# Corporate Hedging of Currency Exchange Risk

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## Abstract

The fluctuation of the exchange rate of Euro against U.S. dollar has a remarkable impact on the annual revenue of an international trading company. This empirical study examines if it is worth adopting an instrument of hedging exchange risk exposures at the non-financial corporate. This study finds that the use of the cash flow methods (internal hedging) or forwards contracts (external hedging) is an essence to eliminate the effect of exchange rate exposures on the firm's value. This paper recounts how this trading company identified and assessed exchange risk exposure, and then approached a couple of means to hedge this exposure.

# 1. Company profile

This is a small Dutch trading company, mainly trading with Thailand but always trading in US dollars. This company faces the transaction risk, namely exchange risk of Euro against U.S. dollar.

# 2. Introduction

The advent of the floating exchange rates since 1970s leads to the problem of exchange rate exposures in the cross-border firms. The exchange rate exposure has three different types in general: translation exposure, transaction exposure and economic exposure (Eiteman, Stronehill and Moffett, 2004). Since the economic exposure is an unexpected change in exchange rates, such as political crisis or natural catastrophes, this paper excluded the effect of economic exposures on exchange risks on one hand. On the other hand, the volatility of exchange rates does affect the cross-border firms in terms of transaction and translation exposures. Recently, the debate between hedging and not hedging these exposures goes very intensive. Dufey and Scinivasulu expressed his feeling on hedging is quoted as follows:

*"Foreign exchange risk does not exist; even if it exists, it need not be hedged; even if it is to be hedged, corporations need not hedge it."*

This hypothesis is certainly inconsistent with various empirical results. Empirical researches have found out different ways to hedge different exposures. For instance, the use of financial instruments or netting has been applied successfully in real cases.

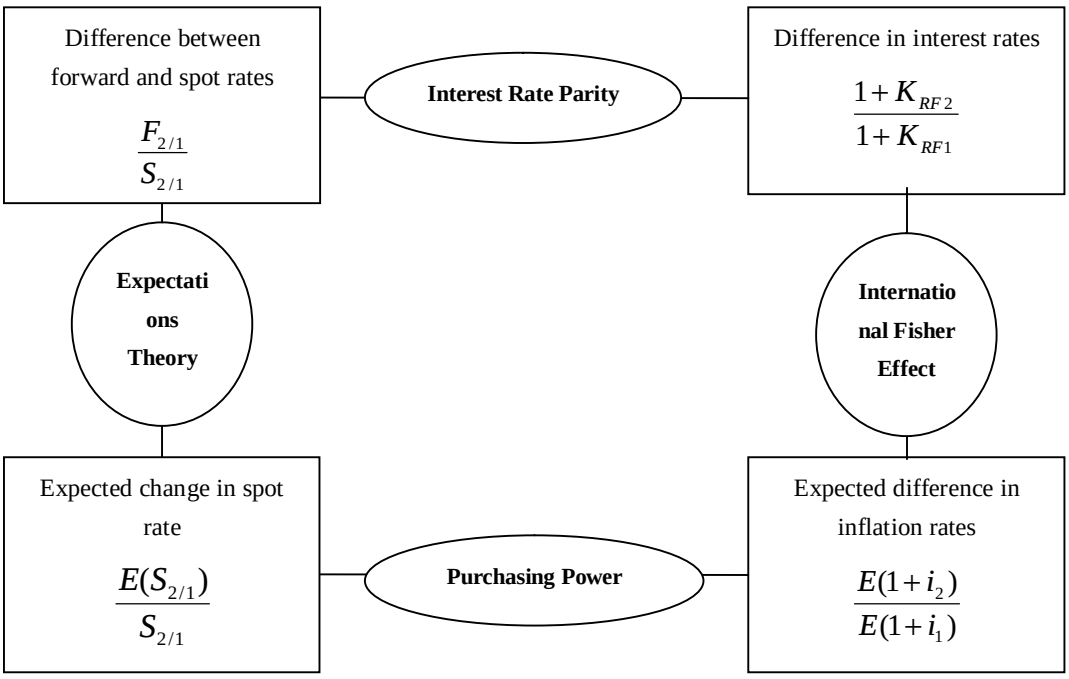
In this study, the data was collected from a small Dutch trading company who mainly faces the exchange risk of Euro against U.S. dollar for its large part of business dealt in US dollars. In other words, it faces the transaction risk. Additionally, its intentions for international expansion will lead to more problems with different currency exchange risks. Therefore, its major exchange risk arises from transaction exposures and the minor is from translation exposures. Thus, the company is willing to adopt hedging instruments to eliminate the main potential risk: transaction exposures. The hedging instrument is considered to be a crucial point in this paper. A proper instrument determines whether hedging of exchange risk exposures is efficient or not. The following sections are structured as: 1) literature reviews; 2) data analysis; 3) company strategy to currency risk; and 4) conclusions will be drawn and recommendation will be given.

