Tyson_AnnotatedBib_Module2

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February 13, 2019

Culp and Miller (1994) Hedging a flow of commodity deliveries with futures: Lessons from Metallgesellschaft

Culp and Miler open by stating that contrary to normal thought, or debate among other economists, a company can hedge its long-term exposure to spot prices with short-dated futures. They even show a three-period example as to why it works. Regardless of the movement of spot prices, the strategy is still profitable.
We do see in Bollen and Whaley's paper that there is a possibility of loss throughout the whole hedge, but it is still small and the expected profit is much greater. Any profit maximizing firm would thus want to use the synthetic storage hedge if they possessed the superior information to do so, which MGRM did, as explained by Culp and Miller.
The real risk that was not considered by MGRM was operational risk. This risk is the risk that management and/or creditors of MGRM didn't understand the strategy fully, which is what ended up happening and the 1.3 billion dollar loss was incurred as a result of early termination of the hedge. Because of the large cash requirements at the beginning of the hedge, MGRM should have gotten advanced credit to provide the cash needed should this crunch occur, and the large loss never would have happened. We can learn a lot from the MGRM case.

Culp and Miller (1995b) Metallgesellschaft and the economics of synthetic storage

MGRM, a conglomerate of Metallgesellschaft, is a contender for the world record loss in derivatives. No one knows why it was liquidated when its margins were called, since it still had fixed-price contracts still in force, but speculation leads us to believe its because the supervisory board believed MGRM wasn't actually hedging as it had said it was, but was speculating on prices, leading them into dangerous territory.
MGRM was participating in something called 'synthetic storage'. MGRM's derivatives protected the firm and its creditors from risks that spot prices would fluctuate in a way that would lead to a loss. MGRM borrowed oil short and lended long, creating a mismatch between assets and liabilities known to be a financial disaster. Oil is different from most commodities, as it has a negative basis. This 'backwardation' occurs when demand for oil is higher than supply. This causes spot prices to rise above futures prices, since firms need oil on hand. Here, it is beneficial to lend short and borrow long. Thus rollover costs must not be judged, as it is the long-term that profits will be made.
These synthetic storage programs can be recalculated each each period to reflect the arrival of new information. This is a concept we have discussed extensively this semester. Even these synthetic storage programs will try to remain in equilibrium.
Funding risk, or the inability to produce cash to maintain payments, is another culprit looked at in the MGRM liquidation. Because short-dated futures are more volatile than long-dated, cash inflows and outflows may be larger as well. Because of this, we can assume MGRM wouldn't have extended its contracts unless it thought it had support from its parent, however that thought must have been unwarranted. It is hard to know what actually caused the failure, and if it would have continued if it wasn't liquidated, since it is the only company to attempt this synthetic storage program.
It would be very interesting to see a new patroleum business attempt what MGRM had. In the oil industry, synthetic storage could lead to good profits should a firm account for operational risks and attempt it as an independent company that can't be shut down by a parent. It is very interesting that oil basis don't seem to stay in equilibrium, and this is a clear arbitrage that MGRM was trying to exploit.

Murray (1994) A Drunk and Her Dog

Cointegration is when there exists a stationary linear combination of non-stationary random variables. If we were to see a dog sitting outside a bar before going in, the longer we wait before coming out provides more confusion about where the dog wandered off to. This is an important characteristic of non-stationary

variables, that the more periods we go out, the higher the variance.
Nonstationary series that become stationary when differenced n times are called integrated of order n. For a set of variables to be cointegrated, they must be integrated of the same order. The use of a standard distribution will lead to too few rejections of the null that variables are not co-integrated. When performing analysis, we must instead use a correct distribution.
If one regresses a stationary variable on a non-stationary variable, the association will go toward 0 in large samples. This cointegration relationship can be applied to derivatives in that the prices of derivatives should be cointegrated with the underlying. Also, many separate derivatives may be cointegrated with one another. For example, oil futures should be cointegrated to some extent with jet fuel.

