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Making transportation options possible

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ABSTRACT

Transportation options provide the buyer the right, but not the obligation, to buy or sell transportation capacity at a future date. These options can provide shippers, carriers and logistics companies a significant opportunity to reduce risks and increase capacity flexibility. This paper summarizes some of these benefits, describes a number of issues to be resolved before trading transportation options can become a reality, and presents possible resolutions for these issues.

INTRODUCTION

In 2006, Tibben-Lembke and Rogers presented the concept of transportation options, a new tool for providing flexibility for supply chain managers. Despite the fact that transportation options are not currently traded, this proposed concept has already been discussed in the supply chain press (Lynch, 2007). Firms have begun looking to hedge their transportation risk, and since financial derivatives are utilized to ameliorate the risk of physical commodities, we believe applying them to transportation could provide managers an additional tool to manage costs.

As described in detail below, transportation options would be quite similar in many ways to stock options and other financial derivatives. A primary function of financial derivatives is for one party to pay another participant to assume some risk. Transportation options would work similarly to stock options in this regard. For example, if a shipper bought an option to ship an item at a future date for a given price, they have eliminated the risk of needing to pay a higher price for that transportation at the time of the transaction. In exchange for the payment they receive, the option seller agrees to accept the risk of price increases, because the seller believes that the price will not rise to the extent that the purchaser of the option believes is likely. Given the sources of uncertainty companies face (access to capacity, fuel prices, driver shortages, etc., etc.), and the possibility for options to reduce these risks, we believe using options to hedge transportation costs could provide significant opportunities for parties at all stages of the supply chain: shippers, carriers, and 3PLs.

Although we will refer to the provider of the transportation service as a "carrier," we believe that transportation options could potentially be written for any transportation modes such as truck, ocean, air, rail, pipeline, or power line. Additionally, the transportation provider could be a non-asset-based third party such as an NVOCC.

In fact, some forms of options have been traded on ocean shipping capacity since 1985 (Gray, 1987, Alizadeh and Nomikos, 2009), when the Baltic International Freight Futures Exchange (BIFFEX) futures contracts were created, trading on the 13 routes defined in the Baltic Freight Index (BFI). Multiple sizes of ships and types of cargoes are now included. The statistical relationships between the lanes and cargo types have been widely studied (Haigh et al..,2004, Nomikos and Alizadeh, 2002). These indices have allowed shippers and carriers to manage their risks and have found acceptance in the ocean shipping world. We believe that a method for hedging and managing other types of transportation risk could provide similar benefits. Below, we address many of the issues that must

be considered before transportation options can be widely traded, present possible solutions for many of these issues, and provide a list of areas where future work is still needed.

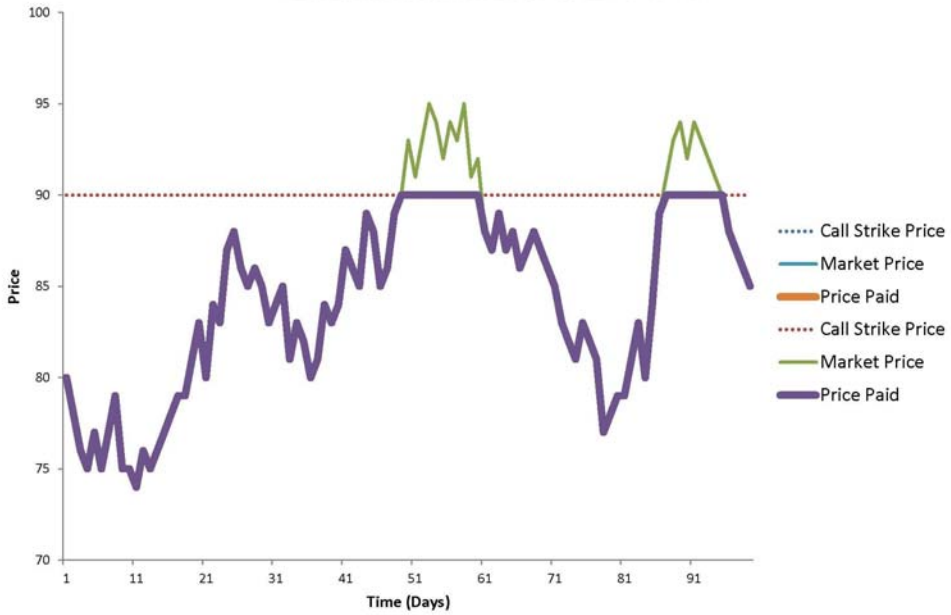
HOW TRANSPORTATION OPTIONS COULD WORK

A transportation option would be similar to a stock option, and like a stock option, could come in the form of both "puts" and "calls." For stocks, a call option allows the purchaser to buy the stock at the specified price, which is called the "strike price." This strike price means the investor will be able to purchase the stock at a guaranteed price. Between the time that the option is purchased and the exercise or strike date, the market price may rise above the strike price, in which case the option will be exercised because the investor can buy the stock more cheaply than the market price and immediately sell it at a profit, or fall below the strike price, in which case the option will not be exercised. In either case, the option allows the manager to reduce the uncertainty of future returns. If the option may be exercised at any time prior to the exercise date, it is known as an "American" option, and if it may only be exercised on the specified date, it is known as a "European" option (Kolb and Overdahl, 2007).

