Hedging Currency Risks at Duke Power

Randall R. Kincaid
Timothy E. Burson
Queens University of Charlotte

Duke Power, an electric generating and distributing company serving portions of North and South Carolina, had been a pioneer in the production of nuclear power. Duke Power needed replacement steam generator tubes for three of its nuclear generating units, and selected Sumitomo Corporation in Japan to manufacture the tubes. Sumitomo was one of the few corporations in the world capable of producing specialty high strength replacement tubes. The exchange rate between the dollar and the yen would float up and down with supply and demand forces over the delivery period. Because the value of the yen floated, and because the contract between Duke Power and Sumitomo was priced in yen, Duke faced considerable transaction risk. Duke Power did have the opportunity to reduce its transaction risk by hedging its position in the foreign exchange (FX) market. FX market financial instruments have become a common tool for businesses involved in foreign trade. Once Duke Power made the decision to hedge its transaction risk, it needed to address the questions of when in the transaction to enter a hedging contract and, then, what hedging vehicle to utilize

INTRODUCTION

Duke Power, an electric generating and distributing company serving portions of North and South Carolina, had been a pioneer in the production of nuclear power. The company made a strategic decision in the 1960s to enter nuclear power, believing that this energy source would provide a cheap, reliable form of electric generation, superior to its predominant coal generation.

After having several nuclear units on line for many years, Duke discovered that it needed to replace steam generator tubes for three of its nuclear generating units. This replacement came as something of a surprise to Duke, since the company originally thought that the tubes would last virtually as long as the other components of the plant. Regardless of that original estimate, however, the company had to replace the tubes.

Nuclear generators had three different water-circulation systems. The first was closed, operating at high pressure, in which the nuclear reactor heated water to 600 degrees

Fahrenheit. A pump sent this super hot water through thousands of tubes—including those that Duke needed to replace—and then back to the reactor. The second water-circulation system pumped water across the tubes, where the heat within the tubes turned the water in the secondary system into steam; this steam drove a turbine which rotated the magnets within the electricity generator, thus generating electricity. A condenser turned the steam back into water, to be reheated in the tubes of the primary system. The third water circulation system was an open one, which used cold lake water to condense the steam in the secondary system.

The tubes that Duke Power replaced thus performed a crucial role in the generation of electricity. They carried super-hot, high-pressure water and transferred that heat to the water outside the tubes to generate the steam necessary to drive the turbine.

There were only a few manufacturers of such tubes, and none were located in the United States. Duke selected Sumitomo Corporation in Japan as its supplier, based on its ability to produce the high strength replacement tubes, on its generally excellent reputation, and on its ability to deliver the tubes in a timely manner. Sumitomo agreed to deliver the tubes over a three-year period, at a total price of ¥7.2 billion. At the time Duke negotiated the deal, the exchange rate between the yen and the dollar was ¥120:$1.00, so the contract totaled $60 million.

The exchange rate between the yen and the dollar would float up and down with supply and demand forces. When Americans wanted more yen—to buy more cars or electronics or other Japanese exports—the yen would appreciate. When the yen would appreciate, Americans could get fewer than 120 yen for each dollar. When the reverse happened, and Japanese wanted to purchase more securities or real estate in the US, the yen would depreciate, and one dollar would buy more than 120 yen.

The problem for Duke Power was foreign exchange transaction risk. Because the value of the yen floated, and because Sumitomo priced the tubes in yen rather than dollars, Duke Power could be looking at a higher price for the tubes. If the yen appreciated over the three-year delivery period for the tubes, then Duke Power would have to pay more dollars for the yen, therefore more dollars for the tubes. On the other hand, if the yen depreciated, Duke Power would have paid less.

Table 1 illustrates transaction risk:

Table 1

Exchange rate	Yen value of contract	Dollar value of contract[1]
¥140:$1.00	¥7.2 billion	$51.4 million
¥130:$1.00	¥7.2 billion	$55.4 million
¥120:$1.00	¥7.2 billion	$60.0 million
¥110:$1.00	¥7.2 billion	$65.5 million
¥100:$1.00	¥7.2 billion	$72.0 million

Clearly the risk for Duke Power was substantial. If the yen appreciated from ¥120:$1.00 to ¥100:$1.00, a 17 percent appreciation, Duke would have to pay $12 million more for the tubes.

The engineers who purchased the tubes, while excellent at design and operation of nuclear plants, had little experience in the foreign exchange (FX) market. However, they took the precaution of tracking recent movements of the yen against the dollar, and found that the yen had been quite stable recently. Hence, the company decided that there was not an excessive level of transaction risk.

Shortly after signing the contract with Sumitomo, the yen began to appreciate, a movement somewhat atypical in the yen-dollar market. This appreciation surprised Duke, and it became clear that, in spite of its earlier belief, the level of transaction risk was unacceptable.