Liu (2005) Price Relations Among Hog, Corn, and Soybean Meal Futures

In the paper they are looking for a cointegrating relationship between futures contracts of hogs, corn and soybeans. All 3 series fail to reject the unit-root test, showing they are non-stationary. Through a first difference test, it can be shown that they are all integrated of order 1, so there is potential for a cointegrated relationship. Since August is the month when summer sales is ending and spring sales is beginning, it is the month left out to avoid the dummy variable trap since the upward or downward trend is unpredictable.
Looks at inefficiencies in these markets and the arbitrage opportunities. Since hogs feed off of these 2 items for the majority of their meals, they should be cointegrated. When prices of these go up, the prices of hogs go down. The hog spread is short hog and long soybean and corn meal.
This spread should only provide a profit if the markets are in disequilibrium, otherwise traders would already be accounting for these inefficiencies.

Bollen and Whaley (1998) Simulating Supply

Bollen and Whaley write about how MGRM's hedging strategy would have been very profitable should it have been allowed to continue. This is a very opposite view to Pirrong, even with his fancy econometric models. They mention MGRM's stacked hedge, and the overall strategy. I will not get too in depth, as it is covered better in the paper Culp and Miller (1995b).
They argue that some companies with a competitive advantage in a certain market, as MGRM almost definitely did in the petroleum market, would be better off speculating than performing minimum variance hedging. Their stack-and-roll strategy was fit to make a profit from the general backwardation of petroleum. In the end, they conclude that almost every simulation run holding MGRM's position until completion results in not only a payoff, but a significant one. They show that it was pulled at the worst time just because there was a merk-to-market loss, but should the hedge have held there would have been large profit. Obviously there were scenarios in the left-tail that would have still had losses, but at least in the chart it showed none of those losses would have been as large as the losses taken by exiting the strategy at the time management shut it down.

Williams (1982) The Origin of Futures Markets

Williams states that there is surprisingly little study done about where futures markets emerged, but there is evidence that they grew slowly. The Chicago Board of Trade encorporated official rules regarding futures in 1865. There was however, evidence of contracts stated as 'To arrive', several years prior to this in many commodities such as cotton and butter. There is even evidence of options traded on futures as early as 1847, which is entirely remarkable.
There is strong evidence in the mid-1800s that futures trading occurred even more often than physical trading. "To-arrive" contracts and future delivery contract volume far exceeded physical volume, even in the dullest of trading days. Rather than increments like the physical markets, futures contracts were traded in round lots of sizes like 100, 500 or 1000. This is evidence that traders weren't interested as much in how much of the commodity they would be receiving, but how easily they could offset the position. This is clear evidence that traders were speculating rather than trading for hedging purposes.

Alizadeh and Nomikos (2008) Performance of statistical arbitrage in petroleum futures markets

They look at trading strategies within the energy industry and want to show that inefficiencies can be exploited even when there are large transaction costs. They use an error-correction model to show that cross-matched pairs of petroleum futures contracts have a cointegrating, error-correcting relationship that

provides an arbitrage opportunity. In the introduction of the paper, they are directly refuting Hayek's idea that prices reflect all available information. They are saying that prices reflect the knowledge inherent in the market, but with intelligent trading strategies, there are ways to earn abnormal returns.
They do go on to say that oil and other energy futures all react simultaneously when there is a knowledge shock to the market, demonstrating they do believe in the underlying theory imposed by Hayek.
They go through the statistical process to show that each futures price is individually integrated of order 1, showing non-stationary patterns, and then use this information to create error-correction models. They state that with this statistical model, there are limitless numbers of trading strategies that could be implemented. They continue to show the cointegrating relationships modeled provide a long-run mean-reversion. This is a main theme we have seen during this module, as with the hog spread and many other energy futures cointegration trading strategies.The biggest difference here, is they are using the relationship between different futures contracts in the energy market rather than looking at the relationship between spot and futures. In this way, it is similar to the hog spread strategy which we have seen worked well.
The strategies implemented here are one more example that there are inefficiencies to be found in markets. They found evidence that investors can benefit in small lapses in MA models that allow for gains to be made on the spread.