A transportation call option would give the shipper the right to ship a given quantity on a specific lane on a given date in the future. If shippers are uncertain about the ability to get access to transportation capacity in the future, or would like to lock in transportation prices for the future, they might be interested in purchasing call options. With a truckload (TL) call option, if the shipper decides against exercising the option, the carrier does not send the truck. This is analogous to the case of the stock option: if the buyer of the stock option decides not to exercise the option, the option seller keeps possession of the stock.

As shown in Figure 1, if a shipper buys a call option, and the market price goes above the strike price, the shipper will never pay a price higher than the strike price, protecting the shipper from upward price movements. The heavy line in Figure 1 depicts the price the shipper would pay. If the market price exceeds the strike price, the shipper would only pay the

FIGURE 1
BENEFITS TO SHIPPER OF CALL OPTIONS



strike price of the call option. At the same time, the call option seller (also called the "writer") is now guaranteed that it will never see revenues greater than the strike price.

A put option on a stock gives the holder the right, but not the obligation, to compel the seller of the option to take possession of the asset and pay the specified price. A put option would give the carrier the right to haul a shipment on a particular date. In a transportation option, a put option would be similar, in that the holder of the put option would have the right to compel the option's seller to take temporary possession of the asset and pay the specified price.

BENEFITS OF TRANSPORTATION OPTIONS

Transportation options can provide a number of different kinds of benefits for all of the participants in the transportation marketplace. Both shippers and transportation providers face uncertainties that could be hedged through the utilization of options. These risks include problems such as increasing or decreasing fuel costs. Options could ameliorate risks such as capacity problems that happen during the period leading up to the Christmas season. Long term negotiated contracts with carriers that can be locked in for heavy freight lanes are useful to manage uncertainty, but contracts with carriers often include volume requirements or implied freight levels to receive the negotiated pricing. Options would be useful for both heavy freight lanes and for lower volume and less repetitive moves. If a driver or equipment shortage develops, or threat of a strike similar to the one that UPS faced in 1997 (Brannigan and Mathews, 1997), using options could allow shippers a steady supply of transportation capacity.

Removing Sources of Risk

There are many sources of uncertainty for ship pers, carriers, and third party logistics service companies whose risk could be reduced through the use of options. For example:

• Access to capacity in tight markets or lanes due to seasonal fluctuations (e.g. pre-holiday shipments)

• Access to capacity in tight markets or lanes due to cyclical fluctuations (e.g. driver shortages)

• Fuel price risks

• Economic fluctuations (e.g. a booming economy means all transportation capacity is tight)

• Equipment positioning imbalances (e.g. due to product flows, equipment is available in a location but is unavailable where it is required)

In 2006 through 2008, there were numerous reports of a tight supply for truck drivers in the U.S. and Europe (Ajlouny, 2006; Lynch, 2006). As the price of diesel spiked in the summer of 2008, and the economy slowed later in that same year, a large number of trucks were taken out of service and shipped to places such as Eastern Europe (Calabrese, 2008). As the economy continues to recover, there may be capacity issues. In Europe, new laws mandating the tracking and monitoring of driver behavior are expected to further tighten the supply of drivers (Zuckerman, 2008). When transportation capacity is tight, costs could be expected to rise, and if options can provide an ability to reduce the risk of paying higher shipping costs, they should be quite attractive for shippers.

In the summer of 2007, a U.S. consumer goods company paid a large 3PL above-market rates in order to have guaranteed access to transportation capacity before a major holiday. The shipper paid the full above-market price, regardless of whether it used the capacity or not. If the shipper would have had the choice to just buy an option for that capacity, it would have been much better off: it would have had the same guaranteed

access to capacity, but at a much lower cost (Sanders, 2010).

One large source of uncertainty for supply chain firms is uncertainty in fuel prices. In recent years, the price of fuel has varied significantly. Although carriers have some ability to protect themselves through the use of fuel surcharges, shippers have no such ability, and call options could protect them from the risk of rising prices. By buying a call option, the shipper ensures that it will never pay a higher price for the capacity than the strike price of the option. Figure 2 shows the fluctuation in prices for No. 2 diesel fuel over the past 20 years from March of 1994 through February of 2014 (EIA, 2014).

Although prices have climbed steadily over this time period, there has been a significant amount of short-term fluctuation within that period, as well. Figure 3 shows how much prices changed over a rolling four week period. For example, in September, 2005, diesel prices were 20% higher than they had been just four weeks earlier. Then, in November, prices fell 20% compared with where than they had been just four weeks prior. Clearly, fuel prices can change significantly in a short period of time.

