The Failure of Hedging Practice in Terms of Model Design: A Case Study of MGRM

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Abstract. Metallgesellschaft Refining and Marketing (MGRM) reported enormous losses on its positions in energy futures and swaps. The failure of the hiding practice leads to a case study of MGRM in order to figure out the attribution behind the hedging model that incurs such loss. The case study is based on secondary information retrieval and literature analysis. Specifically, the paper will look at the role of the "stack-and-roll" strategy in its hedging model design, analyze the required assumptions for the model to be effective, and the significance of backwardation in the model's revenue streaming, as well as evaluate its performances in different scenarios. Based on the analysis, the disconnect of the company market, as well as the breakdown of communication between both companies, led to its failure. Finally, the causal relationship between the model's faulty design and its collapse in market fluctuation has also been investigated in terms of cash flow risk, counterparty risk, market-to-market risk. A possible direction of future research is to conduct quantitative research on primary data on the evaluation of the variance hedging path. These results and findings of this paper revealed the faulty elements in MGRM's hedging model, which can be used as a guideline for the betterment of future financial operations.

Keywords: future markets, energy markets, risk hedging.

1. INTRODUCTION

In 1993, Metallgesellshaft (MG)'s magnificent loss of 1.3 billion dollars in oil trading shocked the financial industry, which then began wondering where the root cause lies. Although one may attribute such catastrophe to the context of a destabilized oil market, the fact that Metallgesellschaft Refining and Marketing (MGRM) is the only major energy trading company that fell during the period forces one to investigate the company's derivative malpractice more thoroughly [1]. In the context of the existence of abundant institutional novices in various trading markets, the unpleasant fact that the uncoordinated parent-subsidiary relation remains an issue unsolved in the business world, thus making the recurrence of MGRM's tragic incidence a possible scenario. Therefore, it is necessary to dive deep into MGRM's hedging models, searching for the faulty elements in its derivative trading and using them as a reference to better future financial operations.

This paper intends to analyze the causal relationship among company's ill financial engineering, which mainly based itself on unrealistic assumptions and expectations of the oil

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market [1], which was accompanied by the massive discrepancy in operating styles between a latent company and its subsidiary [2], as well as the company's ultimate incurrence of massive loss.

MG hopes to build long-term cooperation with American oil retailers to achieve the goal of exploring the U.S. market. MGRM acquired a 49% stake in Castel Energy and reached an agreement with it to purchase the refined oil products in the decade after 1993 at a floating price, with an average of 12600 barrels per day [3].

MGRM began to sell forward supply contracts in 1993 with the contract of supplying oil products at a fixed price in the next 5 to 10 years [4]. The prices on the contract were \$3~5 higher than the spot market price. MGRM offered the other party the option of cash payment (half of the difference between the crude oil futures price of the most recent month and the supply price specified in the contract) [5]. The other party may request MGRM to terminate the contract, and MGRM will pay \$3, assuming the price of the contract is \$17, resulting in the futures price rising to \$23 in the latest month. End users considered it as a good opportunity to ensure future supply at a low price, i.e., they are willing to pay a premium of \$3 ~ 5, with a range of 20% or more. Therefore, MGRM signed contracts of about 160 million barrels.

Fixed price forward delivery comes with the risk of rising prices in the market. MGRM chose to use oil futures and swaps to hedge risks. If MGRM can avoid price risk, it could generate over \$600 million in profits [5].

The rest part of the paper is organized as follows. Section 2 elaborates on the subject of MGRM's risk hedging model involving the company's strategy and assumptions. Then, section 3 focuses on the company's reaction to unexpected circumstances. Subsequently, section 4 analyzes the roles played by the shortcomings of models' design in the company's incompetence in facing the market fluctuation. The conclusion offers a potential research direction after analyzing the current limitations.