Culp (2003) The Modigliani-Miller Propositions

This paper was written to examine the M&M propositions that a firm's value can be derived by its expected cashflows and real net assets, rather than the company's financial structure and fiscal policies. This is really the heart of corporate finance. This means that financial decisions should have no impact on a firm's value. Sometimes this may be the case, but it is important to think about when these decisions will have an impact on future cashflows, as this would have a direct impact on firm value.
Something I found very interesting in this theory is that the company's capital structure should have no effect on its value. So a highly leveraged firm holding the same assets as a zero leverage firm should have the same value. I find this misleading, as the cashflows of a leveraged firm will be much different, and this is not discussed in the paper.
The paper does list several assumptions that would have to hold for the propositions to be true, and these assumpotions would very rarely if ever hold in the real world. In a sense of risk management this is very important to consider, though I still don't agree with the propositions as a whole due to reasons I stated previously.

Culp and Niskanen (2003) Corporate Aftershock: The Public Policy Lessons from the Collapse of Enron and Other Major Corporations

In this paper, Culp is talking about Enron and what exactly happened. It was, afterall, one of the biggest company collapses of all time. Culp opens this discussion by talking about how the neo-Austrian view is that markets are constantly in equilibrium. He counters this by mentioning the neo-Austrian view, which is that markets are in a constant state of flux, always getting closer to equilibrium. This is very important as he mentions later, since the strategies that Enron was implementing by becoming a market-maker in the energy industry was based on the fact that markets were in a constant state of flux, and were working their way towards equilibrium.
This is a very important point to bring up in the Enron case, as the Austrian view of markets is the only view that would give merit to the strategy implemented. Obviously Enron had a lot of bad accounting and management practices occuring in the company that caused it to ultimately fail, but the way it was making a market in the spot and futures of energy commodities was absolutely remarkable. The arbitrage opportunities allowed Enron to make a huge abnormal profit that would be revelled to this day had it not had such large faults that led it to bankruptcy.
When Enron took this role of acting as a market maker, they were a perfect candidate as they could set prices to relay knowledge to markets. This all comes back to Hayek and the knowledge problem. Since Enron had knowledge that would be important to markets, markets became much more efficient with Enron putting on this strategy as an intermediate-supply wholesaler.
We can see the inside knowledge that Enron had, as each time (and there were multiple) that Enron tried to implement this strategy and enter different markets other than energy, it failed.
Much like MGRM as we see in the paper by Bollen and Whaley, Enron also entered into what is called

synthetic storage with oil contracts. They would enter contracts of spot and future that allowed them to collect the convenience yield for oil without actually having exposure to it. This again could only be implemented because of the knowledge that Enron possessed of the oil markets.
Culp goes on to discuss basis trading and how it only works in a neo-Austrian theory, as it is all based on the fact that markets diverge from equilibrium. The basis trading strategy is to look at the spread of spot and futures contracts and then buy when the spread gets larger than the long-run mean, and wait for the mean-reversion to occur to close out the position. Again, very similar to the strategy by MGRM.
Again, Enron's strategies for synthetic storage and market-making were great. If they had not failed for other reasons, they would still be a large company today. We see proof of this as more and more companies have started to implement these strategies in their respective fields.

Culp and Miller (1995a) Hedging in the theory of corporate finance: A reply to our critics

Culp and Miller open by citing Holbrook Working and his explanation of the classical definition of hedging: The risk-minimizing hedge that makes a corporation behave as a risk-averse investor. This is not what MGRM was trying to do. They were engaging in a type of hedging called synthetic storage. This is a debate that we have discussed much in this class, as many people in literature including Pirrong believe that all hedging should be risk-minimizing.
This value-maximizing hedge should be put on by corporations with superior knowledge, which MGRM clearly had in the energy industry. This allows them to maximize their profit rather than minimize risk, which is what any firm capable of doing will choose to do. This hedging strategy changed the volatility of the cashflows for MGRM from the volatility of the spot price to the volatility of the bases, which should have a mean-reverting relationship and be much less volatile, as we have seen in the econometric models in other papers during this module.
This is why MGRM used a 1-for-1 hedge. Obviously, as seen in the Pirrong paper among others, the minimum-variance hedge ratio will be much less than 1, however the synthetic storage that MGRM was looking to exploit called for a 1-for-1 hedge ratio, subject to tailing. The large loss that MGRM took wasn't because of a faulty hedge, it was because management and/or the creditors didn't fully understand the synthetic storage hedge that MGRM was doing, and stopped it too early. If we look at the paper by Bollen and Whaley, they show that the distribution of returns should the strategy be left for the life of the hedge provides much greater chance of large profit, with minimal chance of large losses. I agree with Culp and Miller in their refute against M&P.