# 3. Literature reviews

## 3.1 Why exchange rates change

The fundamental question to why exchange rates change will be reviewed at first. Basically, foreign exchange rates are determined by the relative supply and demand for two currencies, and influenced by the inflation rates and interest rates in the two countries. Before entering into a forward contract, for instance, the buying and selling parties must be acquainted with the determination of the forward exchange rate. On top of that, the relationship between spot exchange rates, forward exchange rates, inflation, and interest will be introduced. This relationship shall not always be hold in the short run due to a couple of factors, such as transaction costs and government intervention. However, the relationship can be hold in the long run as expected by the four parities: the expectations theory, the purchasing power, the international Fisher effect and the interest rate parity. Figure 1 will explain why exchange rates change, in which a number of symbols will be defined at first.

Figure 1




*Source:* "International Financial Management," *Financial Management (1994):270*

Let's define the following symbols:

1: the domestic country
2: the foreign country

$F_{2/1}$ and $S_{2/1}$: forward rate and spot rate in units of country 2's currency to one unit of country 1's currency, respectively

$K_{RF1}$ and $K_{RF2}$: risk-free interest rates in country 1 and country 2 for the appropriate forward period, respectively

$i_1$ and $i_2$: inflation rates in country 1 and country 2 for the appropriate forward period, respectively

Any two connected notes are equal to each other. Each relationship will be explained counterclockwise from the top left theory, expectations theory. This theory says the future spot rates are determined by the current forward rates of exchange.

$$\frac{F_{2/1}}{S_{2/1}} = \frac{E(S_{2/1})}{S_{2/1}} \text{ and thus } F_{2/1} = E(S_{2/1}),$$

where E denotes the expected future spot rate in units of country 2's currency to one unit of country 1's currency.

The second relationship is between the expected difference in inflation rates and the expected change in spot rate between the two countries. Purchasing power parity explains that different currencies should have equivalent purchasing power. In other words, the same goods that are freely traded should cost the same everywhere, measured in the same currency (Desai, 2007). For instance, if $1 can buy one McDonald's Big Mac in China, then $1 can buy the same one in the United States. Therefore, in the long run, the changes in the exchange rate will be influenced by the difference in the purchasing power of one currency relative to another currency.

$$\frac{E(S_{2/1})}{S_{2/1}} = \frac{E(1+i_2)}{E(1+i_1)}$$

Alternatively, this equation states that the relationship between today's spot rate of exchange and the spot rate of exchange in the future is determined by expected differential rates of inflation between the two countries (Pinches, 1994).

Another theory on exchange rate movements is the international Fisher effect, which reflects the relationship between differences in interest rates and differences in inflation rates. According to the equation, this link tells that countries with high rates of inflation should have higher interest rates than countries with lower rates of inflation.

$$\frac{E(1+i_2)}{E(1+i_1)} = \frac{1+K_{RF2}}{1+K_{RF1}}$$

The international Fisher effect explains that the expected differential rates of inflation between the two countries can be changed by differential risk-free interest rates between the two countries.

Lastly, the very important relationship interest rate parity will be examined.

$$\frac{1+K_{RF2}}{1+K_{RF1}} = \frac{F_{2/1}}{S_{2/1}}$$

The differences in risk-free interest rates between the two countries will affect the relationship between the forward rate of exchange and the spot rate of exchange between the two countries. If country 1's return on interest rate was higher than country 2's, there would be excess demand for the former, since investors would all demand country 1's currency for higher return. Thus, the foreign exchange market will be equilibrium as long as the returns on interest rates in any two countries are equally measured in the same currency.

These four fundamental theories on exchange rate movements are hold in a long run, but not in a short run. Imperfections, government intervention, central bank intervention and transactions costs are influenced in a short period.

## 3.2 Types of exchange rate exposures

Hedging of currency exchange risk protects unfavorable exchange rate losses in an international firm, whereas reduces favorable exchange rate gains. Therefore, hedging currency exchange risk can be regarded as an instrument of eliminating risks, or as an instrument of speculations. The three different types of exchange rate exposures can be identified:

### *i. Transaction exposure*

It is arised after the firm has entered into financial obligations. The potential changes in the exchange rates in future cash flows of these obligations will create gains or losses on the firm's value. For instance, the values before and after the conduct of accounts receivable and payable and from commitments to buy or lease capital equipment or financing cash flows are not matched. Transaction exposure risk is different from translation exposure risk is mainly because the former one involves potential changes in cash flows.

ii. *Translation exposure*

It is also named accounting exposure or balance sheet exposure; this exposure is occurred when the parent company consolidates financial statements of all affiliates, whose denominated currencies are different from their parent's.

*iii. Economic exposure*

It is also named as operating exposure or real exposure. This exposure is concerned with risk of exchange losses associated with changes in future cash flows or costs of capital arising from unexpected exchange rate changes. It is unlike the former two exposures which can be hedged by proper financial instruments of risk management. Economic exposure is operated through long-term strategic decisions.

