as an important risk measurement tool, and to suggest hedging strategies aimed at mitigating this risk and minimizing the company's exposure to exchange rate fluctuations.

To achieve this objective, we seek to examine the following study objective:

“How can foreign exchange risk at OCP SA be assessed and managed using the Value at Risk model?”

To address this research question, a mixed-methods approach was adopted, combining qualitative and quantitative methods. From an epistemological perspective, our analysis was based on the **positivist paradigm**, using a **hypothetico-deductive approach** and considering the following hypotheses: H0 and H1.

To this end, interviews were conducted with managers from different hierarchical positions within the Financial Administration and Budgeting Division and the Internal Audit and Performance Monitoring Division, as well as with employees from various departments at the Jorf Lasfar site. Following the analysis of the collected data, the results were processed accordingly. More specifically, we compared

the potential losses that could be incurred by **JFC**, a subsidiary of the OCP Group, using two VaR approaches: **Historical VaR** and **Parametric VaR**. The two methods were evaluated at two confidence levels, 95% and 99%, and over time horizons of 1 and 10 days, respectively.

This research is organized into two principal sections. The initial sectionpresents a review of the literature on foreign exchange risk. The second part constitutes the empirical section of the report, which focuses on assessing and managing foreign exchange risk within OCP SA, analyzing the results obtained, and finally providing recommendations aimed at hedging against foreign exchange risk.

2. Literature Review

2.1 Literature Review

Foreign exchange risk management has attracted sustained attention in international finance because exchange rate fluctuations can affect firms' cash flows, profitability, firm value, and financing conditions. The literature has progressively evolved from the measurement of foreign exchange exposure toward the identification of appropriate hedging strategies and the development of quantitative risk-management techniques.

Adler and Dumas (1984) provide one of the foundational contributions to the literature on foreign exchange exposure. They conceptualize exchange rate exposure as the sensitivity of a firm's economic value to changes in exchange rates and emphasize that such exposure can arise through different channels, including foreign-currency-denominated assets and liabilities, operating cash flows, and competitive effects. Their contribution established an important theoretical basis for subsequent empirical research on corporate foreign exchange exposure.

Jorion (1996) subsequently contributed to the development of quantitative market-risk measurement through the Value at Risk (VaR) framework. VaR estimates the potential loss of a portfolio over a specified time horizon at a given confidence level. This approach has become an important tool for financial risk measurement because it provides managers with a single quantitative indicator of potential losses under normal market conditions. However, VaR also presents limitations, particularly its sensitivity to the choice of methodology, confidence level, time horizon, and assumptions concerning the distribution of financial returns.

Müller and Verschoor (2006) reviewed the extensive literature on foreign exchange exposure and highlighted the difficulty of empirically identifying the sensitivity of firm value to exchange rate movements. Their findings show that theoretical exposure can differ substantially from observed exposure because firms may actively manage or hedge their currency positions. This distinction is particularly important when analysing firms operating in internationally integrated markets.

Recent studies have further reinforced the relationship between currency exposure and corporate risk-management practices. Fisch and Puhr (2022) examine financial hedging and operational flexibility as alternative mechanisms for managing exchange-rate uncertainty. Their results indicate that the performance of financial risk mitigation strategies is influenced by the characteristics of multinational firms and their subsidiary networks. Financial hedging can reduce the negative effects of exchange-rate uncertainty on firm value, while operational flexibility may provide an alternative mechanism for responding to currency fluctuations.

Hecht and Lampenius (2023) provide more recent empirical evidence on how firms manage their foreign exchange exposure. Using publicly reported information on firms' foreign-currency exposures and hedging instruments, they find that approximately 80% of the identified foreign exchange exposure is managed through risk-reducing strategies. Their analysis also shows that previous hedging outcomes can influence subsequent hedging decisions, suggesting that corporate currency-risk management dynamic and changes in reaction to previous market outcomes.

He, Wang, and Yu (2023) further investigate corporate foreign exchange exposure by examining the relationship between exchange-rate co-movements and firm-level exposure in China. Their results show that the co-movements of developed-market currencies can have a stronger effect on corporate exposure than those of emerging-market currencies. The study also highlights the role of currency internationalisation in modifying firms' exposure to exchange-rate fluctuations.

The recent literature also emphasizes that the consequences of exchange-rate movements can be particularly significant during extreme currency shocks. Research on the Swiss franc appreciation of January 2015 shows that firms may remain exposed to currency tail risk even when they use operational pass-through and hedging mechanisms. Extreme exchange-rate movements can therefore have real effects on corporate investment and economic activity.

Recent studies have also examined the effectiveness of different hedging instruments. Zai and Mansur (2024), in a literature review covering studies published between 2018 and 2024, show that firms use both financial derivatives and operational hedging techniques to mitigate foreign exchange exposure. Their review highlights the importance of firm characteristics, including size, leverage, growth opportunities, and the degree of foreign exchange exposure, in determining hedging decisions. The authors also emphasize that the effectiveness of hedging strategies can vary according to the characteristics of the firm and the nature of its exposure.

2.2 Tit Evidence from the Moroccan context

The Moroccan literature has also increasingly addressed foreign exchange exposure and corporate hedging practices. STI, Kabbaj, and Kasbaoui (2023) investigate currency risk exposure across firms listed on the Casablanca Stock Exchange. Their empirical analysis finds that 14.92% of the firms in their sample exhibit significant foreign exchange exposure, with the banking sector showing particularly strong sensitivity.

More recently, STI et al. (2024) examine the impact of exchange-rate fluctuations on the market value of Moroccan non-financial listed firms. Using a sample of 49 companies over the period 2018–2021, the authors find that 14.28% of the firms exhibit significant foreign exchange exposure. Firm size, export intensity, and leverage are identified as important determinants of this exposure. These findings are particularly relevant in the context of Morocco's gradual exchange-rate regime reform.

Hamami and Krami (2024) extend the Moroccan evidence by examining foreign exchange risk-management practices among 117 non-financial Moroccan firms. Their findings reveal that the adoption of standardized financial instruments is particularly influenced by firm size and sector. Moreover, firms with greater international exposure tend to adopt more diversified and sophisticated hedging strategies. The study also suggests that hedging practices contribute to greater financial stability and resilience to exchange-rate fluctuations.

The Moroccan institutional environment has also evolved in recent years. The gradual reform of the exchange-rate regime has increased the importance of foreign exchange risk management for Moroccan companies. The OECD notes that Morocco progressively widened its exchange-rate fluctuation band and that, since January 2024, Bank Al-Maghrib has used a new methodology for determining foreign exchange reference rates based on interbank transactions. These developments have increased the relevance of exchange-rate risk measurement and hedging mechanisms for Moroccan firms.

The practical relevance of these developments is also visible in large Moroccan corporations. For example, OCP Group reports that its operating and financial flows are exposed mainly to the US dollar and euro and that it manages its currency exposure through natural hedging and spot-market transactions. OCP also uses hedge accounting for certain foreign-currency financing flows.

2.3 Theoretical framework

The theoretical framework of this research combines several complementary approaches. First, **Purchasing Power Parity (PPP)** explains long-term exchange-rate movements through differences in price levels between countries. Second, **Interest Rate Parity (IRP)** establishes a relationship between interest-rate differentials and forward exchange rates, providing a theoretical basis for the pricing of forward contracts. Third, theories of exchange-rate determination and exchange-rate regimes help explain how monetary and institutional conditions influence currency volatility.

In addition, **International Portfolio Theory** provides a framework for understanding currency diversification and the reduction of portfolio risk through investments in assets denominated in different currencies. Finally, the **VaR** methodology provides a quantitative framework for assessing potential financial losses associated with exchange-rate movements. Recent empirical research confirms the continued relevance of VaR and related quantitative approaches for measuring foreign exchange risk, including applications based on dynamic quantile models and backtesting procedures.

