Corporate Risk Management Using Financial Derivatives

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Abstract. Modern corporations are exposed to multifaceted risks because oil prices, interest rates, and exchange rates can change greatly, thus affecting the company's profits and stock prices. Companies need to manage these risks and maintain value and stability. This paper mainly studies how financial derivatives (futures contracts) can help companies cope with risks and maintain stable performance in different market environments. Panel data regression, quantile regression, and Generalized Autoregressive Conditional Heteroskedasticity Model (GARCH) are used to analyze the data of airlines in the Asia-Pacific region and financial companies in South Africa and Africa, respectively. The results show that derivatives can reduce the negative impact of oil price fluctuations on returns and make stock returns more stable. It performs best under extreme market conditions, and gold futures perform best. The use of derivatives can improve the risk-adjusted performance, that is, Sharp ratio. However, its effectiveness is affected by the types of derivative products and market conditions, and there are some problems, such as over-reliance on models, difficulties in implementation, and a lack of clear information.

Keywords: Financial derivatives, Risk management, Hedging, Firm performance.

1. Introduction

At present, corporations are facing the impacts of fluctuations in oil prices, exchange rates, interest rates, and the overall market environment. These changes will exert a significant impact on corporate profits and stock prices. Therefore, many corporations adopt financial derivatives to mitigate risks and stabilize their operational performance. It is of great importance to explore whether the use of derivatives can effectively help corporations preserve or enhance their value, especially amid market instability.

Previous studies have shown that derivatives can produce positive effects. Ji used empirical analysis to examine listed firms and found that enterprises applying derivatives for hedging can mitigate operational risks [1], stabilize cash flow, and thereby significantly boost firm value. Yang adopted a regression analysis approach and verified a significant positive correlation between derivative usage and enterprise value among manufacturing firms. In addition [2], Omar and Hamdan conducted a case study on Malaysian non-financial enterprises and found that the use of foreign currency derivatives can effectively reduce exchange rate risk exposure and improve corporate operational performance [3]. However, most of these studies only focus on the average effect of derivatives and fail to explore in detail whether derivatives exert heterogeneous effects in different market conditions (bull or bear markets). This has left a research gap in this field.

This paper reviews and analyzes the effects of financial derivatives on firm value across varying market conditions by drawing on the panel data regression and quantile regression methods. The research aims to verify whether derivatives can boost the average firm value and provide more robust risk protection during periods of market instability.

2. Theoretical Basis

2.1. The Definition of Financial Derivatives

Derivatives are contracts whose prices are linked to underlying assets, rather than standalone financial instruments. Underlying assets refer to the fundamental financial or physical assets on which the value of derivative contracts is based, which can be stock prices, exchange rates, interest rates,

and even commodity prices. Therefore, when the value of the underlying assets fluctuates, the value of derivatives will change accordingly. Typical examples include futures, options, and swaps. These instruments are practically applied to shape corporate risk exposure, enabling enterprises and investors to mitigate unnecessary uncertainties, stabilize cash flows, or transfer certain price risks to other market participants.

2.2. The Relationship between Enterprise Risk Management (ERM) and Derivatives

ERM refers to how a company discovers key risks, judges the severity of risks, decides how to deal with risks, and keeps track of risks. The main idea is to deal with risks by reducing uncertainty and transferring some risks to others when necessary. Even when the conditions are unstable, the company can move towards the goal. As Chance and Brooks pointed out, derivatives are a tool to help enterprises cope with the price fluctuations of basic assets (commodities, stocks, bonds, etc.) [4]. Incorporating derivatives into ERM plans is an important part of effective risk management [4].

In an ERM environment, derivatives are usually used in two practical ways. First, they can be used to transfer price risk. Through derivative positions, a company can transfer part of the price fluctuation to its counterparty, who is willing to bear the risk, which is consistent with the fact that derivatives can transfer the price risk to the outside of the company as part of ERM [4]. Second, they can be used to stabilize future cash outcomes. For example, a company may use derivatives to make future input prices more predictable and to reduce uncertainty in operating margins, so swings in market prices are less likely to translate into large changes in earnings. Chance and Brooks describe this kind of price stabilization as a key benefit of bringing derivatives into ERM [4].

2.3. Concepts and Methods Involved in Data Analysis

2.3.1. Panel Data Regression

As Baltagi stated, panel data regression is a statistical method that combines cross-sectional and time series data to analyze the behavior of economic variables over time and across individuals [5], and it enables the estimation of models that control for both individual-specific and time-specific effects [5]. Panel data regression methods make it possible to account for both individual (such as differences between different companies) and time effects (such as changes in market conditions across different years), which aligns with the core function of panel data regression mentioned by Baltagi to address potential omitted variable bias through controlling these two types of effects [5].