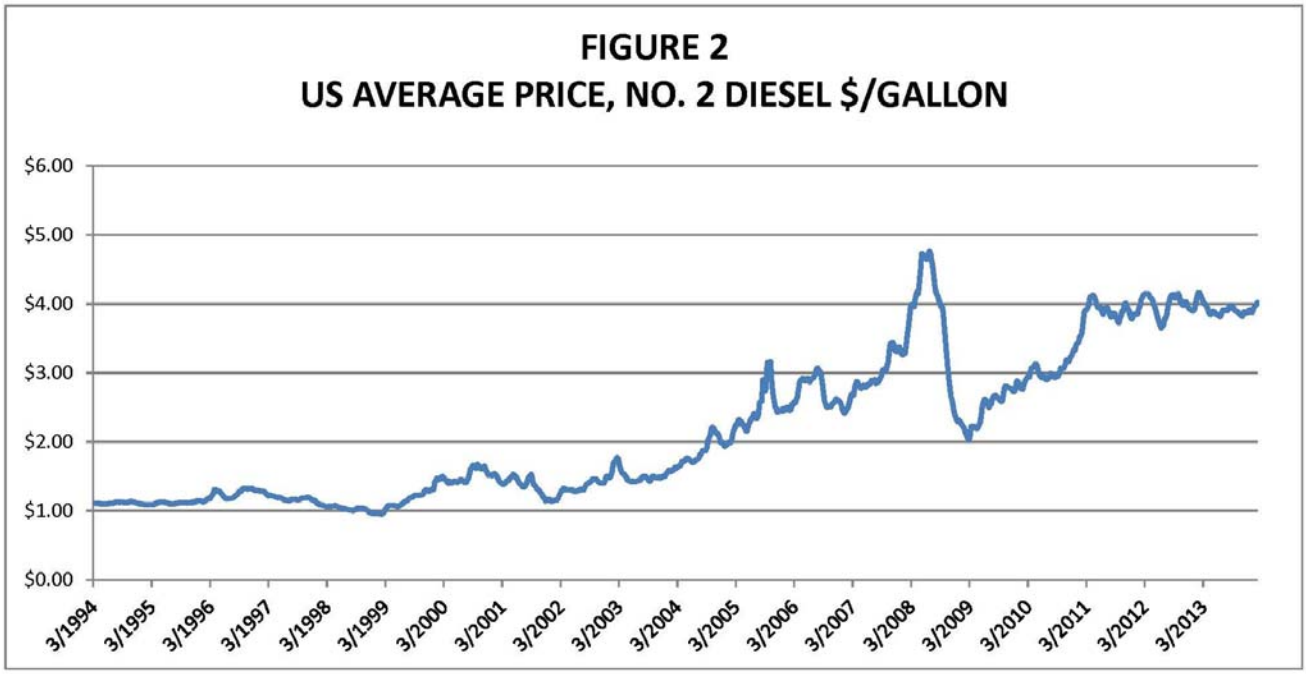
U.S. economic variability can be a source of significant fluctuations in the price and availability of transportation capacity. As U.S. demand for goods manufactured overseas has increased over recent decades, access to transportation capacity has become an increasingly critical resource for retailers, distributors and manufacturers. Cyclical increases and decreases in the U.S. economy can have a significant impact on the demand for transportation capacity. In 2007 and 2008, the declining value of the U.S. dollar increased U.S. exports (New York Times, 2008).

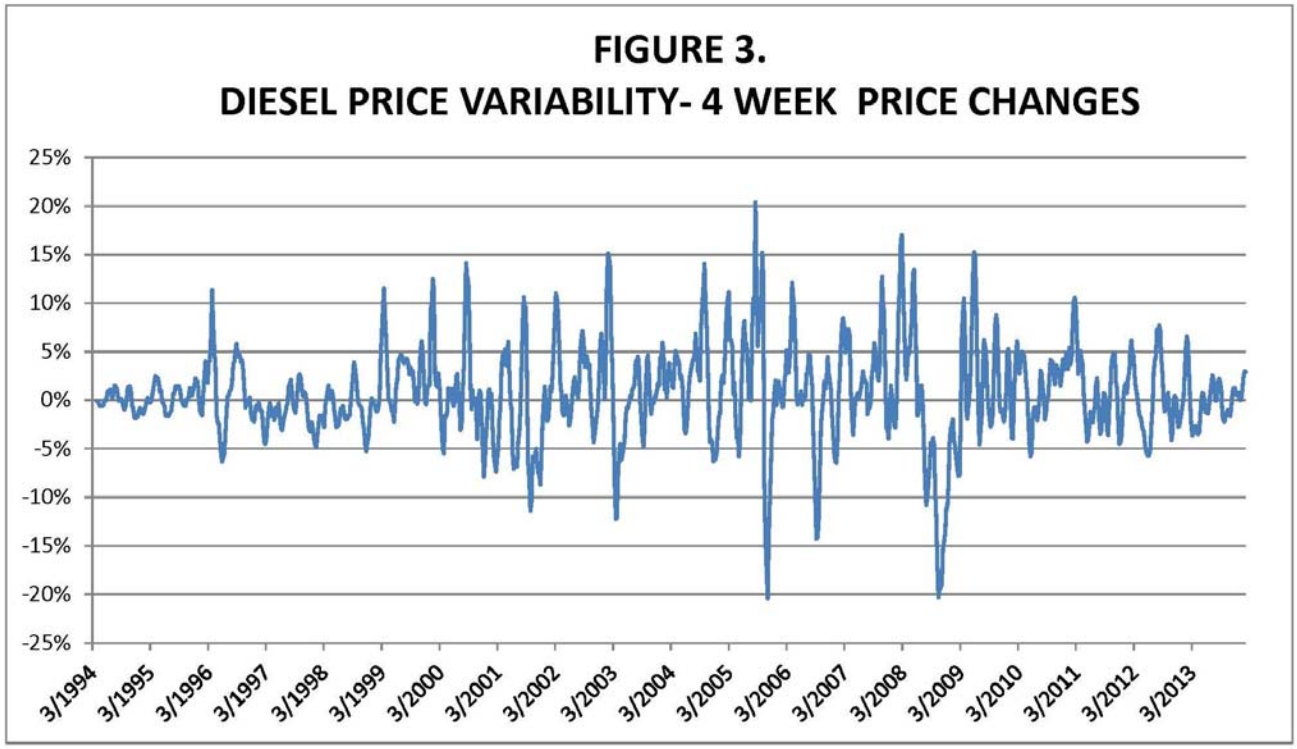
Financial Benefit of Call Options For Both Parties

In order for options to be traded, they have to be attractive to both carriers and shippers. As discussed above, a call option allows shippers to purchase the benefit of not worrying about transportation costs increasing beyond the strike price. Regardless of whether they use the option or not, they benefit from its existence.