Pirrong (1997) Metallgesellschaft: A prudent hedger ruined, or a wildcatter on NYMEX?

Pirrong states that the riskiness of a barrel-for-barrel hedge on crude oil is completely dependent on the dynamics of oil prices. He also states that a variance-minimizing hedge wasn't the only appropriate hedge for MGRM, but that it is a benchmark to compare the risk inherent in other hedging strategies. He then continues to produce his so-called 'best' hedge strategy for MGRM, which is a continually adjusted dynamic hedge ratio. This creates for the firm a synthetic forward position. He argues that since backwardation is a random variable, the hedge ratio should change randomly as well.

Even though Pirrong states that a minimum-variance hedge is not the only optimal hedge for MGRM, he still believes that the definition of hedging is to risk-minimize the strategy, contrary to the belief of Working cited by Culp and Miller. Pirrong employs econometric models to outline a risk-minimizing hedge for MGRM, which is very dynamic in nature. I do not disagree with Pirrong regarding the best strategy for MGRM should they be wanting to minimize the variance of its cash flows, however Pirrong doesn't take into account the risk-neutral situation that MGRM puts itself in as cited by Culp and Miller MGRM acts as a market-maker for oil contracts as it has specialized information that allows it to have a competitive advantage in the oil industry.

Pirrong also believes that many of the assumptions made by Culp and Miller were generous. For example, the discount rate used by Culp and Miller was the 3-month T-bill, even though the rate received by creditors was higher. He also talks about the lack of interpretation regarding the intervention from creditors when they saw the marked-to-market losses incurred by MGRM. He again states that a variance-minimizing hedge would have significantly reduced these risks. I believe Pirrong has a point, especially regarding the creditors that didn't know the finance or econometrics behind the stacked hedge strategy. I believe that this was a risk

that MGRM didn't sufficiently incorporate into their strategy of their hedge, though I do still believe it is a hedge as it put them in a risk-neutral position, even if only according to Working's definition.

Depending on what MGRM wanted to do, there are different answers to the question 'what is the correct hedge ratio'. However, knowing the ratio they went with, we can believe that MGRM was not looking for a variance-minimizing hedge, and was rather speculating and wanting a risk-neutral position due to their superior market knowledge.

The empirical strategy outlined by Pirrong regarding the hedge ratio is a dynamic hedge obtained through a very complex econometric model that continues to adapt as new information regarding spot and futures prices are obtained. Pirrong clearly shows that the hedge ratio is significantly less than 1, and this makes sense.

In class we talked about how Pirrong invokes Bayes' Rule at the end of his paper, discussing the prior. Bayes' Rule can be invoked to describe the predictive distribution, which we can see in the paper by Bollen and Whaley. We see that there is a skewed distribution for the stacked hedge, rather than the normal distribution for the variance minimizing hedge. The skew shows in the predictive density that the stacked hedge has a slightly higher probability of an extreme loss, but that the probability of higher returns was much, much higher.

Pirrong invokes Bayes' Rule to offset the belief that MGRM had superior information, as Culp and Miller oft stated in their paper as a main reason that MGRM was able to work as a market-maker. Pirrong wanted to show that regardless of how informed you thought MGRM was after reading Culp and Miller's paper, his econometric models and dynamic hedge stratey created would prove that if MGRM was really informed they would have used a minimum-variance hedge. I believe he is trying to show overconfidence in his models, stating that regardless of the charitability of ones' priors, his models would still show that any informed firm would use a variance-minimizing hedge, but MGRM wasn't trying to minimize its variance, but rather maximize profits, which is what any firm should do.