In a meeting with the CEO and the CFO, the engineers revealed the recent yen appreciation, and explained the risk that the company faced. Fortunately, the CFO was unfazed. He stated calmly that the company would need to hedge the risk. The CFO, Rich Osborn, recognized puzzled looks in the room. Most of the participants were unaware of the possibility of hedging, and so Osborn explained how Duke could lay off this risk to other parties, and lock in an exchange rate that would exist for the entire three-year delivery period of the tubes.

1 To get the dollar value of the contract, divide the yen value of the contract by the exchange rate.

Rich Osborn also emphasized that the core business of Duke Power was electricity generation and transmission, not foreign exchange speculation. The latter represented a venture far from Duke's core business, and therefore one to avoid.

FOREIGN EXCHANGE MARKET OPERATION

Rich Osborn gave a brief primer on the FX market. He began by explaining that it consisted of a worldwide network of banks, corporations, and individuals connected by satellites, telephone lines and computer screens.

Osborn used the dollar-euro market as an example of the FX market. If a European wanted to buy dollars with euros, he contacted a bank somewhere in the world. That bank would find an American who wished to sell dollars and buy euros. The European would transfer euros to the American, and the American transferred dollars to the European. At the end of the transaction, the European had a deposit in an American bank that he could draw on, and the American had a similar account in a European bank.

The bank that brokered the transaction between the European and the American earned a fee for its services.

Sometimes, the bank would act as a principal instead of a broker in the transaction. European banks frequently held deposits in American banks, and when the European buyer of dollars approached the bank, the bank would transfer dollars from its American bank account to the European individual. In exchange, the bank would get a euro deposit in a European bank.

The entire transaction took place at the then-current exchange rate between the euro and the dollar. Various wire services quoted exchange rates, and these rates would show up on computer screens throughout the world in real time. Rates fluctuated with the usual forces of supply and demand. If, for example, many people were trying to sell dollars and buy euros, the dollar would depreciate and the euro would appreciate.

In addition to their role as brokers and principals in the FX market, banks also speculated in various currencies. They could choose to hold a deposit in another country if they think the value of that money was going to appreciate. So, for example, a bank in France, thinking that the Hong Kong dollar would appreciate, would buy Hong Kong dollars, and hold that deposit in a Hong Kong bank. If the French bank was correct, and the Hong Kong dollar appreciated, the bank would profit from the transaction.

If the bank in France made the opposite forecast—a depreciation in the Hong Kong dollar—the French bank could short the Hong Kong dollar. The French bank, first, borrowed Hong Kong dollars from a Hong Kong bank. Next, the French bank sold these borrowed Hong Kong dollars on the FX market, and bought euros. If the Hong Kong dollar fell against the euro, the bank then used its euros to buy Hong Kong dollars, and would repay its loan to the Hong Kong bank. If, on the other hand, the Hong Kong dollar appreciated against the euro, the French bank must still buy the Hong Kong dollars to repay its loan, but it did so at a higher cost, and consequently lost money.

The table below illustrates these transactions:

Table 2
French Bank Speculates in the FX market using Hong Kong Dollars

Forecast	Action	Actual Exchange Rate Movement	Result
Hong Kong $ will appreciate	Buy Hong Kong $	HK$ appreciates from €1:HK$8 to €1: HK$7.5	BankProfits
Hong Kong $ will depreciate	Borrow HK$ & sell for euro	depreciates from €1:HK$8 to €1:HK$8.5	Bank Profits
Hong Kong $ will appreciate	Buy Hong Kong $	HK$ depreciates from €1:HK$7 to €1: HK$7.5	Bank Loses
Hong Kong $ will depreciate	Borrow HK$ & sell for euro	HK$ appreciates from €1:HK$8 to €1:HK$7.5	Bank Loses

THE ROLE OF CENTRAL BANKS

Central banks such as the US Federal Reserve or the British Bank of England would also buy and sell foreign exchange. They usually did so to influence the exchange rate. For example, if the yen was falling against the dollar, both the US and the Japanese central banks might buy yen and sell dollars in order to bid up the price of yen. Sometimes, central bankers would simply announce that they are thinking about intervening in the FX market; they hoped that the announcement would substitute for the action. If the central bankers announced that they were thinking of buying yen, they hoped that commercial banks and brokers would buy that currency. If they did, the central bank need not participate in any transactions.

Unfortunately, central banks have had some sad experiences trying to influence exchange rate. They discovered, somewhat to their dismay, that movements of exchange rates were almost impossible to stop, since the market was so large. Even though central banks themselves were capable of making very large currency purchases, the sheer size of the market sometimes made even central banks small players on a large field.

FOREIGN EXCHANGE INSTRUMENTS AND HEDGING

When Duke Power began to explore the various ways it could hedge its transaction risk, Rich Osborn listed several ways to accomplish this hedge.