However, there mainly are three obstacles for non-financial firms hedging currency risks comparing with financial firms. First of all, models to forecast forward or spot rates are not well formulated. Secondly, the management team seems risk-averse in respect to FX risks and consequently reluctant to hedge FX risks. Lastly, the monetary allocation to risk management department is relatively less in non-financial firms than in financial firms. Accordingly, the purpose of hedging FX risks for most non-financial firms is to reduce the variance in future cash flows so that the volatility of exchange rate will have little impact on the planning capability of the firm, and on the value of firm or shareholders.

Meanwhile, the advantages of corporate hedging are listed as follows. The corporate hedging can predict a minimum of internally generated cash flows of the firm and thus can efficiently and rationally arrange its financing plan either internally or externally. Additionally, hedging can smooth the reported net income, and this may be valuable in a financial market that pays undue attention to quarterly earnings fluctuations rather than focus of the long-term free cash flows (Froot, Scharfstein and Stein, 1994). As apposed to proponents of currency hedging, a number of unfavorable arguments are against to hedging. The monetary spending on currency hedge can exceed the losses from currency risk exposures. The conflict between shareholders and management occurs if management fails to reduce total risk by hedging, shareholder value may be eroded (Hagelin and Pramborg, 2004). Nevertheless, hedging currency risk is a global trend in reality and the following two subsections will introduce the factors involved in hedging currency exchange risk and the techniques implemented in corporate hedging respectively.

## 3.3 Factors

The empirical literatures found a number of factors concerned in foreign exchange risk management, such as centralization, firm size and tax regimes. Each of them will be discussed as follows.

*Centralization*

The majority of the companies in UK, US and Germany had centralized decision making with varied degrees of centralization, because the parent companies were responsible at least partially for the companies' exposure management (Belk, 2002). Australian companies that were affected by floating exchange rate were willing to centralize the exchange risk function, so that exchange risk management decisions were made either at parent-company level or at top-management level for single entities (Teoh and Er, 1988). Another empirical study also found a positively significant statistical relationship between the centralized control of foreign exchange exposures and the active management of foreign exchange risk (Batten, Mellor and Wan, 1993). Apparently, a number of advantages of centralization include: attaining economies of scales in large transactions and obtaining competitive quotes, seeing the total cash, borrowings and currencies position, and experiencing in risk management as well as developing specialized treasury skills (Lee et al., 2001).

*Firm size*

Exchange exposure is decreasing in firm size; larger firms may have lower exposures due to their ability to use operational hedges (Hagelin and Pramborg, 2004). The larger the firm, the more information are communicated and the more transaction are taken into account with an entity. The size of a firm can be measured in different ways. For example, firm size measured by foreign exchange turnover has the most important effect (Batten, Mellor and Wan, 1993). The size of a firm significantly decided on the use of computer technology, particularly on the use of financial derivatives. Out of the consideration of the capacity of computer technology, larger firms are more prone to use foreign debt (Allayannis and Ofek, 2001). Firm size, as measured by the log of consolidated total assets, had a positive relationship to the relative importance of foreign debt (Aabo, 2005).

*Tax regimes*

Besides, different tax regimes across countries sometimes affect multinational firms' sourcing of debt. The first is due to differences in tax treatment of interest and exchange rate gains and losses, while the second is due to firms arbitraging differences in corporate tax rates across countries (Kedia and Mozumdar, 2003). Multinationals have intended to locate debt in the higher tax entity (parent or subsidiary) for arbitrage tax differentials across countries (Hodder and Senbet, 1990). This may lead to issuing debt in the higher tax country. Furthermore, under a progressive corporate tax structure, the hedging can reduce the expected tax liability for a firm over the range of possible income outcomes (Mayers and Smith, 1982). This finding was followed by the reasons of the convexity of the corporate tax schedule, and of the hedging reduces the volatility of the firm's expected taxable income stream. However, it was also found that the evidence in favor of the tax hypotheses is very week in terms of progressivity and tax carry forwards (Mian, 1996).

## 3.4 Instruments

In addition to these factors influencing currency risk exposures, the choice of a proper hedging instrument is taken into consideration as well. The hedging techniques include spot, forward contracts, options, futures, currency swaps, Eurobonds, Euronotes, Euro commercial paper, window forwards and non-deliverable forwards. Every single instrument has its advantages and disadvantages in hedging. The first five instruments are used very often that will be introduced one by one.

*Forward contracts*

Theoretically, forward contracts are intended for clients who want to fix a favorable current exchange rate on a specified future date. This fixed exchange rate guarantees a customized future payment and the maturity date, and thus eliminates the risk of future volatility. However, forward transactions give up translation profit if the foreign currency appreciates against the domestic currency and creates transaction costs of forward contracts. Whether the bank or the non-bank corporations are competent at forecasting exchange rates is an essence. Practically, the forward market is little used by U.S. nonblank firms for the purpose of covering positions in balance-sheet categories measured by the data published by the U.S. Treasury Department (Fieleke, 1981). Moreover, the “hidden risk” in the use of forward contracts arises when there is uncertainty about either the timing or the amount of the foreign cask flow (Hekman, 1981). These uncertainties must increase as the maturity lengthens. However, a survey conducted within Australian firms in 1988 showed a great interest in using forward exchange contracts as a hedging technique (Teoh and Er, 1988). The advantages of using forward contracts are: 1) it is a tailored instrument including its all parameters, such as the amount, the maturity date and the type of particular currency; 2) the cost of forward contracts is low comparing with other instruments; and 3) the settlement date is up to one year.