A call option also has to benefit the carrier. If the value of the premium from selling a call option is enough to stimulate the carrier to sell, then the option will be perceived to be profitable. Consider, for example, a single-driver load

FIGURE 2
US AVERAGE PRICE, NO. 2 DIESEL $/GALLON





from the Port of Los Angeles to Chicago. In early March 2014, a spot-market quote for two weeks in advance was $3,179 (Freightquote, 2014). For the carrier, suppose gross margins are 10%. So the carrier's costs for the shipment would be $2,861 and gross profit is $318. If the shipper bought the option from the carrier for $75, that would be a 24% increase in the carrier's gross profits from the shipment. Even if the shipper does not use the truck, the carrier keeps the $75 payment. The lower the carrier's margin, the greater the percentage increase in profits from the option premium. For example, if the carrier's margins were 5%, ($159), the $75 option premium would represent a 47% increase in profits for the carrier.

If the spot market price rises to above $3,179, the shipper would exercise the option. If the spot market price is $3,254, the carrier's revenues are the same as if there had been no option, receiving a payment of $3,179 for the shipment, plus the $75 option fee, and still makes its profits $318. If the market price rises above $3,254, the carrier receives less profit from having sold the option than it would have if it had not sold the option. If the market price has increased because of supply imbalances or short-term driver shortages, the carrier's costs (of $2,861) would likely not increase, and the carrier's original profit of $318 remains intact. If the carrier's costs have not increased significantly, the carrier's profit is unchanged by the rising market price, because the revenues and costs are unchanged. If the price rises higher, the carrier is not making as much profit as it could make at the market price, but is still making the profits of $318.

However, this is less profit than the carrier would receive from carrying the load at the higher market price, but the original profit has not been forfeited. If fuel or labor costs increase, the carrier's costs must increase above $3,254 before the carrier will actually lose money by carrying the load for $3,179. That would be a cost increase of $393, almost 14%.

PRICING TRANSPORTATION OPTIONS

Deciding on the price for buying or selling an option is clearly important. Sophisticated models would be required, based on historical data and economic projections, to figure out how much a company should be willing to pay for an option.

In a way, transportation options are like an insurance policy a shipper can buy to guarantee the price to be paid will not exceed a given value. With insurance, companies charge a premium to take on risk for the company. The premium is set at a point where the policyholder feels the benefit in reduced risk exceeds the premium, and yet at a point that the insurance company can make a profit by pooling the risk of insuring a large number of policies. In much the same way that the actuarial field has been developed to set insurance premiums, and options pricing models have been developed to set premiums for stock options, a mathematical study of transportation options pricing is also required.

In the stock exchanges and commodities markets, derivatives have been successful. The primary reason for their success is that they have attracted many different types of traders, and they increase liquidity in the market. The trader can control a large amount of stock with a minimal stake. When a trader wants to take one side of an options contract, there is usually no problem finding another trader that is willing to take the other side.