Ng and Pirrong (1996) Price dynamics in refined petroleum spot and futures markets

After price volatility in the spot oil market, there were limits placed on futures because many believed speculation was causing this volatility. They obviously didn't understand the price information that is gained through derivative trading. This paper introduces a new empirical approach to explaining the relationship between spot and futures contracts. It shows the price information of two very important commodities: heating oil and gasoline.
With econometric analysis, the paper shows that virtually all of the price fluctuations in the spot returns can be shown in the spread of the bases of the two commodities. It can also be seen that volatility shocks in futures markets spill over to spot markets, and also last longer in futures markets.
As seen in many other papers, they show there is an error-correcting relationship between these commodities and the spot and futures prices. The error-correcting coefficient is larger when the spread is larger, meaning the spread reverts to its long-run mean much quicker. This shows a clear cointegrating relationship.

Working (1953) Futures Trading and Hedging

Working gives his definition of futures contracts. He refutes the idea that all futures contracts are for future delivery, since some are actually settled in cash. Because of this, he says, futures can also be considered spot contracts. There is a language issue in markets, in that most people think futures and commodities trading are so different, when they are really the same except for the fact that futures are a derivative of the underlying.
The most important aspect of the paper, at least what we have discussed in our course, is that hedging is not just for minimizing the variance of cashflows, but can also be for speculative purposes, even outright arbitrage. This is the idea that has been attacked ruthlessly by critics of MGRM. Culp and Miller, as we have seen in their papers throughout this module, defend Working very well in his definition of hedging and how there are multiple ways to go about hedging that don't all involve minimizing the variance of returns.

Figlewski (1989) Options arbitrage in imperfect markets

Since basic options arbitrage strategies imply frictionless markets, Figlewski looks at market imperfections and the impact of these imperfections on the classic arbitrage strategy. Because of the fact that options

should have a no arbitrage relationship to the underlying, options hedging strategies should earn the risk-free rate, however in a real world market, this is not the case due to many of the assumptions of the Black-Scholes model being violated.
One of the biggest problems with the assumptions is that volatility is constant. Obviously in the real world, the volatility is constantly changing. For close to the money options, small changes in volatility lead to drastic changes in the option price. This unknown volatility is also a determinant in the hedge ratio, and leads to issues in this as well.
Probably the largest assumption is no transaction costs. With bid-ask spreads, transactions costs will be very important when implementing hedge strategies. It is also important to note that continuous borrowing at the risk-free rate is not reasonable.
Uses simulation to draw from standard normal distribution to determine proper arbitrage option strategies. The standard deviation is higher than one would expect given all of the assumptions. This shows the imperfections of this strategy. We can then look at the difference from the implied volatility and the realized volatility to determine an arbitrage options trading strategy. This is different than the classical arbitrage strategy gecause it is looking at deviations from the implied volatility, and actually works in the real world. There are huge swings in the prices of options when the volatility is not correctly estimated.

Clewlow and Hodges (1997) Optimal delta-hedging under transactions costs

We have seen in class that Black-Scholes and the delta-hedging strategy we have discussed assumes that there are no transaction costs. In the real world, we know this is never the case. This paper looks at computational methods to determine the optimal strategy in a world with transaction costs, both fixed and proportional.
In the paper, they assume transaction costs are constant, which may not be the case in the real world, however it is still a better assumption that assuming no transaction costs. Since the Black-Scholes model relies on the fact that there is a perfect hedge that exists for each underlying asset, this must be taken into account when looking at a hedge with transaction costs. The basic hedging strategy will assume constant rebalancing of a portfolio to remain delta-neutral. In a world with transaction costs, however, this will become infinitely negative when rebalancing constantly. The hedger will go bankrupt in milliseconds.
When considereing transaction costs, this paper looks at maximizing expected utility rather than minimizing delta for the hedging strategy. This can alternatively be viewed as minimizing a loss function, which is exactly what a risk-minimizing hedger is looking to do. The paper gets very technical, and I will just mention the model used, which is stochastic optimal control. Under proportional transaction costs, they set bounds within which the delta must be maintained.
The results of this study are very significant because we can't assume a world with no transaction costs like we see with Black-Scholes. I also find it very helpful that it returns an upper bound and lower bound for which delta must be maintained, rather than an exact number. This allows the hedger to minimize transactions costs because they only have to rebalance when the bounds are crossed.