2. MGRM'S RISK HEDGING MODEL

2.1 Company's utilization of a "stack-and-roll" strategy in its hedging model design

The contract term between MGRM and customers is very long, but the longest futures contract provided by the New York Mercantile Exchange (NYMEX) is 36 months, forward futures contract generally has poor liquidity. Facing the majority of transactions in recent months, MGRM decided to adopt the rollover strategy to cope with this issue [6]: long holders of contracts in recent months, in the beginning, close these positions at the same time as the delivery date and then buy the subsequent contracts. In this way, they move their positions back and forth until the forward and spot delivery date, as shown in Fig. 1. Under this stack-and-roll strategy, assuming that rollovers are done on the last trading day of the expiring contract, the profit would be:

$$\pi_T = C_0 + \sum_{i=1}^{T-1}[S_{t-} F_t(i)] - F_0 \quad (1)$$

The gain/loss from a rollover done at time t can be defined as follows [7]:

$$Dollar\ Rollover\ Gain\ or\ Loss(t) = \ Roll_t = S_t - F_t(1) \tag{2}$$

$$Percentage\ Rollover\ Gain\ or\ Loss(t) = roll_t = lnS_t - lnF_t(1) \tag{3}$$

In this "stack-and-roll" hedging strategy (schematically illustrated in Fig. 2), the two factors that determine whether the strategy can achieve cumulative rollover gains are the frequency of backwardation in energy markets and the typical magnitude of each rollover gain/loss.

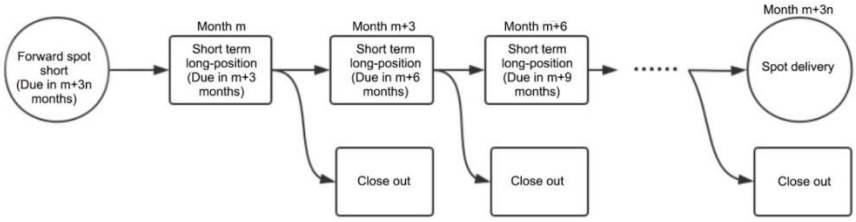

Figure 1. MGRM's rollover strategy [5].

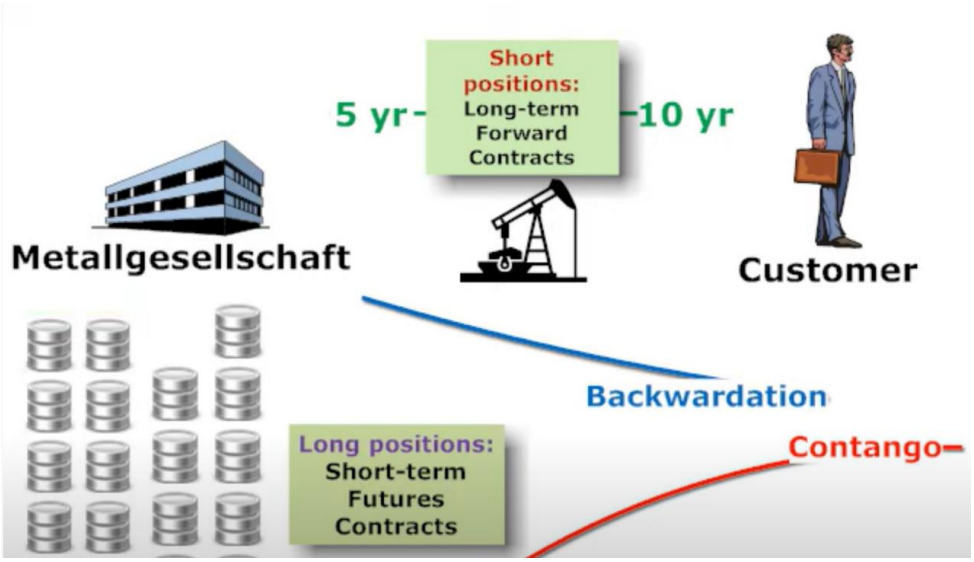

Figure 2. A sketch of the "stack-and-roll" hedging strategy [6].

2.2 Required assumptions for the model to be effective and the significance of backwardation in the model's revenue streaming

This "stack-and-roll" hedging strategy has no cost only when the spot oil futures price (estimate the spot oil price) is the same as the forward futures price. When the recent contract price is greater than the forward contract price, i.e., the market is in backwardation, the rollover method will produce rollover gain, as a cheaper new contract will replace the expired

contract. When the recent contract price is lower than the forward contract price, i.e., the market is in contango, the rollover causes losses [8].

The crude oil market always fluctuates between contango and backwardation, but statistically, backwardations occur more often. Therefore, in the sense of average probability, MGRM can expect to obtain additional profits through a rollover.