USING PUT OPTIONS

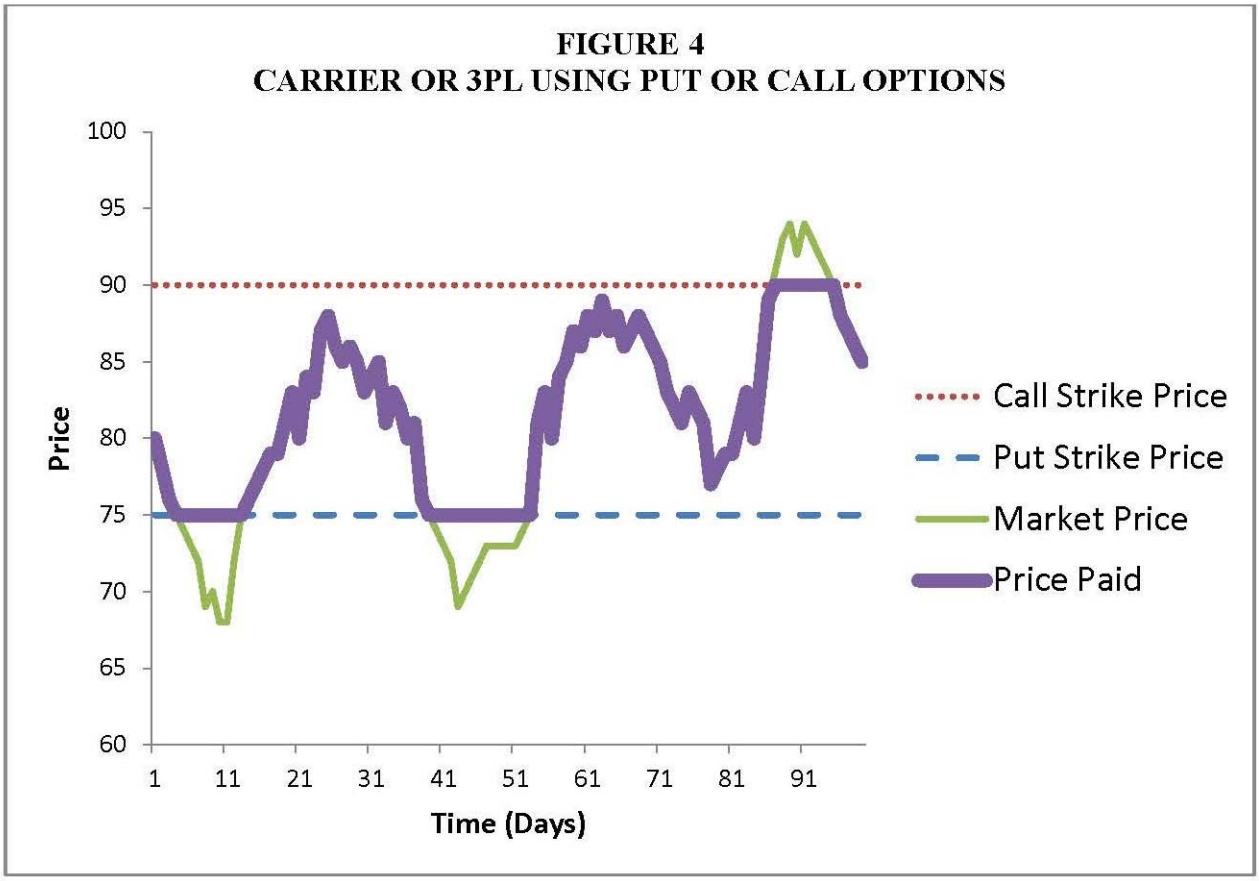
In a stock transaction, a put option gives the holder the right, but not the obligation, to require someone to take possession of the asset and pay the specified price for the asset. If the price of a stock falls below the strike price, the option holder would exercise the option, forcing the option seller to buy the stock at the above-market strike price. In a transportation option, a put option would be similar, in that the holder of the put option would have the right to require the put option's seller to take temporary possession of the asset and pay the specified price.
For example, suppose a shipper sells a put option to a carrier to move a load on a given lane for $1,500, and suppose the carrier pays $100 to the shipper for this option. This gives the carrier the right to require the shipper to use the carrier's trucks at that price. Suppose the spot market price for the lane is $1,300 on the option's strike date. The carrier would decide to exercise the put option, which means that the shipper is obligated to use the truck on the lane and pay $1,500 to the carrier. If the spot market price were above $1,500, the carrier would not exercise the put option, because the carrier can receive a higher payment on the spot market. This guarantees the carrier a revenue stream, which is why it would buy a put. From the shipper's perspective, if the spot market price is below $1,500, the shipper will be forced to pay above-market rates for the lane, because it sold this put option.

The shipper is essentially selling an insurance policy to the carrier, protecting the carrier against the possibility of rates being too low. The shipper must carefully consider its beliefs about future prices, in order to properly put a price on how much it wants to receive in order to be willing to sell the put option. If a shipper thinks there is a realistic possibility that the market price will not be below $1,500, the shipper should consider the possibility of selling a put option.

If the carrier thinks that fluctuations in demand for trucks on the lane and fluctuations in the price of fuel make it a realistic possibility that the spot market price might be below $1,500, the carrier should consider the possibility of buying the put option. The amount the carrier would be willing to pay for this risk protection will depend on its tolerance for risk, and its beliefs about future prices.

Another reason for using put options is to bound the risk realized by a call option. As depicted in Figure 4, if a carrier or 3PL sells call options to shippers, it places a cap on the highest price it can expect to receive for that service. If a carrier or 3PL buys a put option that places a lower bound on the price that it will receive. In Figure 4, both the upper and lower bounds provided by a call option and a put option are shown.

FIGURE 4
CARRIER OR 3PL USING PUT OR CALL OPTIONS



Thus, carriers or third parties have a reason to consider buying a put option, and shippers have a reason to consider selling a put option. For both, the put option represents a type of insurance policy, or hedge, protecting the firm against unfavorable prices in the spot market. In order for a transaction to take place, the amount of protection offered must be sold for a price both think represents a fair price.

OPPORTUNITIES FOR 3PLS

Many transportation transactions are facilitated through a non-asset based third party logistics provider (3PL). A put option would work well with a 3PL positioned in between the shipper and the carrier. One of the duties of the third-party is to match and consolidate supply and demand for capacity, charging a commission for the service. If transportation options became a reality, the 3PL could benefit by selling financial derivatives to both sides in addition to transportation and logistics services.

To some extent, a logistics third-party acts similarly to a stockbroker: a stockbroker advises clients on which investments to make and when, and the 3PL advises shippers about which carriers to use and when. A 3PL may also act like a stockbroker by suggesting opportunities, providing predictions about the future state of the market, and helping the client firm decide when to lock in long-term pricing.

A 3PL could guarantee lower maximum prices for its shippers by buying call options from its carriers. If one particular shipper does not need the capacity, perhaps one of the many other shippers will. Similarly, it could sell put options to its carriers. When the carriers don't exercise the puts, it can bank the premiums. When the carriers do use the puts, it can use the premiums to offset the higher rates.