Doran (2007) The influence of tracking error on volatility premium estimation

Doran is looking at the effect of not considering gamma in a hedger's delta-hedged portfolio. As we saw in class, being short gamma will lead to large losses when there are large fluctuations in the underlying stock price. This shows there is a negative volatility premium for the market-maker, and these large losses are not overcome by small gains when the stock price stays fairly static.
It is first important to understand that a delta-hedge is not a risk-minimizing hedge. All the trader is trying to do is remain delta-neutral. This can lead to an insignificant relationship between the volatility risk premium and the hedged portfolio. This can be overcome by gamma hedging as well.
Gamma hedging is done by also buying an out-of-the-money call or put option to add to a delta-hedged portfolio. The gains from this gamma-hedged portfolio can then be attributed to the volatility risk premium, as was expected with a basic delta-hedged portfolio. The addition of this option eliminates tracking error that can be found in delta-hedged portfolios.
We can see this is a volatility risk premium, but it is not dependent directly on vega. It is, however, dependent on the cross-product of the derivative of volatility.
The findings in the study support the hypothesis that there is a positive volatility risk premium when a hedger accounts for gamma in their portfolio. It is then shown through some complex modeling that any profit in a delta-gamma-hedged portfolio comes from this volatility premium that is being ignored in a

simple delta-heded portfolio. When looking back at the previous clewlow paper, it is important to note that transactions costs with rebalancing the three positions may overcome any profit to be made. In fact, the author touches on this at the very end, and is not to go unnoticed.

Haug and Taleb (2011) Option traders use (very) sophisticated heuristics, never the Black–Scholes–Merton formula

The argument in this paper is that the formula that BSM came up with for options pricing has, in fact, been used for years by traders, and all BSM did was adapt it to fit economic conditions a little better by fudging the tails of the distribution to come up with a hedging strategy. The no-arbitrage pricing theory underlying Black-Scholes has been around for years, and all they did was come up with economic literature to show what options traders have known for years.
Throughout the paper, the authors note that options traders have been using Black-Scholes for years before it was written. It does make sense, since traders are known to develop and pass on techniques without writing them down, as it is what works for them so why would they give away their secret. I still believe that Black-Scholes has its place for options traders though, and is the base that most options markets use today. We have heard in class that Black-Scholes is the most important discovery in all of economics. Though it may be the case that the underlying theory behind Black-Scholes has been seen for years, I still believe what they did to come up with the pricing formula deserves merit, and has completely enhanced options markets.

Figlewski, Silber, and Subrahmanyam (1990) Financial Options: From theory to practice

Options rely on the equilibrium price between the underlying and the option to denote the option's fair value. Since it is difficult to match buyers and sellers in practice, some market-maker stands ready to buy or sell options based on their fair value. This improves liquidity in the market, and allows Hayek's theory of knowledge to work, and prices better reflect information in the options markets.
Though a market-maker's bid/ask spread is super relevant, not much is known about how exactly one arrives at this spread. This paper tries to look at the thought process that market-makers exhibit and how they influence market behavior.
The liquidity costs of market-makers is not fixed. Depending on the position the market-maker is currently holding, they may manipulate this spread to their liking in order to most benefit them to remain in a risk-neutral position. This is why traders will ask what the bid/ask spread is and then instruct their broker to beat it. This can reduce the liquidity costs without impacting the market-makers
Zero-risk arbitrage opportunities are not worth a trader's time. Since they don't have zero transactions costs like market-makers do, even if they do find one, they may not be able to make the profit that a market-maker can if they find the same opportunity. This is why these arbitrage opportunities almost always find their way into the hands of market-makers.
Market-makers have higher spreads at the opening of trading because they have yet to see much information regarding the flow of trades that day. Looking at Hayek, we can see that this is not the most optimal way for knowledge to flow into markets. Since market-makers will introduce less liquidity in the beginning of the day, some knowledge will not find its way into markets until later.
We see in this paper that market-makers have a very important role in markets. They introduce liquidity, and allow knowledge to be introduced to options markets, which will also show equity traders much needed information.

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