Taken together, these theoretical and empirical contributions provide a comprehensive framework for analysing foreign exchange risk. They make it possible to move from the identification of currency exposure to its quantitative measurement and, subsequently, to the evaluation of appropriate hedging strategies. This framework is particularly relevant to the Moroccan context, where exchange-rate regime reform, increasing internationalisation, and the development of corporate hedging practices have strengthened the need for effective foreign exchange risk-management mechanisms.

3. Research Methodology

In this section, we will first present the research methodology and the host organization. Secondly, we will assess the foreign exchange risk to which the OCP Group is exposed using the Value at Risk (VaR) method. We will then base our study on a comparison of selected hedging strategies with the systematic non-hedging approach that has been practiced by the OCP Group to date.

The foreign exchange risk hedging strategies whose results will be simulated are **forward exchange contracts, the Export Open Forward (Classical CTO), and the Export Open Forward with Reduced Premium (CTO PR).**

3.1 Presentation and History of the Sample

Our sample, considered one of the world leaders in the phosphate and phosphate-derivatives industry, has played a prominent role on the international stage since its establishment in 1920. Initially known as the Office Chérifien des Phosphates, the OCP Group underwent a legal transformation and became a public limited company, known as OCP S.A., in 2008.

Present throughout the entire value chain, OCP is involved in the extraction, processing, and commercialization of phosphate, phosphoric acid, and fertilizers. It ranks among the world's foremost suppliers of phosphate rock and phosphoric acid, while also being one of the world's largest fertilizer producers.

The Accounting Center of Excellence is located at the heart of the Industrial Skills Center inaugurated at the Jorf Lasfar industrial complex by His Majesty King Mohammed VI. This center aims to meet the OCP Group's need for the industrial skills required to support its industrial strategy, which focuses on enhancing the nation's intangible capital.

The Accounting Center of Excellence provides training to OCP employees and new recruits, as well as to subcontractors and industrial companies operating within the Jorf Lasfar complex. Its primary responsibility is to oversee the accounting activities of OCP's subsidiaries and joint ventures in Jorf Lasfar.

3.2 Data Collection and Analysis Tools.

To conduct our study, it was necessary to use appropriate data collection tools. In our case, we employed a range of complementary tools. In particular, a documentary analysis was conducted with the objective of collecting the data and information required to achieve the objectives of our study. A comprehensive review of documentary sources was carried out, covering, in particular, available balance sheets and income statements, internal files and circulating documents, accounts receivable and accounts payable statements, payment terms, and corporate websites.

For our analysis, we also required foreign exchange rate data for the currencies considered in our study, particularly for the calculation of **Value at Risk (VaR)** and the assessment of hedging strategies. In addition, we carried out interviews with senior and middle-level executives from the **Financial Administration and Budgeting Division** and the **Internal Audit and Performance Monitoring Division**. These managers are responsible for maintaining accounting records, preparing financial statements, and monitoring the implementation of procedures.

We also conducted interviews with analysts from the **Management Control and Budget Department**. These interviews focused on the economic and financial situation of the OCP Group. In addition, interviews were conducted with staff members from several departments at the **Jorf Lasfar industrial complex**.

The analysis of the interview content conducted as part of our exploratory research on foreign exchange risk management within OCP followed a rigorous methodological approach. Following the careful transcription of the interviews, a **thematic analysis method** was employed to detect and categorize relevant emerging central issues. The identification of patterns and trends made it possible to derive significant insights, highlighting both common and organization-specific practices.

The participants' responses were contextualized within the broader organizational environment of OCP, thereby ensuring an accurate interpretation of the findings. **Data triangulation** enhanced the reliability of the results by cross-checking the information against other sources, while a validation stage involving the participants helped ensure the accuracy of the interpretations.

In summary, this content analysis provided an in-depth understanding of foreign exchange risk management practices within OCP, based on rich and contextualized qualitative data.

Following the data analysis, the results were examined accordingly. More specifically, we assessed the potential financial losses faced by **JFC, an OCP-affiliated company**, by applying both methodologies included in the VaR framework. The **historical approach** was calculated using confidence thresholds of **95% and 99%**, then evaluated against the **parametric approach** under identical confidence thresholds and across holding periods of **one and ten days**, respectively.

Furthermore, based on the four quarters examined, we propose recommendations regarding the profitability and relevance of implementing a hedging strategy to mitigate foreign exchange risk.

3.3 Justification of the Research and the Sample

The choice of a case study and OCP as the sample in our methodology is motivated by several strategic and practical considerations aimed at ensuring the relevance and depth of our research.

One of the main reasons is the complexity and specificity of the OCP Group's context. As a major international group operating in the phosphate and chemical industries, OCP faces considerable financial complexity due to its presence in global markets. The case study approach makes it possible to explore the company's internal dynamics in depth and provides a comprehensive perspective on foreign exchange risk management within a complex business environment.

Furthermore, the choice of OCP as the sample is also justified by privileged access to information. Access to internal data and relevant information was essential for conducting a detailed analysis. As research partners, the interviews conducted with OCP managers facilitated the collection of crucial data, thereby improving the quality and reliability of the study.

In addition, the sectoral relevance of OCP constitutes another justification for its selection. OCP plays a leading role in the phosphate and chemical industries, and its case study provides relevant insights for other companies operating in similar industries and facing comparable challenges in terms of foreign exchange risk management.

The study also provides an opportunity for the practical application of the financial theories adopted in our research. These theories can be applied concretely by examining OCP's actual financial operations. The case study therefore provides an appropriate framework for linking theoretical concepts to specific situations encountered by the company.

At the same time, the contextual dimension of the OCP Group is also important. As a company based in Morocco, its selection makes it possible to incorporate a geographical and contextual dimension into the research while taking into account the specific characteristics of the Moroccan currency exchange system.

In summary, the choice of OCP as a case study is justified by the objective of contributing significantly to the understanding of foreign exchange risk in a complex international context, while benefiting from privileged access to essential information required for an in-depth analysis.

4. Evaluation of Foreign Exchange Risk Using the VaR Method

In this section, we will assess the potential loss risk incurred by **OCP** in the context of its international commercial transactions. We will use the **Value at Risk (VaR)** method, given its widespread adoption as a benchmark for measuring market risks, including foreign exchange risk.

In our approach, OCP's average monthly revenue denominated in US dollars will be considered as a portfolio. Foreign exchange risk, namely the adverse change in the value of the US dollar, will be identified as the main risk factor to be considered. This analysis will enable us to estimate the potential amount of loss that OCP could incur as a result of fluctuations in the exchange rate of the US dollar against other currencies, using VaR as a risk measurement tool.

We will also propose several hedging strategies that OCP could consider in order to mitigate its foreign exchange exposure. To apply the VaR method to foreign exchange risk, we require historical exchange rate data covering a sufficiently long period. With regard to OCP, the relevant currency value is the **USD/MAD exchange rate.**

Historical Exchange Rate Data

For our study, we used the **USD/MAD Currency value for the year 2025.** We focus on calculating VaR using the **Historical VaR method** for receivables and payables, as well as using the **Parametric VaR method** for the receivables of **GFC**, a subsidiary of OCP.

4.1 Historical VaR on Receivables

First, we will present a table summarizing the daily dollar exchange rate returns for the 2025 fiscal year. The exchange rate selected to calculate the maximum potential loss on the dollar-denominated receivables portfolio is the buying exchange rate. When the CEC (Accounting Center of Excellence) collects its dollar-denominated receivables, the bank purchases the foreign currency from the company and provides the corresponding amount in Moroccan dirhams (MAD).