In the current environment, when a 3PL is responding to a bid, it has to tell the customer

that it has no way to know for sure what the prices are going to be in the future. Typically, a third party or a carrier will write a contract that allows them to place transportation surcharges on the shipper. If the 3PL could buy or sell options, it would be more able to protect both its customer and its transportation supplier. By buying call options, the 3PL could offer its customers guaranteed freight rates, which would be a competitive advantage. Currently, 3PLs are often on "both sides of the table," buying and selling transportation capacity. 3PLs might find options a valuable way to reduce the risk exposure to customers, suppliers and themselves. On the other hand, a 3PL may believe that it has sufficient capacity reserves to be able to absorb the market risks of other companies, and it may choose to sell options.

POSSIBLE RISKS OF FINANCIAL DERIVATIVES

Because much of the credit crisis of 2008 was related to financial derivatives, description of the potential risks of transportation options is in order. Also, because there was widespread belief that speculators had significantly affected the price of oil, we will attempt to address the possibilities for transportation options to be similarly affected by speculation.

First of all, the authors do not believe that transportation options will provide any significant risk to the transportation markets. Much of the "subprime meltdown" of 2007 and "credit crunch" was exacerbated by the heavy use of complicated risk derivatives in the financial markets (Mizen, 2008). The use of securities derived from mortgages became widely accepted in capital markets, and produced high returns. To meet this need, mortgage professionals actively sought customers of lower and lower creditworthiness, (because all of the better credit-risk individuals already had mortgages). Based on traditional mortgage default percentages, brokers and financial professionals felt that the risk of default was quite low, which is what made them so attractive to investors. Unfortunately, these least-qualified buyers were going to prove to default in much higher numbers than predicted. Also, the mortgage-generating institutions were not concerned with the riskiness of the loans, because they were going to sell the loans off to be repackaged, so they would not bear the risk of the loans (Mizen, 2008).

Thus, the risk from mortgage derivatives came from loaning money to people that were poor credit risks, because of an inaccurate assessment of those risks. Because transportation options will not be based on loaning anyone money, the types of problems experienced during the US credit crisis would not seem to be a likely risk for transportation options.

There are two conclusions for us to draw from the credit crisis, however. First, it illustrates that financial professionals are ready to participate heavily in any industry where they believe financial gain may be made by carefully weighing financial risks and returns. Second, when evaluating risks, it is absolutely imperative that the data being used be truly representative of the risks being considered. Another likely outcome of the subprime credit crisis and the more recent LIBOR scandal is that financial derivatives are likely to become more heavily regulated and placed under greater scrutiny. As a result, additional emphasis must be placed on transparency and accountability as we work toward developing transportation derivatives.

We believe that the problems encountered with mortgage-backed securities are unlikely to occur with transportation options. With transportation options, a problem would show up more quickly. If you had hired a bad carrier the feedback from that would be quicker, and no more transactions with that carrier would be created.

Speculation

Speculators' only interest in the underlying product is its price fluctuation and trying to guess its future direction; they have no need for the actual good. Speculators "play an important

role in the market by providing the liquidity that makes hedging possible and assuming the risk that hedgers are trying to eliminate" (Chance and Brooks, 2007). They provide liquidity by stepping in to buy when there are no other interested parties available. For those speculators, at the strike date, there is no need for the actual product or instrument to change hands: an exchange of money equal to the difference in value is sufficient. Such products are "cash settled." However, in the case of transportation options, the whole reason companies are interested in the options is to hedge the risk of transportation costs. If capacity is scarce, the call option holder may not be satisfied to receive a payment for the difference between the strike price and the current spot-market price. What they really need and want is the transportation capacity at the negotiated price. However, if a more centralized spot market existed, and the shipper felt confident that it would, in fact, be able to purchase the capacity at the spot market price, the shipper should be willing to accept a cash-settled payment.

Dangers of Options

Options can be very useful instruments. They can be utilized for hedging, speculation, and arbitrage. They also have inherent dangers built into them. Sometimes traders who are supposed to hedge risks can follow an arbitrage strategy that becomes irresponsible speculation. The results of such speculation can be disastrous. Nick Leeson at Barings Bank in Singapore provides an example of this. Mr. Leeson, was an employee of the Singapore office in 1995, and was looking for arbitrage opportunities between the Nikkei 225 futures prices on the Singapore Exchange and those on the Osaka Exchange (Hull, 2008). As he began to speculate, he incurred losses which he was able to hide at first. He then took larger speculative positions to recover the huge losses, but in the end only made the losses worse. The total loss was close to $1 billion. As a result, Barings Bank, which had operated successfully for 200 years, was put out of business.

Firms must use options carefully and be utilized to hedge risk wisely. Firms could use options to find arbitrage opportunities to reduce transportation cost. Firms have to be careful that they do not cross the line into highly risky market speculation.

STANDARDIZING OPTIONS

An important factor that has made the Baltic Dry Index possible was that ocean shipping routes lend themselves very readily to standardized lanes, given the small number of international ports, as compared to the number of possible origin and destination points for truckload shipments. In order for an active market in options to exist, a standardized set of widely traded options must be created.