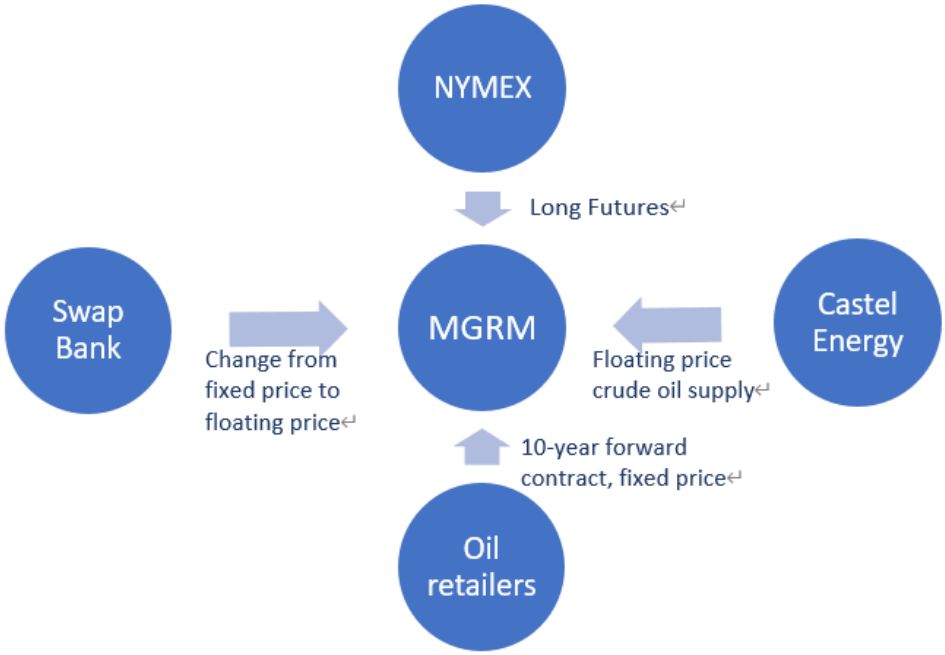

Figure 3. Interaction among MGRM and other Financial as well as industrial players.

MGRM hedges through futures markets and swaps. In the futures market, by the fourth quarter of 1993, MGRM held a long futures position of 55 million barrels. In terms of swaps, there are 100 million to 110 million barrels, and the swap parties are large swap dealers, including major banks, as exhibited in Figure 3.

2.3 Required physical storage of oil under different scenarios

Another hedging strategy MGRM could have taken is the physical storage of crude oil. MGRM could have purchased physical crude oil required to meet its forward commitments and then stored these products to the promised delivery date. However, physical storage costs are relatively high, which would require MGRM to provide storage cost funds, insurance cost funds, and transportation costs. Therefore, under the premise of the fixed forward contract price, the use of physical storage strategy can allow MGRM to enjoy the low price of physical oil but also raise extra costs. Hence, whether to use physical storage strategy depends on the calculation of the breakeven point. MGRM can make a detailed breakeven analysis on the premise of reducing risk, providing a more favorable supply agreement price.

3. RESULTS & DISCUSSION THE MODEL'S PERFORMANCE IN THE UNEXPECTED MARKET ENVIRONMENT

3.1 Fluctuation in the oil trading market and the market's divergence from backwardation

As OPEC failed to reach an agreement on production reduction, crude oil prices dropped significantly. The crude oil trading market has been in backwardation from June 1993 to December 1993, the price of crude oil fall from $ 19 per barrel to less than $15 per barrel. Then, the market shifted to contango after December 1993, and the price raised to over $20 per barrel in June 1994, as depicted in Fig. 4.

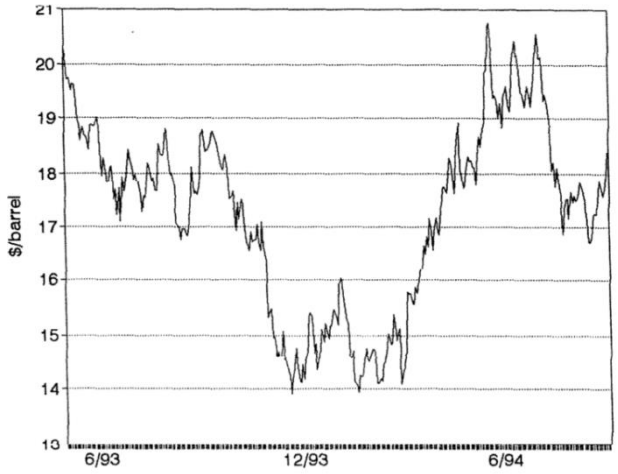

Figure 4. Fluctuation in the oil trading market [9].