Table 1. Calculation of Daily Dollar Exchange Rates for the 2025 Fiscal Year.

No.	Date	Buying Rate	Returns	Sorted Returns	VaR Reference %	VaR AT x%
1	02/01/2025	10,1100	—	—	—	—
2	03/01/2025	10,1540	0,004352127	-0,010679452	0,403226%	99,5967742%
3	04/01/2025	10,1260	-0,002757334	-0,008641171	0,806452%	99,1935484%

4	05/01/2025	10,0740	-0,005135295	-0,006887962	1,209677%	98,7903226%
5	06/01/2025	10,0660	-0,000794123	-0,006314317	1,612903%	98,3870968%
6	09/01/2025	10,0710	0,000496722	-0,006174564	2,016129%	97,9838710%
7	10/01/2025	10,0480	-0,002283785	-0,006162651	2,419355%	97,5806452%
8	11/01/2025	10,0480	0	-0,006155068	2,822581%	97,1774194%
9	12/01/2025	10,0050	-0,004279459	-0,005896868	3,225806%	96,7741935%
10	13/01/2025	10,0080	0,00029985	-0,005558876	3,629032%	96,3709677%
11	16/01/2025	10,0380	0,002997602	-0,005446734	4,032258%	95,9677419%
12	17/01/2025	9,9822	-0,005558876	-0,005351474	4,435484%	95,5645161%
13	18/01/2025	9,9952	0,001302318	-0,005170071	4,838710%	95,1612903%
14	19/01/2025	10,0260	0,003081479	-0,005135295	5,241935%	94,7580645%
15	20/01/2025	10,0020	-0,002393776	-0,004877526	5,645161%	94,3548387%
16	23/01/2025	9,9592	-0,004279144	-0,004703209	6,048387%	93,9516129%
17	24/01/2025	9,9503	-0,000893646	-0,004467411	6,451613%	93,5483871%
18	25/01/2025	9,9536	0,000331648	-0,004401455	6,854839%	93,1451613%
19	26/01/2025	9,9777	0,002421235	-0,004355042	7,258065%	92,7419355%
20	27/01/2025	9,9788	0,000110246	-0,004339016	7,661290%	92,3387097%
21	30/01/2025	10,0090	0,003026416	-0,004329459	8,064516%	91,9354839%
22	31/01/2025	9,9458	-0,006314317	-0,004279459	8,467742%	91,5322581%

Source : Authors' own calculations

Return of D6:

D6 = (C6 − C5) / C5

VaR Reference (%) is obtained as follows:

VaR Reference = Row Number / Total Number of Rows

VaR at x% = 1 − VaR Reference %

The Historical VaR model is based on historical fluctuations in dollar exchange rate returns. The objective is to identify the value corresponding to the desired confidence level. This model aims to calculate the maximum loss that a portfolio of foreign-currency receivables or payables may incur over a given period. Based on this table, we can easily estimate the Value at Risk of this portfolio over 1-day and 10-day horizons, which are the most commonly used, at confidence levels of 95% and 99%.

4.1.1 Historical VaR on Receivables at a 95% Confidence Level

VaR (95%, 1 day) represents the value used to calculate the maximum loss that the company's dollar-denominated receivables portfolio may incur over a one-day period, with a 95% confidence threshold (5% margin of error). Therefore:

−0.005135295 → 94.76%

X → 95%

−0.005170071 → 95.16%

Therefore, X corresponds to the Historical VaR for a 1-day horizon at a 95% reliability level.

The VaR at the 95% for a 10-day horizon is obtained by multiplying the 1-day VaR at the 95% confidence threshold by the square root of 10.

Table 2. Linear Interpolation for VaR based on a 95% Confidence Level: Historical VaR Reference Points and Interpolated Value

Linear Intepolation	
-0,005170071	95,161%
-0,005135295	94,76%
	95,00%
	0,6
	$-3{,}47756 \times 10^{-5}$
	$-2{,}08654 \times 10^{-5}$
X	$-5{,}156161 \times 10^{-3}$

Source : Authors' own calculations

The table presents a linear interpolation used to estimate the value of X for different probabilities. The data provide specific points along the interpolation curve, where The vertical axis displays X values and secondary vertical axis shows the corresponding probabilities. For example, at a probability of 95.161%, the estimated value of X is −0.005170071, while at a probability of 94.76%, the estimated value of X is −0.005135295.

These data make it possible to plot a linear interpolation curve, thereby facilitating the estimation of X for intermediate probabilities. The X values are calculated using a linear interpolation method between the given points, allowing for a continuous estimation of X across different probability levels.

Table 3. Linear Interpolation of Historical VaR using a 95% Confidence threshold

Calculation of Historical VaR using a 95% Confidence threshold	
	Historical Value at Risk
Value of the Dollar-Denominated Receivables Portfolio (in billions)	3,434
VaR (95%Confidence Threshold, 1 Day) in %	$-5{,}156161 \times 10^{-3}$
VaR (95%Confidence Threshold, 10 Days) in %	$-1{,}6305212 \times 10^{-2}$
VaR (95%Confidence Threshold, 1 Day) in Value	$-1{,}770645669 \times 10^{7}$
VaR (95%Confidence Threshold, 10 Days) in Value	$-5{,}599273244 \times 10^{7}$

Source : Authors' own calculations

The results of the Historical VaR calculation for the dollar-denominated receivables portfolio are presented at a 95% confidence level. VaR is expressed as a percentage of the portfolio, thereby allowing potential losses to be estimated. Over a one-day horizon, the VaR is estimated at −0.005156161%, corresponding to a value of −17,706,456.69 MAD. Over a ten-day horizon, the VaR increases to −0.016305212%, corresponding to a value of −55,992,732.44 MAD. These results indicate the maximum potential loss expected for the portfolio at a 95% confidence level over one-day and ten-day horizons, providing an important measure for financial risk management.

The company's dollar-denominated receivables portfolio may therefore incur a maximum loss of 17,706,456.69 MAD over one day and 55,992,732.44 MAD over ten days, with a 5% margin of error.

4.1.2 Historical VaR on Receivables at a 99% Confidence Level

VaR (99%, 1 day) represents the value used to calculate the maximum loss that the company's dollar-denominated receivables portfolio may incur over a one-day period, with a 99% confidence threshold (1% margin of error). Therefore:

−0.008641171 → 98.79%

$X \rightarrow 99\%$

$-0.006887962 \rightarrow 99.19\%$

Therefore, X corresponds to the Historical VaR for a 1-day horizon at a 99% confidence level.

Table 4. Level Linear Interpolation of Historical VaR at the 99% Confidence Level

Linear Interpolation	
-0,008641171	99,19%
-0,006887962	98,79%
	99,00%
	0,525
	-0,001753209
	-0,000920435
X	-0,007808397

Source : Authors' own calculations

The table illustrates a linear interpolation technique used to determine X using on different probabilities. The dataset provides specific points along the interpolation curve, where the left-hand column represents the X values and the right-hand column represents the corresponding probabilities.

For example, at a probability of 99.19%, the estimated value of X is −0.008641171, while at a probability of 98.79%, the estimated value of X is −0.006887962. Using these points, linear interpolation makes it possible to calculate the value of X for an intermediate probability of 99.00%, thereby providing a continuous estimate of X along the interpolation curve.

The value of X at a probability of 99.00% is calculated as −0.007808397. This method provides a linear approach for estimating X values between the available data points, thereby enabling continuous estimation across the entire range of probabilities.