*Futures*

Unlike forwards, futures contracts are standardized in terms of a standard volume that is about to be exchanged on a settlement date in the future. The standard volume means no tailored transaction amounts can be traded on markets like the Chicago Mercantile Exchange. Futures contracts are similar to forwards contracts. However, trading futures contracts is intended to speculating profits, since futures positions can be closed out before their delivery dates. In contrast, most forwards contracts are used for currency hedging and obliged on the delivery date.

*Spots*

A spot contract allows you to buy or sell foreign currency at today's exchange rate, and its final settlement date usually will be two business days later. Spot foreign exchange transactions are available for those clients who benefit from approval spot limits.

*Currency options*

Another often used currency hedging instrument is currency options, because it guarantees a worst-case exchange rate for the future purchase of one currency for another. Options are also contracts but the costs of options are much more than the costs of forward contracts. Since the company has the right but not the obligation to purchase (a call option) or sell (a put option) a currency at an agreed exchange rate (the strike price) (Desai, 2007). Because of this right, the buyer pays a premium that is more expensive than the costs of forward contracts. Unlike a forward contract, the option does not obligate the buyer to deliver a currency on the settlement date unless they exercise the option. The big advantage of using options is to protect against downside risk and allow upside appreciation, which leads to a more stable company with more stable infrastructure. Whether the upside appreciation can speculate profits is dependent on how much the foreign currency goes up or goes down against domestic currency. If the foreign currency only goes up a little bit, suppose we buy put option denominated in the foreign currency, and then the put option would be worthless. The gains on the appreciation of the foreign currency will be approximately offset by the losses on buying the put option. If we still buy the same put option, but the foreign currency goes up quite a lot, and thus profits would be made although the fees on purchasing the put option has been paid. However, the main disadvantage of using currency options is it can be quite costly for it is essentially an insurance policy. Personally, the purpose of the use of options as a hedging instrument should be an insurance policy for non-bank corporations to hedge foreign exchange rate risk. Speculation probably can be achieved by bankers.

*Currency swaps*

In addition to the most popular hedging approaches, currency swaps is sometimes used. Currency swaps are generally used for long term period with a high volume under an ensured high liquidity. When entering into a currency swap, the client simultaneously purchases and sells a given currency at a fixed exchange rate and then re-exchanges those currencies at a future date allowing you to convert a stream of cash flows in one currency into another currency at a fixed exchange rate. Its main advantages are: 1) minimizing the costs of foreign conversions and thus client is protected against exchange rate risk; 2) allowing firms to make use of advantages of maturities; 3) clients are flexible to shorten or prolong the period of the existing swap; 4) it costs nothing to enter into a swap which is an “at-the-money” initiative. Except for advantages, its disadvantages are: 1) since the volatility of exchange rate increases as time goes on, the actual market rates could deviate from the contractual rates more; this potential risk may lead to greater gains or losses; 2) the client can be suffered from the default risk of its counterparty. Other derivative instruments are worthless be described in this paper since they are seldom used in practice.

In conclusion, Table 1 gives a general view of the comparison of these financial instruments in terms of advantages, disadvantages, amounts of transaction, costs, descriptions and how often it is used.

Table 1 *Comparison of financial instruments*

| Instruments to hedge | Descriptions | Used often | Advantages |
|---|---|---|---|
| Forward contracts (a popular one) | Buy or sell a currency at a favorable fixed rate on a specified future date and trade over the counter. Individually. | Yes | A tailored instrument for meeting the needs of clients. Guarantee a particular future payment and eliminate the risk of future volatility. |
| Futures | Like forwards, but specifying a standard volume of a currency and trading on markets. | Yes | The same as forwards. |
| Options | A contract that, for a fee, guarantee a worst-case exchange rate for the future purchase of one currency for another. | Yes | Protect against downside risk and allow upside appreciation. |
| Currency swaps | Convert a stream of cash flows in one currency into another currency at a fixed exchange rate. | No empirical result available. | Minimize the costs of foreign conversion while client is protected against exchange rate risk; cost nothing to enter into a swap. |
| Spot | Buy or sell foreign currency at today's exchange rate. | No | Benefit from approved spot limits. |

Table 1 *Comparison of financial instruments Continue*

| Instruments to hedge | Disadvantages | Amounts of transaction | Costs |
|---|---|---|---|
| Forward contracts (a popular one) | Give up translation profit if (Euro) appreciates against the (U.S. dollar) and creates transaction costs of forward contracts. | Any amount, tailored amount. | Not too much. |
| Futures | The same as forwards. | Standardized amounts, eg. Each Canadian dollar futures contract contains 100,000 CAD. | Not too much. |
| Options | Essentially an insurance policy and therefore can be quite costly. | Any large amount. | Much more than the cost of a forward. |
| Currency swaps | The client can be suffered from default risk of its counterparty. | Any large amount. | Depends on the fee. |
| Spot | Not found in literatues. | Any amount. | Nothing. |