3.2 The emergence of margin call and its role in the model's consistent loss

The price decline from June 1993 to December 1993 resulted in a large loss on MGRM's long position. Even though it can be offset by the book profit of the forward spot contract, but the cash flow cannot be realized until the delivery. The margin on the futures had to be added. Moreover, the futures premium stage increased additional losses when extending and moving positions. Meanwhile, NYMEX canceled the "hedging preference" for MGRM and doubled the margin given the large position of MGRM.

3.3 The role played by ineffective communication between parent and subsidiary

The board of supervisors of MG, the parent company, considered that the loss was caused by a large amount of speculation and liquidated, closed the oil futures position, terminated the forward supply contract by paying liquidated damages. MGRM lost $1.3 billion and spent another $1 billion to terminate the contract with Castel Energy. These losses exceed half of MG's capital. It was an unwise decision, which exacerbated the loss of MGRM. The liquidation took place at the most undesirable moment. If MG did not liquidate, MGRM could

achieve its initial goal without losing capital. One of the reasons for this loss is the ineffectual communication between parent and subsidiary.

4. THE CAUSAL RELATION BETWEEN THE MODEL'S FAULTY DESIGN AND ITS COLLAPSE IN MARKET FLUCTUATION

The reasons for the huge losses of MGRM are related to external market situations. The short-term decline in oil prices is caused by the OPEC's agreement failure. On the other hand, there are also internal risk management factors.

4.1 The design's rollover cash-flow risk

A major feature of rollover hedging is the continuous replacement of short-term contracts to achieve long-term hedging. Based on establishing bulls in the futures market and carrying out rollover hedging can generate rollover gain in backwardation but rollover loss in the contango. Thus, the prediction of the market direction is crucial in this strategy. If the market is misjudged, MRGM would suffer losses and be required to add margin. Especially when the forward contract cannot be delivered, MRGM would not have enough cash flow support.

4.2 Counterparty risk

MGRM's 10-year forward contract has the risk of counterparty default when oil prices fall. Owing to the opacity and high-performance risk of the contract, if MGRM's futures position has a big loss, they would not be able to use the forward contract as collateral to obtain loans and pay much-needed margin, regardless of the large potential profits in the forward contract.

4.3 Market-to-market risk

The futures price may fluctuate sharply for a short time during the hedging, and a firm can suffer the risk of additional margin [10]. The energy market was depressed in 1993, the long short-term oil futures contracts used for hedging formed huge floating losses. According to the settlement rules of mark to market of futures trading, MGRM has to pay a sufficient margin. What is more disadvantageous is that the energy market has turned into a futures premium instead of the usual futures discount. In addition, to pay the closing loss, a large amount of cash should be spent to make up for the change of basis. In addition, to reduce the risk of default, NYMEX doubled the initial margin of oil product futures contracts, which suddenly put MGRM under greater pressure.

5. CONCLUSION

In summary, several factors contributed to the loss of MGRM are analyzed. The hedge model did not allow for unexpected fluctuations in the market. Executives based future profit margins on current markets and allowed no room for safety-net protections for the forward delivery contracts. In essence, the company went against the golden rule of the market, preparing for the unpredictable.

The limitation of the research is that most research on the loss of this company is from third-party observers. It is difficult to truly understand how the key players came to form these decisions when there is no one directly involved to give the history of what happened. Besides, the research is rather general instead of specific, which repeats the same information because of hearsay. When attempting to delve into research on such topics in the future, first-hand knowledge is the best. Scholars can better analyze the decisions and actions that came before the results, which will be more effective.

A possible direction of future research is to develop the analytics underlying the hedging of long-term flow commitments with short-term futures contracts to a quantitative evaluation of the minimum variance hedging path. The findings of this paper can be used as a reference for the betterment of future financial operations to deal with the usage of short-dated instruments in a stack and roll strategy to hedge long-dated obligations.

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