Table 5. Historical VaR for the Dollar-Denominated Receivables Portfolio at the 99% Confidence Level over 1-Day and 10-Day Horizons

	Historical Value at Risk
Value of the Dollar-Denominated Receivables Portfolio	3 434 038 978,66
VaR (99% Confidence Threshold, 1 Day) in %	$-7{,}808397 \times 10^{-3}$
VaR (99% Confidence Threshold, 10 Days) in %	$-2{,}4692319 \times 10^{-2}$
VaR (99% Confidence Threshold, 1 Day) in Value	$-2{,}681433871 \times 10^{7}$
VaR (99% Confidence Threshold, 10 Days) in Value	$-8{,}479438429 \times 10^{7}$

Source : Authors' own calculations

The results of the Historical Value at Risk (VaR) calculation for the dollar-denominated receivables portfolio, at a 99% confidence level, are presented as follows:

Over a one-day horizon, the VaR is estimated at −0.007808397%, corresponding to a maximum potential loss of −26,814,338.71 dollars.

Over a ten-day horizon, the VaR increases to −0.024692319%, corresponding to a maximum potential loss of −84,794,384.29 dollars.

These results provide a quantitative assessment of the maximum potential losses for the dollar-denominated receivables portfolio at a 99% confidence level over one-day and ten-day horizons. Historical VaR is an important measure for financial risk management, as it quantifies potential losses based on the historical volatility of portfolio returns.

4.2 Historical VaR on Payables.

Table 6. Evolution of Daily Dollar Exchange Rate Returns and Historical VaR Thresholds at the 5% and 1% Levels for the 2025 Fiscal Year

Date	Cours vendeur	Rendement	Rendements triés	Ref VaR %	VaR à x%
02/01/2025	10,1700				
03/01/2025	10,2150	0,00442478	-0,01067703	0,40323%	99,596774%
04/01/2025	10,1870	-0,00274107	-0,0085999	0,80645%	99,193548%
05/01/2025	10,1350	-0,00510455	-0,00688918	1,20968%	98,790323%
06/01/2025	10,1270	-0,00078934	-0,006256828	1,61290%	98,387097%
09/01/2025	10,1310	0,00039498	-0,006168433	2,01613%	97,983871%
10/01/2025	10,1080	-0,00227026	-0,006147744	2,41935%	97,580645%
11/01/2025	10,1080	0	-0,006118622	2,82258%	97,177419%
12/01/2025	10,0650	-0,00425406	-0,005892807	3,22581%	96,774194%
13/01/2025	10,0680	0,00029806	-0,005545653	3,62903%	96,370968%
16/01/2025	10,0980	0,00297974	-0,005444573	4,03226%	95,967742%
17/01/2025	10,0420	-0,00554565	-0,005349576	4,43548%	95,564516%
18/01/2025	10,0550	0,00129456	-0,005170849	4,83871%	95,161290%
19/01/2025	10,0860	0,00308304	-0,005104545	5,24194%	94,758065%
20/01/2025	10,0620	-0,00237954	-0,004869732	5,64516%	94,354839%
23/01/2025	10,0190	-0,0042735	-0,004696223	6,04839%	93,951613%
24/01/2025	10,0100	-0,00089829	-0,004471412	6,45161%	93,548387%
25/01/2025	10,0130	0,0002997	-0,004396276	6,85484%	93,145161%
26/01/2025	10,0380	0,00249675	-0,004360526	7,25806%	92,741935%
27/01/2025	10,0390	9,9621E-05	-0,004344708	7,66129%	92,338710%
30/01/2025	10,0690	0,00298335	-0,004334928	8,06452%	91,935484%
31/01/2025	10,0060	-0,00625683	-0,004273504	8,46774%	91,532258%
01/02/2025	10,0030	-0,00029982	-0,004254056	8,87097%	91,129032%

Source : Authors' own calculations

4.2.1 Historical VaR on Payables at a 95% Confidence Level

VaR (95%, 1 day) represents the value used to calculate the maximum loss that the company's dollar-denominated payables portfolio may incur over a one-day period, with a 95% confidence threshold (5% margin of error). Therefore:

−0.005104545 94.758065%

X 95%

−0.005170849 95.161290%

Therefore, X corresponds to the Historical VaR for a 1-day horizon at a 95% confidence level.

Table 7. Linear Interpolation of Historical VaR at the 95% Confidence Level: Historical Reference Points and Interpolated Value

Linear Interpolation	
-0,005170849	95,161%
-0,005104545	94,76%
	95,00%
	0,6
	$-6{,}63041 \times 10^{-5}$
	$-3{,}97824 \times 10^{-5}$
X = VaR (95% Confidence Threshold, 1 Day)	$-5{,}144327 \times 10^{-3}$

Source : Authors' own calculations

The table presents a linear interpolation method used to estimate the value of X corresponding to a specific probability, namely the VaR for a one-day period at a 95% confidence threshold.

The table presents a linear interpolation to estimate the value of X, corresponding to VaR (95%, 1 day). The specific points along the interpolation curve are provided, with the left-hand column representing the X values, the right-hand column representing the associated probabilities, and the subsequent columns indicating the corresponding adjustments. Using these points, linear interpolation was applied to estimate the VaR (95%, 1 day) at −0.005144327.

This method makes it possible to continuously estimate the value of X for intermediate probabilities between the available data points. The resulting VaR represents a quantitative measure of the maximum potential loss for the portfolio at a 95% confidence level over a one-day horizon. This linear interpolation procedure provides a practical approach for estimating VaR values between the specific data points available.

Table 8. Historical VaR for the Dollar-Denominated Payables Portfolio at the 95% Confidence Level over 1-Day and 10-Day Horizons

Calculation of Historical VaR at a 95% Confidence Level	
	Historical Value at Risk
Value of the Dollar-Denominated Payables Portfolio	389 127 450,12
VaR (95% Confidence Threshold, 1 Day) in %	-0,005144327
VaR (95% Confidence Threshold, 10 Days) in %	-0,016267792
VaR (95% Confidence Threshold, 1 Day) in Value	-2 001 799,02
VaR (95% Confidence Threshold, 10 Days) in Value	-6 330 244,33

Source : Authors' own calculations

The results of the Historical (VaR) calculation for the dollar-denominated payables portfolio, at a 95% confidence level, are presented as follows:

For a one-day period, the VaR is estimated at −0.005144327%, corresponding to a maximum potential loss of −2,001,799.02 dollars.

For a ten-day period, the VaR increases to −0.016267792%, corresponding to a maximum potential loss of −6,330,244.33 dollars.

These results provide a quantitative assessment of the maximum potential losses for the dollar-denominated payables portfolio at a 95% confidence level over one-day and ten-day horizons. Historical VaR is a crucial measure for financial risk management, as it quantifies potential losses based on the historical volatility of portfolio returns.

The company's dollar-denominated payables may therefore incur a maximum loss of 2,000,799.02 MAD over one day and 6,330,244.33 MAD over ten days, with a 5% margin of error.

4.2.2. Historical VaR on Receivables at a 99% Confidence Level

VaR (99%, 1 day) represents the value used to calculate the maximum loss that the company's dollar-denominated payables may incur over a one-day period, with a 99% confidence threshold (1% margin of error). Therefore:

$-0.0085999 \rightarrow 98.790323\%$

$X \rightarrow 99\%$

$-0.00688918 \rightarrow 99.193548\%$

Therefore, X corresponds to the Historical VaR for a 1-day horizon at a 99% confidence level.

Table 9. Linear Interpolation of Historical VaR at the 99% Confidence Level

Linear Interpolation	
-0,0085999	99,19%
-0,00688918	98,79%
	99,00%
	0,52
	-0,00171072
	-0,000889574
X = VaR (99%, 1 Day)	-0,007778755

Source : Authors' own calculations

The table presents a linear interpolation method used to estimate the value of X corresponding to a specific probability, namely the one-day Value at Risk at a 99% confidence threshold.