2.3.2. Quantile Regression

As Cameron and Trivedi stated, quantile regression estimates the conditional quantile of the dependent variable given the regressors [6], rather than just the conditional mean, and it is particularly useful for analyzing heterogeneous effects of covariates across different parts of the conditional distribution of the dependent variable [6]. This model can effectively capture tail risks and is thus highly useful for studying how derivatives exert heterogeneous impacts on corporate performance under different market conditions.

In Felix et al. 's study, quantile regression was adopted to analyze how derivatives can effectively hedge oil price risks amid different oil price fluctuations [7]. Through quantile regression, the different effects of derivatives on corporate stock returns during periods of low and high oil prices can be clearly identified.

2.3.3. GARCH Model

The GARCH model is used to estimate and predict the volatility of time series data. It constructs a conditional variance equation based on historical volatility and return shocks to capture the volatility clustering characteristic of financial data. A core advantage is its ability to dynamically measure time-varying volatility, which makes up for the deficiency that traditional regression models cannot capture conditional heteroscedasticity, that is, volatility will change under different market conditions.

3. Empirical Analysis of Financial Derivatives in Corporate Risk Management

3.1. Oil Price Risk Hedging in Asia-Pacific Airlines

Felix et al. researched 22 listed airlines in the Asia-Pacific region [7], with the core research focus being to explore whether airlines can mitigate risks and stabilize stock returns by using futures contracts amid significant oil price fluctuations. This research focus is of great practical significance, as fuel costs generally account for 30% to 50% of airlines' total operating costs, meaning that oil price fluctuations will directly and rapidly exert an impact on corporate profits and stock prices.

Felix et al. adopted monthly data from 2010 to 2019 for 22 airlines, generating 2376 observations across 108 months [7]. Given the inherent differences among airlines in routes, cost control, and management strategies, as well as time-varying macroeconomic conditions, the researchers employed panel data regression in the study, a method that can simultaneously control for firm-specific and time-specific effects to eliminate potential omitted variable bias.

From the results, the change in oil prices will cause an obvious negative impact on the airline's stock returns. The estimation coefficient is -0.173($p<0.01$). That is, if the oil price volatility increases by 1%, the airline stock return will decrease by about 0.173%. This shows that the airline's oil and gas business is a highly oil-related industry risk exposure.

After adding hedging tools to the model, the negative impact becomes smaller. This shows that futures contracts can reduce the impact of oil price shocks on aviation stocks.

The author also examines whether the effect of hedging is different under different market conditions. Observe the five levels of stock returns: 0.10, 0.25, 0.50, 0.75, and 0.90 percentiles. Represents a very bad, bad, normal, good, and very good market situation.

When the market is very bad (0.10 quantile), the hedging effect of gold futures is the best, with a coefficient of 0.682 ($p < 0.01$). Oil futures are only 0.315 ($p < 0.05$), VIX futures are 0.278 (no statistical significance). When the market is under strong pressure, gold futures perform better.

Under normal market conditions (0.50 quantile), gold futures still performed best, with a coefficient of 0.453 ($p < 0.01$), compared with oil futures of 0.297 ($p < 0.05$) and VIX futures of 0.241 (insignificant).

Even if the market is very good (0.90 quantile), gold futures still have a significant effect of 0.396 ($p < 0.05$), while the other two instruments are no longer significant.

Felix et al. also use the Sharpe ratio to measure the risk-adjusted performance [7]. Without hedging, the average Sharpe ratio of the airline stock portfolio is 0.83. After adopting gold futures, it rose to 1.27, an increase of 0.53. Oil futures lifted the Sharpe ratio to 0.98 (an increase of 0.18), and VIX futures raised the Sharpe ratio to 0.93 (an increase of 0.12). Gold futures can not only reduce risks but also improve the overall performance of the portfolio.

Finally, the oil price level is also very important. When the oil price is more than $80 per barrel, the hedging effect of gold futures is 0.587(p less than 0.01). When the oil price is lower than 40 USD/barrel, it is 0.306($p<0.05$). Therefore, the impact of the high oil price period will be expanded to 1.92 times.

Therefore, the study believes that airlines are obviously affected by oil price fluctuations, and the hedging tools they choose will be very different. Among these three tools, gold futures perform best, especially in extreme market conditions.

3.2. Derivatives Risk Management in South African Companies

Chikwira and Rawjee studied the non-financial companies listed in South Africa, trying to find out whether using derivatives to manage risks would make the companies' stock more stable [8]. They are concerned with two main measures. The first indicator is stock volatility, which is used to indicate the extent of stock price rise and fall. High volatility means that the stock fluctuates up and down, which is risky, while low volatility means that the stock is relatively stable. The second indicator is the beta coefficient, which shows the extent of stock fluctuation with the market. A higher beta value

means that the stock changes greatly when the market fluctuates, while a lower beta value means that it is less affected by the market.

