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Hedging jet fuel price risk: The case of U.S. passenger airlines

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ABSTRACT

Jet fuel accounts for a large portion of passenger airlines' operating costs, and airlines' earnings are susceptible to swings in the price of jet fuel. This study uses daily data over the past two decades to determine the minimum variance hedge ratio for airlines wishing to hedge jet fuel price risk with futures, while also establishing the best cross hedging asset. Airlines hedging with futures would create the most effective hedge by using heating oil futures contracts with a 3-month maturity. We also find that beyond the 3-month veil, increased time to maturity makes heating oil less effective as a cross hedge proxy for jet fuel. However, both in-sample analysis and Monte Carlo simulation results with daily data show that none of the 4 cross hedge proxies, including heating oil, can be considered highly effective.

1. Introduction

The total number of travelers has more than doubled since deregulation of the U.S. airline industry in 1978. However, airlines are still having a difficult time staying profitable. Due to competition, the price premium that airlines are able to charge has fallen 20% over the past two decades (Borenstein, 2011). These have worked out as a tremendous advantage for passengers. However, it has not had the same favorable effect on airlines.

The increased competition has also made it so airlines cannot easily pass on costs to consumers. In conjunction with this, airlines have narrow profit margins implying that airlines have restricted cash flows in the event of an input price increase. The combination of these factors means that for an airline to succeed it must manage costs more efficiently. Of airlines' many costs, the two largest single areas of cost are labor and jet fuel. Traditionally, labor has been an airline's greatest cost but jet fuel has gradually replaced labor as the single largest cost. The increase in the price of jet fuel has been paired with an increase in the price volatility, meaning that not only have the price swings become larger as a percentage, but fuel costs have also become larger in both nominal and real terms.

Airlines currently use many different methods to reduce fuel usage. Many airlines are updating fleets and making modifications to aircraft to increase fuel efficiency. Other airlines have gone as far as replacing the seats, television monitors, and even the beverage carts with newer and lighter versions (FAA, 2011). However, these improvements have not been enough for airlines to remain profitable during times of increased jet fuel costs. Because of this, fuel hedging and financial contracts play an important role in fuel cost risk management. Typically airlines use a cross hedge, where the hedging contracts have commodities that are highly correlated with jet fuel. Airlines are presented with a small array of different commodity options, but the most widely used are West Texas Intermediate – Sweet Crude (WTI), Brent North Sea oil (Brent), heating oil and gasoil.

Nevertheless, the traditional benchmark used for jet fuel hedging, WTI, has started to follow jet fuel price less closely than it did in the past. Previously, the price movements for WTI and other crude oils moved along similar to the movements of jet fuel. However, recently the movements have become less correlated. As the gap between crude and jet fuel prices increases, it will significantly hurt those who hedge with WTI futures. Recent shale revolution and increased unconventional oil production in North America strained the existing infrastructure at Cushing, resulting in a bottleneck that led to excess supply which resulted in the large price differential between WTI and Brent. Additionally, since the pipelines are at capacity, the truck and rail costs of transporting crude oil to the Gulf Coast also increased the price differential between the Gulf Coast and WTI. While there are many reasons for the gap increases, one potential reason is that the U.S. is exploiting new sources of crude oil, which is lowering the price (IATA, 2013).

This study aims at finding risk minimizing hedge ratios for the different futures contracts used for cross hedging jet fuel. Airlines

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often feel that they should hedge, but admit that they are not sure of the best way to do so (Mercatus, 2012). Those that do hedge often do not have the most effective or successful hedges (Morrell and Swan, 2006). Much of the existing literature in this area addresses why firms hedge (Morrell and Swan, 2006; Halls, 2005), value creation from hedging (Carter et al., 2006), or transportation operations and hedging (Treanor et al., 2014; Lim and Hong, 2014). There is limited research (Adams and Gerner, 2012) that presents the optimal volatility reducing hedge ratio for airlines. Furthermore, no study has examined the hedge effectiveness of the abovementioned petroleum commodities for jet fuel. While other studies have attempted to provide this answer, they have focused more on the models than the results.

We examine four commodities (WTI, Brent, heating oil and gasoil) that are typically used by airlines for cross hedging jet fuel. We find heating oil to be the most suitable commodity for cross hedging, and contrary to an earlier finding by Adams and Gerner (2012), we find gasoil to be the least suitable of the four. This result, however, maybe sensitive to the price of jet fuel spot market location used for the analysis.

The paper is structured as follows: Section 2 provides a review of literature; respectively, Sections 3 and 4 present the models and the data used for our study; Sections 5 provides a discussion on the results, and Section 6 concludes.