The table presents a linear interpolation to estimate the value of X, corresponding to VaR (99%, 1 day). The specific points along the interpolation curve are provided, with the left-hand column representing the X values, the right-hand column representing the associated probabilities, and the subsequent columns indicating the corresponding adjustments. Using these points, linear interpolation was applied to estimate the VaR (99%, 1 day) at −0.007778755.

This method makes it possible to continuously estimate the value of X for intermediate probabilities between the available data points. The resulting VaR represents a quantitative measure of the maximum potential loss for the portfolio at a 99% confidence level over a one-day horizon. This linear interpolation procedure provides a practical approach for estimating VaR values between the specific data points available.

Table 10. Historical VaR for the Dollar-Denominated Receivables Portfolio at the 99% Confidence Level over 1-Day and 10-Day Horizons

Calculation of Historical VaR at a 99% Confidence Level	**Historical Value at Risk**
Value of the Dollar-Denominated Receivables Portfolio	389 127 450,12
VaR (99% Confidence Threshold, 1 Day) in %	$-7{,}778755 \times 10^{-3}$
VaR (99% Confidence Threshold, 10 Days) in %	$-2{,}4598583 \times 10^{-2}$
VaR (99% Confidence Threshold, 1 Day) in Value	$-3{,}02692703 \times 10^{6}$
VaR (99% Confidence Threshold, 10 Days) in Value	$-9{,}57198372 \times 10^{6}$

Source : Authors' own calculations

The results of the Historical Value at Risk (VaR) calculation for the dollar-denominated receivables portfolio, at a 99% confidence level, are presented as follows:

For a one-day period, the VaR is estimated at −0.007778755%, corresponding to a maximum potential loss of −3,026,927.03 dollars.

For a ten-day period, the VaR increases to −0.024598583%, corresponding to a maximum potential loss of −9,571,983.72 dollars.

These results provide a quantitative assessment of the maximum potential losses for the dollar-denominated receivables portfolio at a 99% confidence level over one-day and ten-day horizons. Historical VaR is a crucial measure for financial risk management, as it quantifies potential losses based on the historical volatility of portfolio returns.

The company's dollar-denominated payables may therefore incur a maximum loss of 3,026,927.03 MAD over one day and 9,571,983.72 MAD over ten days, with a 1% margin of error.

4.3 Parametric VaR on Receivables

The Parametric VaR model is based on the assumption that the USD/MAD returns follow a normal distribution. The maximum loss on the foreign-currency receivables portfolio is determined based on the three parameters of this model, namely the probability (margin of error), the expected value, and the standard deviation of the currency portfolio, by applying the NORM.INV function.

Table 11. Daily Returns Ranked from Lowest to Highest and Corresponding Historical VaR Thresholds at the 5% and 1% Levels

N° observation	Date	Cours acheteur	Rendements	Rendements triés
1	02/01/2025	10,1100	—	—
2	03/01/2025	10,1540	0,004352127	-0,010679452
3	04/01/2025	10,1260	-0,002757534	-0,008641171
4	05/01/2025	10,0740	-0,005135295	-0,006837962
5	06/01/2025	10,0660	-0,000794123	-0,006314317
6	09/01/2025	10,0710	0,000496722	-0,006174564
7	10/01/2025	10,0480	-0,002283785	-0,006162651
8	11/01/2025	10,0480	0	-0,006155068
9	12/01/2025	10,0050	-0,004279459	-0,005896868
10	13/01/2025	10,0080	0,00029985	-0,00555876
11	16/01/2025	10,0380	0,002997602	-0,005446734
12	17/01/2025	9,9822	-0,005558876	-0,005351474
13	18/01/2025	9,9952	0,001302318	-0,005170071
14	19/01/2025	10,0260	0,003081479	-0,005135295
15	20/01/2025	10,0020	-0,002393776	-0,004877526
16	23/01/2025	9,9592	-0,004279144	-0,004703209
17	24/01/2025	9,9503	-0,000893646	-0,004467411
18	25/01/2025	9,9536	0,000331648	-0,004401455
19	26/01/2025	9,9777	0,002421235	-0,004355042

Source : Authors' own calculations

4.3.1 Parametric VaR of Receivables at a 95% Confidence Level

Table 12. Parametric VaR for the Dollar-Denominated Receivables Portfolio at the 95% Confidence Level over 1-Day and 10-Day Horizons

Calculation of Parametric VaR at a 95% Confidence Level	
Value of the Receivables Portfolio	3 434 038 978,66
Confidence Level	95%
Variance of the Foreign-Currency Portfolio	0,0007641%
Standard Deviation of the Foreign-Currency Portfolio	0,2764225%
Calculation of the Parameters of Parametric VaR	
Probability	5%
Expected Value	26 240,29
Standard Deviation	9.49245771×10^{6}
VaR (95% Confidence Threshold, 1 Day)	$-1{,}558746321 \times 10^{7}$
VaR (95% Confidence Threshold, 10 Days)	$-4{,}929188668 \times 10^{7}$

Source : Authors' own calculations

The results of the Parametric Value at Risk (VaR) calculation for the foreign-currency receivables portfolio, at a 95% confidence level, are presented as follows:
The probability used for the calculation is 5%.
The expected value of the portfolio is 26,240.29.
The standard deviation of the portfolio is 9,492,457.71.
Based on these parameters, the Parametric VaR over a one-day horizon is estimated at −15,587,463.21, while over a ten-day horizon, it amounts to −49,291,886.68. These values represent the maximum potential loss expected for the foreign-currency receivables portfolio at the 95% confidence threshold, using a parametric approach that takes into account the portfolio's variance and variability. Parametric VaR is an important measure for assessing and managing the financial risk associated with a given portfolio.
According to the Parametric VaR method, JFC I's dollar-denominated receivables portfolio may incur a maximum loss of 15,587,463.21 MAD over one day and 49,291,886.68 MAD over ten days at a 95% confidence level.

4.3.2 Parametric VaR on Receivables at a 99% Confidence Level

Table 13. Parametric VaR for the Dollar-Denominated Receivables Portfolio at the 99% Confidence Level

Calculation of Parametric VaR at a 99% Confidence Level	
Value of the Receivables Portfolio	3 434 038 978,66
Confidence Level	99%
Variance of the Foreign-Currency Portfolio	7,64094E-06
Standard Deviation of the Foreign-Currency Portfolio	0,002764225
Calculation of the Parameters of Parametric VaR	
Probability	1%
Expected Value	26 240,29
Standard Deviation	$9{,}49245771 \times 10^{6}$
VaR (99% Confidence Threshold, 1 Day)	$-2{,}205651853 \times 10^{7}$
VaR (99% Confidence Threshold, 10 Days)	$-6{,}974883581 \times 10^{7}$

Source : Authors' own calculations

The results of the Parametric Value at Risk (VaR) calculation for the foreign-currency receivables portfolio, at a 99% confidence level, are presented as follows:
The probability used for the calculation is 1%.
The expected value of the portfolio is 26,240.29.
The standard deviation of the portfolio is 9,492,457.71.
Based on these parameters, the Parametric VaR over a one-day horizon is estimated at −22,056,518.53, while over a ten-day horizon, it amounts to −69,748,835.81. These values represent the maximum potential loss expected for the foreign-currency receivables portfolio at a 99% confidence level, using a parametric approach that takes into account the portfolio's variance and standard deviation. Parametric VaR is an important measure for assessing and managing the financial risk associated with a given portfolio.