# 4. Data analysis

## 4.1 The current status of the trading company

According to those factors involved in foreign exchange risk management, the current status of the trading company will be shortly described. This is a small trading company that faces higher exchange risk than a large company, because it lacks of the abilities of the use of the operational hedges, particularly the use of complex financial derivatives. Because it is a small trading company and its trading regions are not diversified, it must take a centralized control of foreign exchange exposures. Centralization is a plus for eliminating exchange risks exposures according to empirical research results. Since the centralized risk management see the total cash flows, currencies position and borrowings, and develop specialized treasury skills. The factor tax regimes will not affect this small company too much. Therefore, this trading company can adopt the cash flow method or a simple financial instrument to reduce or to hedge its exchange risk exposures.

The economic exposure is usually out of considerations in any case, and the translation exposure is an accounting concept. Thus, only the transaction exposure will be analyzed in this case. Nevertheless, analyzing the data of cash flows will help finding a proper hedging instrument for this small trading company.

## 4.2 Data analysis (2007)

The data of cash flows of this company is collected from January 2007 to February 2007. Because this is a trading company and its invoices are received in advance, the company surly knows the exact date when they transact the highest amount of cash outflow every month. Its initial cash position is: $2450 and €2000. The following four figures will show the real monthly cash flows and net exposures in US dollars, respectively. All these cash flows are in US dollars except for one transaction paid out in euros on 25$^{th}$ of each month. The everyday cash outflow is exactly the same as daily cash outflow, while the cash inflow is calculated as:

*the net cash position of yesterday + the cash inflow of today.*

Figure 2 and figure 3 show the daily cash positions in each month. Figure 4 and figure 5 give a map of the daily net exposures.

Figure 2

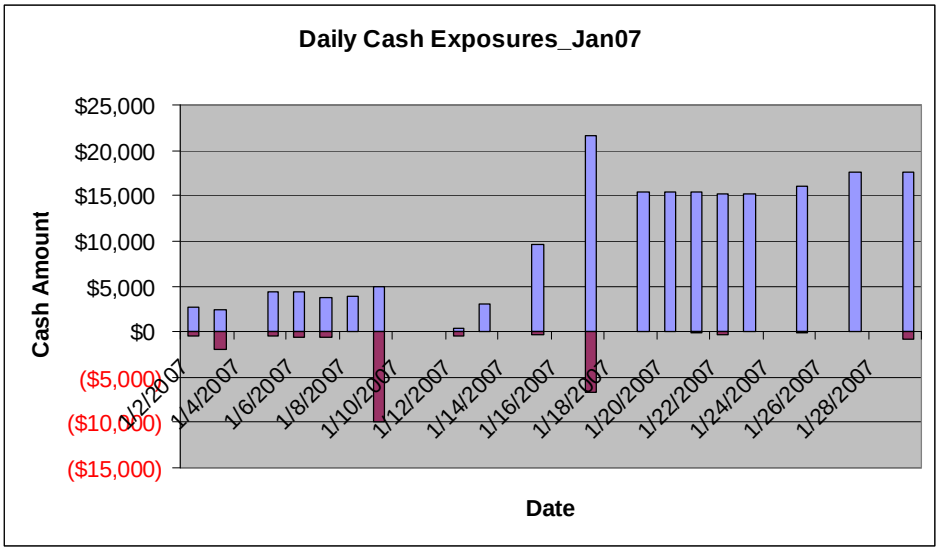



Figure 3

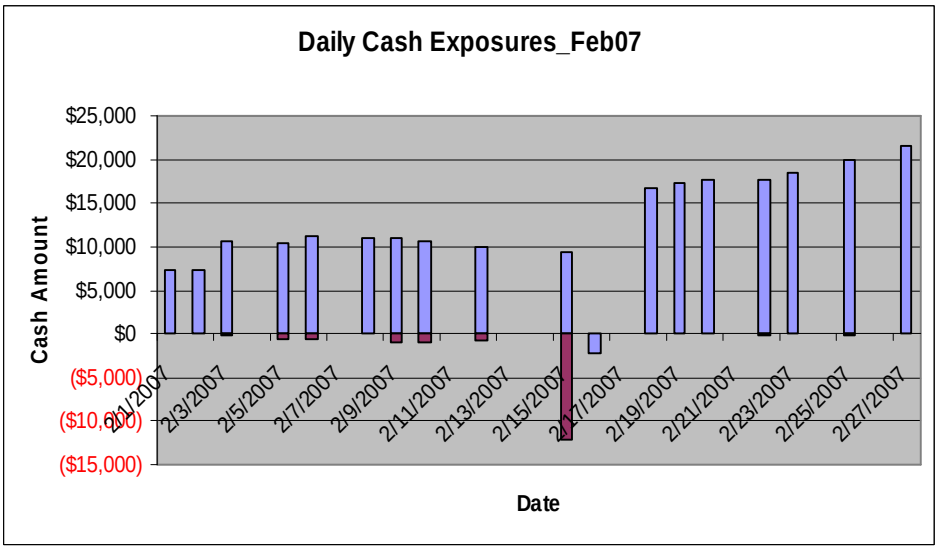



Figure 2 and figure 3 tell that this trading company has more cash inflows than cash outflows in US dollars, which is a positive sign to manage its currency exchange risks. Figure 4 and figure 5 show a clear view of net daily cash exposures. Only a few days are happened to negative net cash positions in US dollars, which is also good news for hedging currency exposures.