Lanes

A set of key lanes could be determined that would be broadly representative of the conditions in the market, in the same way that the S&P 500 or the Dow Jones Industrial Average is widely watched in the stock market. These lanes should probably be some of the highest-volume lanes, freight-wise, but also the ones with the highest volume of options activity. As options trading around transportation has not yet begun, it is not possible to know which lanes will generate the most trading activity. However, it seems likely that the highest-volume freight lanes, shipment-wise, may be among the most actively traded. Demand and supply on transportation lanes are typically asymmetrical. For example, the cost of a truckload originating from Reno, Nevada and delivered to Los Angeles, California is different than the cost of a truckload moving from Los Angeles to Reno. This is because the demand for delivered freight is greater in Los Angeles than it is in Reno.

Off-Lane Origins and Destinations

A convention should be developed regarding how far off of a lane the origin or destination may be for the shipment to still be considered in

the lane. For example, suppose an option from Los Angeles to Chicago is going to be exercised at a price of $3,000. The distance is roughly 2,000 miles. Suppose the shipper actually wants a delivery made to Kenosha, Wisconsin, 65 miles north of Chicago: Should it be allowed?

A convention for off-lane origins and destinations could to be developed to facilitate option settlement. If a shipper bought a Port of Long Beach to Detroit option, and wants to use it to haul a load from the port to Lansing, Michigan which is approximately 80 miles from Detroit, an agreed upon settlement mechanism to account for the extra distance would need to be developed. Perhaps, this mechanism could be built into the option. For example, for shorter distances, under 500 miles, a maximum of 50 additional miles would be allowed, and for longer distances, a percentage maximum could be allowed. Alternatively, perhaps off-lane points of any distance should be allowed, but a surcharge should be added, related to the distance from the lane to the point.

Cost for Off-Lane Points

If a shipper wants to exercise an option and send the shipment from a slightly different source or to a slightly different destination, it would seem the shipper should pay an additional cost. How much additional should the shipper pay? There are several possibilities. Consider the Los Angeles to Kenosha example mentioned above.

• One solution would be to say that the exercise price of the option is $3,000/2000 miles = $1.50/mile, and the shipper must pay this additional cost for the distance from Chicago to Kenosha (65 miles): $97.50.

• Perhaps the shipper should pay $195, twice the cost of driving from Chicago to Kenosha, to represent the deadhead miles the truck will incur in getting back to Chicago to pick up another load.

• Alternatively, the shipper could argue that when driving from LA to Kenosha, taking the shortest interstate routes, Kenosha is only 30 miles farther from LA than Chicago is. Perhaps the shipper should pay 30 miles of additional distance, plus a 65 mile deadhead charge back to Chicago, $142.50

At this point, it is not possible to predict which of these policies will be put in place, but it seems that the strongest arguments can be made in favor of the last two policies. Both compensate the carrier for the extra mileage. Shippers would prefer the third option, carriers the second one. Also notice that the same issue arises for origin points which are not right at the specified origin, and a similar policy will need to be implemented for off-lane origins.

Arbitrage

It is important to note that these off-lane costs are important for providing arbitrage opportunities. Arbitrage is when someone finds an unexplained difference between the pricing of two commodities, and takes advantage of the pricing misalignment to profit. As multiple parties exploit the arbitrage opportunity, the price of the under-priced asset goes up, and the price of the over-priced asset goes down, and the arbitrage opportunity ends. In this way, the ability of traders to take advantage of arbitrage opportunities is very important in maintaining the liquidity of the markets.

Off-lane pricing provides for the possibility of arbitrage in the following way. Suppose the price of LA-Chicago is high, and the price of LA-Detroit is low. A shipper could buy the LA-Detroit lane, and pay the off-lane charges to send the shipment to Chicago, and still be cheaper than buying the LA-Chicago lane. As more shippers take advantage of this, the price of LA-Chicago will fall, and LA-Detroit will increase, until the prices are brought into alignment.

Additional Stops

A related issue is whether additional stops along the way may be requested. If some mechanism can be created to allow this possibility, it would increase interest in the options. In some way, the shipper must agree to pay some additional cost for additional stops. This additional cost will probably include:

• An additional cost for each additional stop added to the route

• A cost proportional to the distance the stops add onto the trip length

• A charge per hour required by the stop

At a minimum, the additional costs must be sufficient to cover the carrier's additional labor and fuel costs generated by the stops. Also, the carrier probably would like to maximize the number of loads it can move per week, and would rather not make a lot of stops, and would rather have the cost per stop to be rather high, to serve as a disincentive for shippers to request a lot of stops. For that reason, the cost per mile for the additional distance would likely be higher than the cost per mile of the shipment overall. Perhaps one of the formulas mentioned above will be used. However, it is likely that the cost will be proportional to the total number of miles added to the trip by the stops. The charge for the additional mileage may be some multiple of the cost per mile of the rest of the trip, say 1.5 or 2 times the regular mileage charge. If the shipper is going to request any stops, those would likely need to be specified at the time that the shipper informs the carrier of the intent to use the option.

Timing

To further simplify the trading of common lanes, a convention must be decided upon for the dates of the options. Carriers and shippers alike need to have agreement on the windows when the options can be used. Again, the more standardization that can be brought into the options market, the more efficient the market should be. Also, carriers and shippers do not want to have to keep track of the differing conventions used by different carriers, shippers, or marketplaces. The whole point of transportation options is to reduce uncertainty about future shipments for carriers and shippers. The options must provide enough certainty about the timing of the shipments in order to serve the needs of the shippers, so they can rely on these shipments to meet their needs. Otherwise, there would be no incentive for shippers to use them.