2. Literature review

2.1. Industry background

In the decade after U.S. airlines deregulation in 1978, the industry lost $10 billion (Borenstein, 2011). The following decade, the general economic growth of the 1990s saw the airline industry reclaiming $5 billion only to lose $54 billion dollars in the 2000's (Smith and Cox, 2008; Borenstein, 2011).[1] During the year 2005, four of the top seven largest domestic airlines in America were under Chapter 11 bankruptcy restructuring (United Airlines, Delta Air Lines, US Airways, and Northwest Airlines). These issues have led some to determine that “there is no conventional long-run equilibrium explanation for an industry that perpetually loses money” (Borenstein, 2011; page 233).

Due to the industry's competitive nature, U.S. airlines have very low profit margins. This means that any sort of external shock to their already narrow profit margins could result in a huge loss for the airlines. If jet fuel costs were constantly rising, then airlines could react appropriately; however because the price will change frequently and erratically, airlines have a harder time planning their expenses. For example, in 2008 the price of jet fuel in the beginning of January was $2.714 per gallon; it rose 54% in six months to $ 4.179 per gallon before falling 71% to $1.202 in December of that year. These price swings are potentially damaging when coupled with the fact that fuel can be over 35% of an airline's costs (Southwest Airlines, 2013).

While 2008 is by no means an average representation of a typical year for jet fuel prices, it is an extreme representation of what can happen. Also, when airlines do face high jet fuel prices, there does not seem to be any possible short term capacity adjustments to tackle the sticky and fixed costs (Borenstein, 2011). To protect themselves from adverse price swings many airlines enter into derivative contracts and financial instruments, although others have resorted to other alternatives, like the 2012 Delta Air Lines purchase of an oil refinery (Delta Air Lines, 2013). The takeover of an oil refinery gives many benefits to Delta. First, it may help to protect against swings in all petroleum commodity prices. Delta has contracts in place to exchange the non-jet fuel distillates and products to BP and Phillips 66 for jet fuel (Delta Air Lines, 2013). Additionally, the purchase of the refinery included the assets needed to use the jet fuel refined at Trainer to support Delta's operations in Northeastern US, including LaGuardia and John F. Kennedy International Airport (Delta Air Lines, 2013). However, the purchase of the refinery exposes the airline to the additional risks that arise from operating a refinery.

2.2. Fuel hedging and the U.S. airline industry

Because of jet fuel price risks, many airlines have created fuel hedging programs in an attempt to limit their exposure to upward swings in the cost of jet fuel. The problem with jet fuel is not specifically the cost but the volatility in the cost, because risk does not necessarily depend on the cost of the asset. U.S. airlines often have a difficult time hedging. Airlines frequently use an Over the Counter (OTC) contract called a forward that is specifically catered to the airline's needs, but this is often a difficult task for an airline that refuels in many places. The OTC derivative markets were implicated as a systemic risk during the U.S. financial crisis of 2008. To address the regulatory oversight of the huge risk exposures associated with the OTC markets, one of the requirements under the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, or the Dodd-Frank Act, is that most OTC derivatives be traded on exchange (Miller and Ruane, 2012). More airlines may begin to hedge on exchange traded contracts after the implementation of the Dodd-Frank requirement and when more exchange traded contracts become available. During most of the period of this study (1994–2014), there were no exchange traded jet fuel contracts. This means that airlines must undertake a practice called cross hedging. In this practice, an item that is highly correlated with jet fuel is hedged. For airlines, this means that in lieu of using futures contracts for jet fuel, they would use one of a different petroleum product. Airlines are left with the choice of which commodity they would like to use as a cross hedge.[2]

Southwest Airlines is well known for hedging a high percentage of its fuel use and mentions “the Company has found that financial derivative instruments in other commodities, such as West Texas Intermediate (WTI) crude oil, Brent crude oil, and refined products, such as heating oil and unleaded gasoline, can be useful in decreasing its exposure to jet fuel price volatility” (Southwest Airlines, 2013; page 25). However, the use of instruments with underlying assets that differ from those actually used leads to a potential situation where the two commodities are not perfectly correlated. The difference between the spot and futures prices is called the basis. For firms that cross hedge, there is an increase in the size of the basis, leading to an increased amount of basis risk.

There is no way to be sure of the connection between the two assets. Southwest notes that “the correlation between WTI crude oil prices and jet fuel prices during recent periods has not been as strong as in the past, and therefore the Company can no longer demonstrate that derivatives based on WTI crude oil prices will result in effective hedges on a prospective basis” (Southwest Airlines, 2014; page 27). Thus airlines hedging strategies are not necessarily successful (Morrell and Swan, 2006; Mercatus, 2012), and fuel hedging has no statistically significant effect on airline

[1] Much of the loss of the 2000s came as a result of the terrorist activities on September 11, 2001 and the Severe Acute Respiratory Syndrome (SARS) leading to a $23.2 billion loss between 2001 and 2003 (Smith and Cox, 2008).

[2] Under the Dodd-Frank Act, traders must put down cash at the opening of a contract to cover potential losses, and subsequent deposits are required to cover the actual losses of a position (Miller and Ruane, 2012).