Figure 4

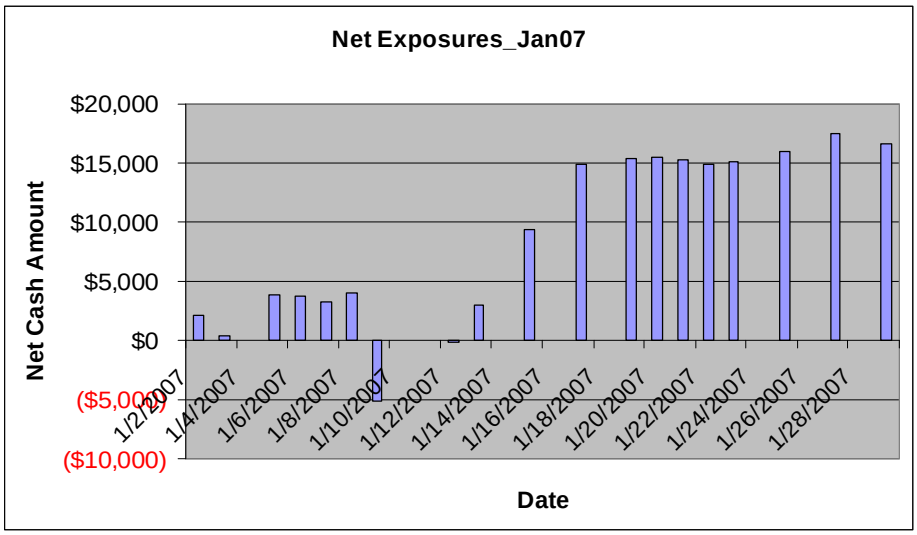
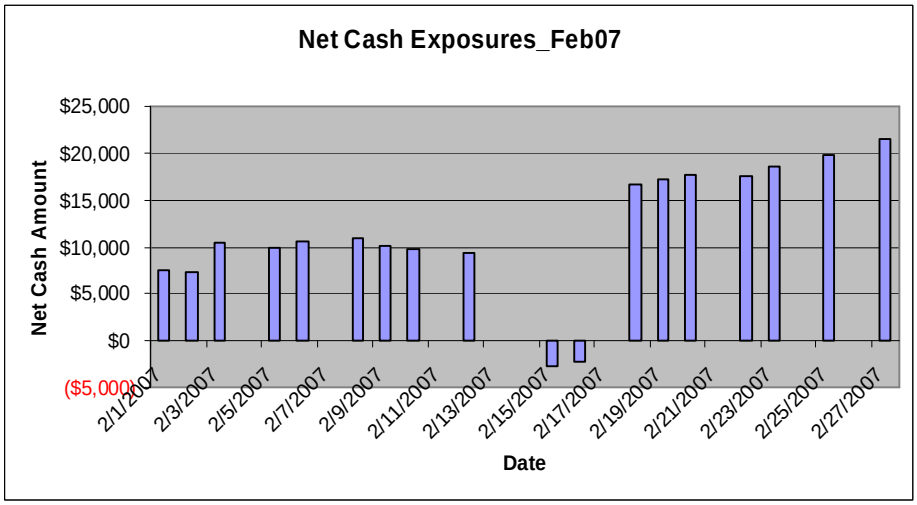



Figure 5




Exchanging Euros to US dollars is completely out of concern, since this is a Dutch based company. Holding more Euros is beneficial to its cash management. There are two key problems will be concerned in this paper. The first problem is how and when to exchange surplus US dollars into Euros. Since the trading company knows the date when it pays the highest cash outflow each month, it will not exchange its US dollars into Euros before this transaction date. Therefore, there will be two scenarios when the company enters the transaction after this date but before the end of the month.