We propose that options be traded for each calendar week of the year, where a week is defined as 12:00 am Sunday to 11:59 pm Saturday ET. For example, a shipper may buy a call option for week 48, to have a guaranteed price for last-minute deliveries before the end of the Christmas selling season.

Another possibility would be that a shipper may seek to purchase options good for any week in a range of weeks, over a 4, 8, or 12 week period. This would give a shipper much more flexibility, but it would place a lot more uncertainty on the carrier, making it much harder for the carrier to plan for the future. Given that the carrier is accepting considerably more risk, these options should carry a much higher risk premium.

Advance Notice (Strike Dates)

Standardization is also required for how much notice the option holder must give before exercising the option. There are several likely possibilities:

• One way would be to say that the decision to use or not use an option must be communicated by 5:00 p.m. on Friday of the prior week, and at that point, the day of the following week on which the option is to be used must be specified, but the final pickup time on that date can be specified later.

• Similarly, the shipper could be required to give notice of intent to use the option by some time, say 5:00 p.m. Friday, and that the actual time (and location) of the shipment must be specified at least 24 hours in advance.

• The final way these could be structured would be to say that the option holder must give at least so many hours of advance notice, perhaps 24 hours. This period of advance notice should be sufficient to allow the carriers to have the necessary equipment in place by the required time.

Some conventions will need to be determined regarding other details of the shipments, for example, regarding holidays. Perhaps the consensus will be that national holidays will be blackout days on which the options cannot be used. Alternatively, they could be treated like regular days, or a surcharge of some percentage, or a fixed dollar surcharge will be added.

Non-Compliance Penalties

If a carrier promises to provide service to a call option buyer, and it fails to deliver as promised, the carrier must face some form of punishment, and the same would hold for the seller of a put option. It would seem likely that this punishment would include a significant financial penalty for the event, and a long-term consequence of being barred from participating in trading either transportation options, or if the trading is taking place on an established change such as the Chicago Board Options Exchange, being barred from participating in that exchange in the future. If the firm has too many non-compliance events in a given period of time, SEC involvement may be required. At a minimum, the financial penalty needs to be large enough that no carrier would decide to abandon its obligation, because abandoning it would be cheaper than fulfilling it. The penalty should be large enough to cause carriers to do everything they can do to provide the promised service.

On the other hand, these options will involve large vehicles traveling on public roads. Equipment breakdowns and unforeseeable major traffic situations can happen. If a carrier has taken reasonable and prudent efforts to provide the capacity, but an unforeseeable incident makes the carrier late, the penalties probably should not be draconian.

Premium Services

Separate options should be sold for team and single-driver service on a given lane. As a majority of cross-country loads are single-driver, they will likely represent the majority of interest in options. With a single driver, Los Angeles to Chicago takes four days versus only two for team drivers. However, teams cost 25% more than single driver rate. Some carriers may decide to offer options that could be "upgraded" to other services, like team drivers, or refrigerated loads.

MANAGING TRANSPORTATION OPTIONS

For a company using transportation options, it needs to be able to track and manage those options, and be able to decide when to buy or sell them. The need for options by shippers, carriers and 3PLs will be closely related to their future transportation needs, so any tool for managing options needs access to as much information as possible about those future needs. The most likely solution is for any Options Management System (OMS) to be tightly linked to the company's transportation management system (TMS), perhaps as a module of the TMS. In the TMS, the OMS will have access to all of the company's existing future transportation needs and plans. Shippers will want to track the eventual shipments via their TMS, so obviously a linkage between the OMS and the TMS will be important.

Having estimates of future transportation needs for upcoming peak shipping seasons would seem a good way to maximize the benefits of using options. However, many companies may not be making plans very far into the future via their

TMS, so some companies will need to expand their abilities to forecast freight needs to maximize their benefits from options.

CONCLUSIONS AND FUTURE WORK

Transportation options could provide buyers and sellers the opportunity to hedge transportation capacity and cost. As described above, options can provide shippers, carriers and logistics companies a significant opportunity to reduce risks.

We believe that transportation options present an opportunity for supply chain professionals to gain significant advantage in managing supply chain risk. There are, however, numerous issues that remain to be addressed.

Given that the recent credit crisis was exacerbated (if not caused) by the use of derivatives, future developments in transportation options must proceed carefully and earn the industry's trust that these will be a tool to help manage risk, without creating an unforeseen set of new risks for the industry.

Further clarification is needed as to how options should be constructed and traded on an exchange. There are different ways that options could be traded and settled, and these issues need to be decided. More work is also needed to investigate the role of transportation indexes in pricing and settling options contracts.

As identified above, there are numerous areas where buyers and sellers of options need to agree on what the common terms of the options would be. Transportation options need to be standardized. The purpose of transportation options is to reduce uncertainty about future shipments for carriers, shippers, and third parties. Options must provide enough certainty about the timing of the shipments in order to serve the needs of the shippers, so they can rely on these shipments to meet their needs. This standardization is needed to allow options to be widely traded on an exchange, so future work is needed to identify more clearly what the "standard terms" of a transportation option are likely to look like.

Once the terms of the options are more readily in focus, work is needed to properly value the options. Because of their similarity to financial and commodity options, it is likely that the models and methodologies for valuing transportation options will borrow heavily from the existing financial literature.

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