According to the Parametric VaR method, JFC I's dollar-denominated receivables portfolio may incur a maximum loss of 22,056,518.53 MAD over one day and 69,748,835.81 MAD over ten days at a 99% confidence level. Comparison Between Historical VaR and Parametric VaR

- **Comparison Between Historical VaR and Parametric VaR**

Table 14. Comparison of Historical and Parametric VaR for the Dollar-Denominated Receivables Portfolio at the 95% and 99% Confidence Levels over 1-Day and 10-Day Horizons

Total Portfolio Amount	**$3{,}43403897866 \times 10^9$**	
	Historical VaR	Parametric VaR
VaR (95% Confidence Threshold, 1 Day) in Value	$-1{,}770645669 \times 10^7$	$-1{,}558746321 \times 10^7$
VaR (95% Confidence Threshold, 10 Days) in Value	$-5{,}599273244 \times 10$	$-4{,}929188668 \times 10^7$
VaR (99% Confidence Threshold, 1 Day) in Value	$-2{,}681433871 \times 10^7$	$-2{,}205651853 \times 10^7$
VaR (99% Confidence Threshold, 10 Days) in Value	$-8{,}479438429 \times 10$	$-6{,}974883581 \times 10^7$

Source : Authors' own calculations

The table compares the Historical Value at Risk (VaR) and Parametric VaR values for a given portfolio over different time horizons and confidence levels:

- VaR (95%, 1 day) in value:

Historical VaR: −17,706,456.69
Parametric VaR: −15,587,463.21

- VaR (95%, 10 days) in value:

Historical VaR: −55,992,732.44
Parametric VaR: −49,291,886.68

- VaR (99%, 1 day) in value:

Historical VaR: −26,814,338.71
Parametric VaR: −22,056,518.53

- VaR (99%, 10 days) in value:

Historical VaR: −84,794,384.29
Parametric VaR: −69,748,835.81

These values represent the maximum potential losses expected for the portfolio over different time horizons and confidence levels, using two different approaches: Historical VaR, which is based on the historical volatility of returns, and Parametric VaR, which is based on the variance and standard deviation of the portfolio. These measures are essential for assessing and managing the financial risk associated with the portfolio. Parametric VaR tends to be more conservative than Historical VaR in many cases.

Based on the Historical VaR approach, we observe that JFC I's dollar-denominated receivables portfolio would incur higher losses than under the Parametric VaR approach, except for the 95% confidence threshold over a 10-day period, where the difference amounts to 6,700,846 MAD, and the 99% confidence le threshold over a 10-day period, where the difference amounts to 15,045,549 MAD.

- **Simulation of the Use of Certain Hedging Strategies**

In the case of OCP, more than 80% of foreign currency sales and purchases are denominated in U.S. dollars. The total amount of dollar purchases represents less than 20% of the total amount of dollar sales. This percentage was verified for the 2025 fiscal year. Given these figures, our simulations will be limited to dollar sales (export position).

The foreign exchange hedging strategies whose results we will simulate are forward exchange contracts, Export Open Forward (Classical CTO, or simply CTO), and Export Open Forward with Reduced Premium (CTO PR).

In general, a company exposed to foreign exchange risk may adopt different approaches depending on its degree of risk aversion. Three common approaches are generally distinguished: systematic non-hedging, systematic hedging, and selective hedging. In our simulation, we will compare the results obtained under systematic non-hedging with those obtained under systematic hedging using forward exchange contracts, Classical Export Open Forward (CTO), and Export Open Forward with Reduced Premium (CTO PR).

The main objective of the simulation is to compare the results of the systematic non-hedging strategy, forward exchange hedging, Classical CTO hedging, and CTO PR hedging.

- **Simulation Results**

The table below presents the weighted average exchange rates, weighted by the amounts sold, for the four strategies simulated during 2025.

Weighted Average Exchange Rate between January 1, 2025 and December 31, 2025

Table 15. Comparison of Exchange Rates under the Four Foreign Exchange Hedging Strategies: Spot, Forward, Floor, and Collar

SPOT	FORWARD	Minnimun Price Protection	Price Range Protection
9.666×10^{o}	8.937×10^{o}	9.6578×10^{o}	9.6806×10^{o}

Source : Authors' own calculations

The table shows that the most effective strategy is dollar hedging. However, the difference compared with the other strategies is minimal, except for systematic hedging using forward exchange contracts. This is naturally due to the fact that the period under study encompasses all possible scenarios of exchange rate movements (increase, decrease, and stagnation).

In the following section, we will compare the four strategies for each quarter under study and determine which strategy would have been appropriate for each quarter.

Table 16. Quarterly Comparison of Exchange Rates under the Four Foreign Exchange Hedging Strategies : Spot, Forward, Floor, and Collar

	SPOT	FORWARD	FLOOR	COLLAR
QUARTER 1	10,006	9,3777	10,0171	10,0262
QUARTER 2	9,8127	9,0376	9,7658	9,8172
QUARTER 3	9,4256	8,6076	9,4237	9,445
QUARTER 4	9,4199	8,7256	9,4244	9,434

Source : Authors' own calculations

During the first quarter, the CTO PR selling rate was higher than the selling rate under the Classical CTO. Therefore, it could have been advantageous to enter into CTO PR contracts, given the upward trend in the dollar and the apparently high level of volatility.

During the second quarter, selling the foreign currency at the spot exchange rate remained the most favorable strategy. The use of forward exchange contracts or CTO PR proved to be less appropriate, given the upward trend in the dollar.

During the third and fourth quarters, the use of CTO PR hedging could have been more beneficial. The dollar exchange rate was on a downward trend during this period; therefore, entering into CTO PR contracts would have been appropriate and would have enabled us to realize a foreign exchange gain.

- **Profitability of Using or Not Using Hedging Strategies**

By analyzing the table below, we can assess the impact of using Classical CTO, CTO PR, and forward exchange contracts as follows:

Table 17. Quarterly Comparison of the Values Associated with the Four Foreign Exchange Hedging Strategies: Spot, Forward, Floor, and Collar

	SPOT	FORWARD	FLOOR	COLLAR
Q1	1111775032	1041082257	1097989011	1109136108
Q2	959119758,3	897149893,6	962375490,3	972145799,8
Q3	1087022325	1105657371	1202164276	1215755247
Q4	112487761,2	108107437	129248365,7	130778809

Source : Authors' own calculations

In Quarter 1, the most favorable approach was systematic non-hedging, thereby taking full advantage of the positive movement of the dollar. We could have incurred a foreign exchange loss of MAD 2,638,924 by using CTO PR, MAD 13,786,021 by using Classical CTO, and MAD 70,692,775 by using forward exchange contracts.

In Quarter 2, we could have realized a foreign exchange gain of MAD 13,026,041.5 by using CTO PR and MAD 3,255,732 by using Classical CTO. However, we could have incurred a foreign exchange loss of MAD 61,969,865 by using forward exchange contracts.

In Quarter 3, we could have realized foreign exchange gains of MAD 128,732,922 by using CTO PR, MAD 115,141,951 by using Classical CTO, and MAD 18,635,019 by using forward exchange contracts.

In Quarter 4, we could have realized foreign exchange gains of MAD 18,291,048 by using CTO PR and MAD 16,760,604 by using Classical CTO. However, using forward exchange contracts would have resulted in a foreign exchange loss of MAD 4,380,324.

Over the entire period under study, we could have realized a foreign exchange gain of MAD 157,411,087 by using CTO PR and MAD 121,372,266 by using Classical CTO. However, using forward exchange contracts would have resulted in a foreign exchange loss of MAD 118,407,918.