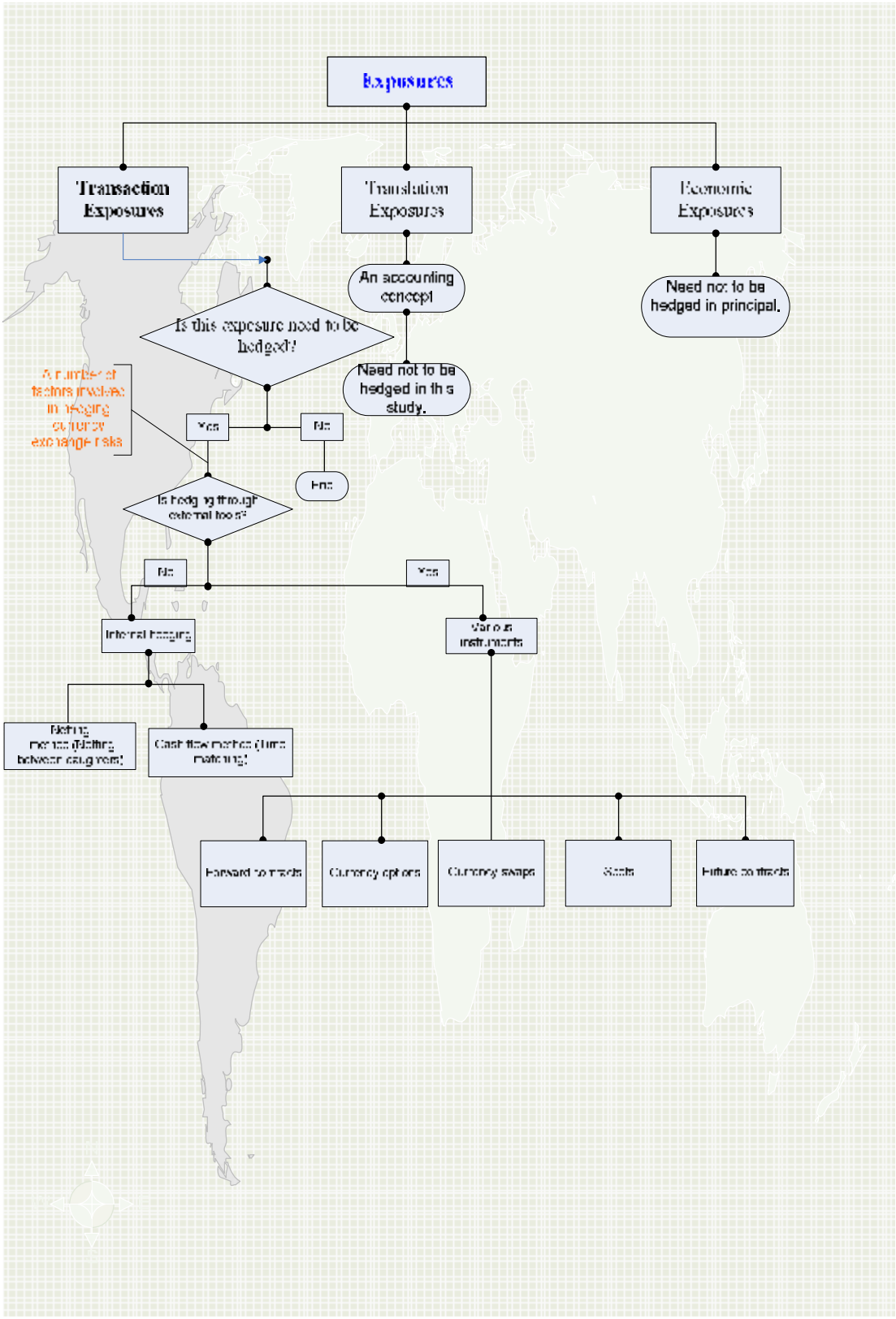
Firstly, if the company entered into the transaction for the favorable exchange rate somewhere before the end of the month but after paying the highest cash outflow, there are two situations:

1) its US account could still stay positive, which is a lucky situation;
2) it could have negative cash position in the US dollar account and thus be asked to pay interests by the bank. However, the interests received from the positive Euro account probably could compensate the interests paid out from the negative US dollar account.

Secondly, if the company exchanges the surplus US dollars into Euros by the end of the month, its US dollar account would not be negative very often on one hand. On the other hand, the company may lose from an unfavorable exchange rate as if it could have done earlier. Briefly, these two scenarios are unpredictable for a small company, because it does not have the computer technology to predict the trend of the exchange rates. Once it takes such actions, it is speculating money which is not a right attitude towards the company's future development.

Additionally, the second problem arises from the monthly outflow -€4000 on 25$^{th}$ of each month. The company should think of how to hedge this negative exposure, internally or externally? Which financial instruments will be adopted to hedge the currency exchange rate risk? Does it worth hedging this exposure by an external financial instrument? Will the internal hedging method be more efficient? These questions can be described straightforward in Graph 1. Again, only the transaction exposure is analyzed in this paper. A number of factors involved in hedging decisions determine whether the internal means or external instruments will be adopted to eliminate the transaction exposures. If hedging internally, the internal hedging method would be chosen between netting and cash flow method. Otherwise, the external hedging instrument would be determined among forward contracts, currency options, currency swaps, spots and future contracts by comparing their advantages and disadvantanges listed in Table 1.