Duke could buy yen and hold them in a Japanese bank. Duke could buy the entire ¥7.2 billion, using dollars borrowed from a US bank. Duke would then hold the yen in a Japanese bank, and draw them as necessary to pay Sumitomo. This method of hedging was simple and absolute. If it chose this option, Duke would eliminate FX risk.

Duke's second choice for hedging was to buy yen forward. Banks in the FX market regularly sold yen (or almost any other money) at an exchange rate determined that day for delivery on a future date. For example, if a firm needed British pounds six months from now to pay for something it was importing from the UK, it could enter a contract with a bank to receive the pounds sterling in six months, and the bank would agree to an exchange rate that day. The firm would thus eliminate its FX risk by entering a forward contract.

A third way for Duke Power to hedge would be the futures market. The futures market dealt in commodities such as frozen orange juice, gold, and unleaded gasoline, and in financial instruments such as S&P 500 futures and various currencies. Futures contracts had a standard size and maturity date, and traded on such exchanges as the Chicago Mercantile Exchange (CME) and the commodity exchange in New York (COMEX).

Duke's fourth choice for hedging would be the options market. Currency options offered buyers the right, but not the obligation, to buy or sell a currency at a specified exchange rate. Options in the currency market operated in much the same way as options in the real estate market. Suppose a couple wanted some time to decide whether to purchase a particular residence; they could enter an option contract, which gave them the right, but not the obligation to buy the house. Of course, the potential buyer had to pay a fee for this right, since the seller removed the house from the market during the life of the option.

An option to buy, such as the real estate example, is referred to as a call option. If a firm bought a call option on yen, the option gave the firm the right to buy a fixed number of yen at a guaranteed exchange rate for a specified period. The opposite of a call is a put option. If a firm bought a put option, it had the right to sell a fixed number of yen at a guaranteed exchange rate for a specified period. If the firm did not exercise its option during the specified period, the option would expire, and the firm would lose any money it paid for the option.

So if Duke Power bought a call option on yen, it had the choice of buying yen on the spot market or exercising its option. Having that choice is one of the most attractive features of options. An option buyer could buy currency in the spot market, but the presence of the option places a ceiling on the price the buyer must pay.

The cost of an option is called the option premium, the amount of money the buyer of an option must pay the seller. The option premium is higher (a) the longer the option lasts, and (b) the greater the variability in the exchange rate which the market forecasts.

Options are bought and sold in two very different markets: banks and exchanges. Bank options are for any amount, any time period, and any exchange rate agreed upon by the two parties. Exchange options worked very much as futures: they were written in amounts specified by the exchange, with maturity dates also specified by the exchange.

Theoretically, Duke could have used one additional method of hedging: matching payables and receivables. In this method, a multinational firm hedges by having obligations to pay yen, but was also receiving yen revenue. This method was not available to Duke, since it had no revenue-producing activities in Japan, and likely no way to begin such activities.

The final way that Duke Power could have dealt with its transaction risk was by getting Sumitomo to price the sale of the steam tubes in dollars instead of in yen. In effect, if Duke could have done so, it would have been shifting the transaction risk to Sumitomo. But apparently Sumitomo was unwilling to price the deal in dollars, owing to its superior leverage, so that this method of hedging was not available to Duke Power.

DUKE POWER OPTIONS PURCHASE

Rich Osborn contacted a large money-center bank in New York. The bank recommended using options as the hedging device. The bank's yen trader pointed out that the yen had appreciated dramatically in the previous two months—from 125 to 105 yen to the dollar, a trend the trader believed would continue. The trader recommended that Duke purchase options at 98 yen to the dollar. This rate would become Duke's worst case. If the market rate for yen appreciated even further, Duke could exercise its option, and the resulting cost of the steam tube contract would have been $72.35 million (¥7.2 billion divided by 98). The bank further recommended structuring the call options to correspond the 12 individual tube shipments from Sumitomo.

Unfortunately for Duke, the potential cost of these options could be substantial. If the bank's fee were one percent, Duke's cost would approach one million dollars. However, Duke's cost became moot when the bank made the second part of its proposal. The bank suggested that it (the bank) would buy puts from Duke at 108. In effect, the bank's proposal was that Duke be both a buyer and a seller of options. As a buyer, Duke would have to pay a fee, but as a seller, Duke would receive a fee.

After hearing from the bank, Rich Osborn reconvened the group of engineers, as well as the executive committee of the company to discuss the various options, and to decide on a course of action.

ADDITIONAL READINGS

Chance, D., (1989) *An Introduction to Options and Futures*

Levi, M., (1990), *International Finance*

Stoll, H. and R. Whaley, (1993), *Futures and Options – Theory and Application*

Tygier, C., (1988), *Basic Handbook of Foreign Exchange*

www.optionetics.com/education

www.cboe.com/LearnCenter/