According to Lamrani and Bennis (2021), the existence of several hedging products can make it difficult for companies to choose the most appropriate instrument. However, since each company has a different financial situation, each one requires a solution adapted to its specific needs. In the course of their activities, companies are exposed to several risks, particularly the risk arising from exchange rate fluctuations. The appropriate approach for the treasurer is to identify this risk, acquire the necessary tools to measure it, and be able to hedge it, either fully or partially.

5. Discussion of the Results

The discussion of the results of our study, in comparison with the literature review, provides a critical and analytical perspective on foreign exchange risk management practices within OCP. Consistent with the theories adopted, our findings reveal that OCP implements various hedging strategies, reflecting the complexity of the global financial environment. Borrowing costs and parity-level appear to influence hedging decisions, thereby confirming the underlying theoretical principles. However, variations are observed across departments and hierarchical levels, illustrating the diversity of internal approaches.

The discussion also highlights unexpected findings or results that diverge from the existing literature. For example, certain practices adopted by OCP may differ from standard recommendations. This divergence can be attributed to contextual factors specific to OCP, highlighting the importance of adapting foreign exchange risk management strategies to the specific characteristics of the industry and the company.

Furthermore, the analysis of the interviews revealed specific concerns among internal stakeholders regarding exchange rate fluctuations, highlighting the psychological impact on financial decision-

making. This behavioral dimension may require greater consideration in theoretical models of risk management.

Compared with the literature review, our findings highlight the need for a flexible and adaptive approach to foreign exchange risk management, sometimes extending beyond the boundaries of traditional theoretical models. This critical discussion sheds light on the limitations of standard theoretical approaches and emphasizes the importance of contextualizing risk management practices within specific environments, thereby strengthening the relevance and validity of strategic recommendations.

In conclusion, the in-depth discussion of the results in light of the literature review enhances our understanding of foreign exchange risk management practices at OCP, offering significant contributions at both the theoretical and practical levels. It also underscores the need for continuous adaptation of strategies according to the company's specific context and the global economic environment.

6. Conclusions

Treasury management is a strategic function that contributes significantly to improving a company's profitability. In our case, in order for GFC 1 to better control its cash flows while taking into account potential foreign exchange losses, we propose a Value at Risk (VaR) model as one of the tools for calculating the maximum potential loss of a foreign-currency portfolio. To address this issue, we developed an analytical framework that began with a literature review covering the different exchange rate regimes, their characteristics, the introduction of the concept of foreign exchange risk, methods for measuring this risk, and the techniques that can be used to hedge against it. This was followed by the development of the research plan and the collection and analysis of data through documentary analysis, interviews, and Internet-based sources. Finally, after analyzing the data, we examined the findings obtained. Accordingly, we compared the possible financial losses that could be incurred by JFC 1, a subsidiary of the OCP Group, and provided recommendations based on the four quarters studied regarding the profitability of using or not using a hedging strategy to address foreign exchange risk.

To this end, we presented foreign exchange risk in order to ensure that readers clearly understand the challenges associated with its management. We then examined the endogenous and exogenous tools and techniques used to manage foreign exchange risk. We also reviewed the various foreign exchange hedging strategies and the situations in which they can be applied. In this context, we conducted a study of the profitability of using certain hedging combinations by OCP.

The results of our study show that the maximum loss that JFC 1 could incur on its receivables, according to the Historical VaR model, at a 95% confidence level over a 10-day horizon, is MAD 55,992,732.44, compared with MAD 49,291,886.68 under the Parametric VaR method. At a 99% confidence level, the maximum potential loss is MAD 84,794,384.29 under the Historical VaR method and MAD 69,748,835.81 under the Parametric VaR model.

In order to optimize OCP's foreign exchange risk management, the choice of hedging strategy should be made periodically according to changes in certain environmental factors. Regarding the hedging techniques to be used, OCP may implement certain internal techniques to significantly reduce foreign exchange risk, including the choice of invoicing currency, leading and lagging, indexation clauses when entering into contracts with foreign customers, and discounts for advance or cash payments. With regard to external techniques, the Group should closely monitor developments in the Moroccan foreign exchange market and seek to benefit from them through rigorous and systematic management.

The results of our research have significant implications from both managerial and scientific perspectives. From a managerial perspective, our analysis highlights the critical importance of

proactive treasury and foreign exchange risk management for GFC 1 and, more broadly, for other companies operating in international markets. The recommendations arising from our study, particularly those concerning the periodic adjustment of hedging strategies in response to changes in the business environment, provide practical avenues for strengthening the organization's financial resilience to exchange rate fluctuations.

From a scientific perspective, our research adds to existing research on foreign currency risk management offering detailed analyses of potential losses and specific hedging strategies. By implementing a VaR-based approach and comparing different calculation methods over specific periods, we have enhanced the understanding of the tools and techniques available for assessing and managing financial risks in an international context. Furthermore, our methodological approach, combining an extensive literature review, interviews with key stakeholders, and rigorous data analysis, may serve as a reference framework for other researchers and practitioners interested in similar financial risk management issues.

Overall, our research makes tangible contributions at both the managerial and scientific levels, thereby strengthening the knowledge base in the field of foreign exchange risk management and providing practical guidance for decision-makers and researchers undertaking similar initiatives.

The conclusion of our research also provides an opportunity to reflect on future research perspectives, unresolved questions, the limitations of our study, and its main contributions.

Regarding future research perspectives, it would be worthwhile to further investigate hedging strategies while taking into account macroeconomic and geopolitical fluctuations that may influence foreign exchange markets. In addition, an in-depth study of the impact of new technologies and financial innovations on foreign exchange risk management could further enhance our understanding of this constantly evolving field.

Other issues also deserve further investigation, particularly how internal factors such as liquidity management policies and investment decisions may interact with hedging strategies to influence overall financial performance. Furthermore, an in-depth analysis of the tax implications associated with different hedging strategies could provide valuable insights for companies operating in international markets.

With regard to the limitations of our research, it is important to emphasize that the results are based on data specific to a given period and that market conditions may change over time. A continuous longitudinal study would therefore be necessary to capture changes over time and assess the long-term effectiveness of the proposed hedging strategies.

Despite these limitations, our research makes several significant contributions. The use of the VaR model to assess foreign exchange risk in a specific context, together with a detailed comparison of the results obtained using different methods, represents an important methodological contribution. Moreover, our mixed-method approach, combining quantitative and qualitative methods, provided a holistic understanding of the issue.

In conclusion, this research offers promising perspectives for the future development of foreign exchange risk management in a dynamic environment. The unresolved issues and limitations identified highlight the need for continued research in this field in order to remain at the forefront of best practices and effective strategies. The findings obtained can provide a solid foundation for practitioners and researchers interested in financial management and strategic decision-making in an international context.

Reference

[1] (Harwood, 2008) Harwood, J. (2008). Title of the cited article. Available online: URL (accessed on Day Month Year).

[2] (Hutcheson, 2012) Hutcheson, V. H. (2012). Title of the thesis [XX Thesis, Name of Institution Awarding the Degree].

[3] (Lippincott & Poindexter, 2019) Lippincott, T., & Poindexter, E. K. (2019). Title of the unpublished manuscript [Unpublished manuscript/Manuscript in preparation/Manuscript submitted for publication]. Department Name, Institution Name.

[4] Abadie, L., & Mercier-Suissa, C. (2011). International Finance: Foreign Exchange Markets and Risk Management. Armand Colin.

[5] Adler, M., & Dumas, B. (1984). Exposure to currency risk: Definition and measurement. Financial Management, 13(2), 41–50.