Because the stock price will not always change in the same way, sometimes it is calm, and sometimes it is crazy, so the author uses the GARCH model to study the data. This model can capture the change of volatility with time, so it is more realistic for the real market.

The results indicate a big difference between companies that use derivatives and companies that don't use derivatives. The stock volatility of companies that use derivatives is less than that of companies that do not use derivatives. The coefficient of the derivative variable in the model is negative, which is statistically significant ($p < 0.05$). The use of derivatives is related to small stock price fluctuations.

The result of market risk is the same, that is, the beta value of companies using derivatives is lower than that of companies not using derivatives (the coefficient is negative, $p<0.05$). That is, the share prices of these companies have changed little.

Overall, this study shows that the use of derivatives will reduce the volatility of the overall stock, making the stock less sensitive to large market fluctuations. The stocks of companies that use derivatives to manage risks are relatively stable and are less affected by violent market fluctuations.

4. Improvements and Recommendations

4.1. Suggestions of Enterprises

Many studies believe that derivatives can control risks, but there are also some problems in practical use that need to be improved. First, some companies rely too much on models or formulas and think that it is safe as long as they are right. But when the market changes, the key figures used in the model will also change. The price fluctuation suddenly became larger, and the relationship between different assets became unstable. At this time, the hedging result may be inconsistent with the original plan, and the risk cannot be well controlled [9]. Second, real transactions will encounter difficulties. The price of the hedging contract cannot be completely consistent with the actual risk exposure. It is not easy to buy and sell quickly when the market is inactive. In addition, high transaction costs will reduce hedging performance [10]. Third, from the side of public information, it is evident that some companies did not explain why they used derivatives, how much they used, or whether hedging was effective. This will confuse outsiders and even cause management problems[11].

Therefore, three improvement paths can be obtained. First of all, companies should not use only one tool to hedge risks. They can use a combination of methods to test the effectiveness of hedging in very bad or unstable situations [9]. Second, the implementation process should be managed more carefully. For example, companies can set specific targets and rules for hedging and prepare enough funds in advance to respond quickly when the market becomes very volatile [10]. Third, the company should give clearer information, including the purpose, process, and result of hedging. This makes it easier for others to understand and reduces the risk of misunderstanding and compliance [11].

4.2. Improvement of Research Methods

Quantile regression can understand the influence of independent variables on different levels of dependent variables, not just the average. It is very useful to study the influence of derivatives on companies under different market conditions. But it can't handle the situation that changes with time well. If the stock price or market changes greatly, it will miss these patterns. In addition, the results are difficult to explain. In order to improve this, researchers can use panel quantile regression or add time series components to take into account both company differences and time changes.

The GARCH model is applied to examine stock price volatility, especially in cases of volatility clustering. Yet it has notable shortcomings. The standard GARCH model assumes that positive and negative news have a symmetric impact on volatility, which is inconsistent with real market conditions—negative news actually leads to far greater volatility. It also requires pre-specified parameters, and incorrect parameter selection will result in inaccurate predictions. Furthermore, its

linear structure means it poorly captures abrupt or complex market changes. To address these issues, asymmetric models such as EGARCH and GJR-GARCH are adopted to model the asymmetric effects of news on volatility, and more flexible approaches like random volatility and Markov-switching GARCH models are used to adapt to heterogeneous market conditions. Chikwira and Rawjee leveraged such GARCH extended models in their study of South African non-financial firms [8], effectively capturing the time-varying stock volatility and accurately measuring the risk-mitigating effect of derivatives with reliable empirical results.

Overall, both models are useful, but neither is perfect. Using an improved or more flexible version can better describe the impact of derivatives on stock volatility.

5. Conclusion

This paper studies whether financial derivatives can reduce company risks and make stock performance more stable. From the previous analysis and results, it can be seen that derivatives can reduce risks and reduce the sharp fluctuation of stock returns. In the case of airlines, the change in oil prices will damage the return of stocks, but the use of futures contracts can weaken this negative impact. The research of other listed companies also shows that companies that use derivatives generally have low stock volatility and are less affected by the overall market ups and downs. Derivatives can help companies manage risks, especially when the market is in turmoil. But the results also show that the effect varies with the tools used by the company and the market situation at that time.

This study also has limitations, and the results are influenced by specific model settings. Using different models will get slightly different results. In addition, the data period and sample size are also smaller, so the results are not generalizable. Future research can use a longer period of time, more industries, and different methods to test whether the results are consistent.

In a word, derivatives have been used in aviation, manufacturing, and international trade. With the increase in market uncertainty, the company will rely more on derivatives to control risks in the future.

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