[6] Ayoub MASSIKI, & Olaya METWALLI. (2026). Islamic Finance and Its Contribution to the Financing of Moroccan SMEs. African Scientific Journal, 3(38). https://doi.org/10.5281/zenodo.23220455

[7] Ayoub, M. ., Olaya, M. ., Salma, D. ., & Omar, K. . (2025). The impact of the IPO on the stock performance of companies in the industrial and energy sector listed on the Casablanca stock exchange. International Journal of Innovative Research and Scientific Studies, 8(4), 1946–1956.

[8] Ayoub, M., Olaya, M., Salma, D. et Omar, K.(2025). L'impact de l'introduction en bourse sur la performance boursière des sociétés des secteurs industriel et énergétique cotées à la Bourse de Casablanca.International Journal of Innovative Research and Scientific Studies,8(4), 1946-1956. https://doi.org/10.53894/ijirss.v8i4.8278

[9] Ayoub, M., Olaya, M., Salma, D., Hicham, B., Rachid, Z., Raja, C., Ayoub, O., & Zahra, B. F. (2025). The Impact of Initial Public Offerings on Corporate Performance: Evidence from Morocco's Vocational Training and Sectoral Education Markets in Health, Finance, and Business. Educational Process: International Journal, 18, e2025504.

[10] Ayoub, M., Olaya, M., Salma, D., Hicham, B., Rachid, Z., Raja, C., Ayoub, O., & Zahra, B. F. (2025). The Impact of Initial Public Offerings on Corporate Performance: Evidence from Morocco's Vocational Training and Sectoral Education Markets in Health, Finance, and Business. Educational Process: International Journal, 18, e2025504.

[11] Bertrand, J., Bruno, S., & Christophe, P. (2014). Financial Markets: Portfolio and Risk Management. Dunod.

[12] Campart, S., & Jimenez, P. (2016). Interest Rate and Foreign Exchange Risks: Identification and Hedging Strategies (p. 9).

[13] Chérif, M. (2002). The Exchange Rate (Chapter 5: Exchange Rate Regimes, p. 85).

[14] Chérif, M. (2002). The Exchange Rate (p. 34).

[15] De La Bruslerie, H., & Eliz, C. (2017). Corporate Treasury Management: Liquidity and Risk Management (4th ed., p. 426).

[16] Debeauvais, M., & Sinnah, Y. (1992). Comprehensive Foreign Exchange Risk Management (2nd ed.). Economica.

[17] Debels, V., Desmuliers, G., & Dubus, B. (1992). Corporate Financial Risks (p. 129). Economica.

[18] F, P. (2011). Foreign Exchange Markets (2nd ed.).

[19] Fisch, J. H., & Puhr, H. (2022). Financial hedging and operational flexibility as instruments to manage exchange-rate uncertainty in multinational corporations. Global Strategy Journal, 12(2), 308–333.

[20] Fokou, R. (2006). Measuring the Market Risk of an Equity Portfolio (Value at Risk, Conditional Value at Risk).

[21] Girardeau-Montaut, A., & Klein, I. (2012). Foreign Exchange Option Strategies: Hedging and Investment (p. 33). RB Éditions.

[22] Hamami, R., & Krami, R. (2024). Dynamiques monétaires et stratégies de protection financière : Les réponses des entreprises non financières au Maroc. African Scientific Journal.

[23] He, Q., Wang, W., & Yu, J. (2023). Exchange rate co-movements and corporate foreign exchange exposures: A study on RMB. International Review of Financial Analysis, 90, 102831.

[24] Hecht, A., & Lampenius, N. (2023). How do firms manage their foreign exchange exposure? Journal of Risk and Financial Management, 16(8), 359.

[25] International Finance: Foreign Exchange Markets and Financial Risk Management (2011). Reference page: p. 101.

[26] Jorion, P. (1996). Value at risk: The new benchmark for controlling market risk. The McGraw-Hill Companies.

[27] Lahreche-Revil, A. (2000). The State of the World Economy 2000 (p. 93).

[28] Lamrani, K., & Bennis, L. (2021). "Foreign Exchange Risk Hedging within Moroccan Companies." Revue Internationale du Chercheur, 2(3), 1721–1744.

[29] Massiki Ayoub, & Metwalli Olaya.(2026). L'impact d'une introduction en bourse sur la performance économique des entreprises familiales cotées à la Bourse de Casablanca. In International Journal of Strategic Management and Economic Studies (IJSMES) -ISSN: 2791-299X. Zenodo.

[30] Massiki Ayoub, Kharbouch Omar, Dahhou Nabil, Sara El Aoufi et Olaya Metwalli.«Le paradoxe de la croissance économique du Maroc: le rôle du développement financier». [réf.]: vol.22, 2024.

[31] MASSIKI, A., KHARBOUCH, O., DAHHOU, N., & METWALLI, O. (2023). Le comportement des investisseurs individuels et l'impact des biais comportementaux sur le marché boursier marocain.International Journal of Accounting Finance Auditing Management and Economics,4(4-2), 302–318.

[32] Massiki, A., Metwalli, O., Dahhou, N., & Kharbouch, O. (2023). Factors influencing the financial composition of Moroccan companies listed on the stock exchange in the agri-food, real estate, and hotel sectors. African Scientific Journal, 3(20), 373-402.

[33] Massiki, A., Metwalli, O., Kharbouch, O., & Dinar, B. (2024). Évaluation de la rentabilité d'un projet d'investissement au sein du groupe OCP. African Scientific Journal, 3(25), 1190.

[34] MASSIKI.A& AL(2023) «Les facteurs de la composition financière des entreprises marocaines cotée en bourse: secteurs agroalimentaires, immobilières et hôtelières», Revue Française d'Economie et de Gestion«Volume 4: Numéro 11» pp: 43–70.

[35] Müller, A., & Verschoor, W. F. C. (2006). Foreign exchange risk exposure: Survey and suggestions. Journal of Multinational Financial Management, 16(4), 385–410.

[36] Nabil, D., Soufiyan, B., Abdellah, O., & Ayoub, M. (2024). The Role of Green Finance in Harmonizing Economic and Environmental Goals: A Moroccan Perspective. Revista De Gestão Social E Ambiental, 18(12), e010189.

[37] Olaya, M., Salma, D., Ayoub, M., Imane, A., et Zahra, BF. (2025). Cartographie bibliométrique de la recherche sur l'intelligence artificielle appliquée à la fintech et à la stabilité financière (2018-2024). International Journal of Innovative Research and Scientific Studies , 8 (8), 296-312.

[38] Olaya, M., Zahra, B.F., et Ayoub, M. (2025). L'impact de la stabilité de la demande de monnaie sur l'efficacité de la politique monétaire dans un contexte d'innovation financière : données économétriques entre 1990 et 2023. International Journal of Innovative Research and Scientific Studies , 8 (5), 911-925.

[39] Simon, Y., & Laitier, D. (2005). International Finance (9th ed.). Economica.

[40] STI, N., Kabbaj, S., & Kasbaoui, T. (2023). L'exposition au risque de change des entreprises au Maroc : Une étude empirique des sociétés cotées en Bourse de Casablanca. Revue du Contrôle, de la Comptabilité et de l'Audit, 6(4).

[41] STI, N., Nabil, S., Rouggani, K., & Benjouid, Z. (2024). Econometric analysis of the impact of exchange rate variations on the market value of Morocco's non-financial firms. International Journal of Applied Management and Economics, 2(10), 134–[pages à vérifier].

[42] Trigo, D. (2008). Value at Risk: A Debatable Risk Management Tool.

[43] Zai, F. S., & Mansur, A. (2024). Hedging strategy to mitigate exchange rate risk in cross-border transactions: Literature review. Journal of Business Management and Economic Development, 2(3).