Graph 1


Exposures
Transaction Exposures
Translation Exposures
Economic Exposures
An accounting concept
Need not to be hedged in principal.
Is this exposure need to be hedged?
Need not to be hedged in this study.
A number of factors involves in hedging currency exchange risks
Yes
No
End
Is hedging through external tools?
No
Yes
Internal hedging
Various instruments
Netting
Cash flow matches (Time matching)
Forward contracts
Currency options
Currency swaps
Swaps
Future contracts

# 5. Company strategy to currency risk

## 5.1 External hedging

According to those two key problem mentioned in section 4, this section will select possible hedging methods among those discussed financial instruments in section 3.2, such as forward contracts, futures, options and currency swaps. Suppose the company hedges the cash outflow -€4000 paid on 25$^{th}$ of each month externally for a short term period, the currency swaps are impossible be used. Since currency swaps are generally used for long term period with a high volume under an ensured high liquidity. Also, four thousands Euros is actually not a huge amount, so those instruments cost too much will not be taken into consideration, such as options. Spot is used often but not that often than forward contracts, futures, currency options or currency swaps. In the end, the best decision will be made between futures and forward contracts.

### 5.1.1 Forward contracts VS futures

As mentioned above, the costs of forward contracts and futures are zero that is a big advantage in front of a small company. Futures are fundamentally standardized forward contracts, for instance, standard volume and a particular settlement date. Apparently, €4000 is not a standard volume to be traded on an organized exchange market. This trading company should take advantages of the forward contracts to hedge its currency exchange risk. Once entering the forward contracts, the company can negotiate over the counter and can deliver the actual volume in the end. It is not possible to close out the forward contracts before the delivery date, so this instrument is intended for hedging exchange risk but not for speculating profits. Before applying the forward contracts into practice, the determination of the forward rates will be introduced.

### 5.1.2 The determination of forward exchange rates

In general, the forward rate is dependent on whether the currency is expected to appreciate or depreciate as shown on the left-side equation in Figure 1. If the currency is expected to appreciate, the forward rate is about to higher than the spot rate; and the other way around. The following part will determine the forward exchange rate by the numerical calculation.

From the cash flow method, it is known that the future value of a currency is equal to the present value plus the interests earned over time in the country where you deposit. Simply, the method of the annualized interest will be applied in calculating the future value of a currency.

$FV = P\,[1 + (r/m)]^{n}$, where

FV: future value
P: principle
r: yearly interest rate
n: number of n period
m: m equal periods each year

If the forward exchange rate is determined by the future value of the quote currency and the future value of the base currency, the equation can be written as:

$FER_{2/1}$ = *Future value of quote currency / future value of base currency*

$= \frac{s(1+r_q/m)^n}{(1+r_b/m)^n}$, where

$FER_{2/1}$: foreign exchange rate in units of country 2's currency to one unit of country 1's currency
s: spot price
$r_q/m$: interest rate of quote currency

$r_b/m$: interest rate of base currency

Let's take an example to calculate the forward exchange rate.
The spot price for EUR/USD = 1.3021 on 1st February 2007, that is 1 Euro is equivalent to 1.3021 USD. The interest rate on a yearly base in Europe is 3.75% and in the United States is 5.25%, respectively. Insert all parameters into the above equation and the 1-month forward exchange rate for EUR/USD is predicted at 1.3037, which is lower than the spot rate 1.3173 on 1st March. If only concerning the effect of interest rates change in the two countries, this is a way of predicting forward exchange rate. There are other factors influencing the changes of forward exchange rates, so a complex model is required.

$$FER_{2/1} = \frac{s(1+r_q/m)^n}{(1+r_b/m)^n} = \frac{1.3021(1+0.0525/12)^1}{(1+0.0375/12)^1} = 1.3037 \quad (1)$$

In this equation, only interest rates play an important role in determining the exchange rates. Table 2 shows how sensitive EUR/USD FER to the changes in US interest rate and in Europe interest rate, respectively. This sensitivity test assumes the interest rate is increased by 25bp in the US and in Europe, meanwhile fixes the other interest rate, respectively. This test is taken under four situations: 1-month forward, 3-month forward, 6-month forward and 1-year forward.

*Case 1: increase US interest rate by 25bp to 5.5% and fix Europe interest rate at 3.75%*

The left part of Table 2 shows positive changes in EUR/USD FER as the US interest rate goes up by 25bp, given fixed Europe interest rate at 3.75%. For example, the US Fed increased the interest rates by 25bp to 5.5%, and then the 1-month forward exchange rate will increase to 1.3040 (rounded). In other words, 1 Euro will exchange more US dollars under each situation and therefore the Euro gets stronger. The positive difference increases from 3bp to 33bp as the maturity increases from 1 month to 1 year. Generally, when the interest rate of quote currency increases, the forward exchange rate will go up. As the maturity becomes longer, the EUR/USD FER becomes more sensitive to the US interest rate change.

*Case 2: increase Europe interest rate by 25bp to 4% and fix US interest rate at 5.25%*

The right part of Table 2 shows negative changes in EUR/USD FER as the Europe increase their interest by 25bp to 4% on a yearly base, given fixed US interest rate at 5.25%. The changes in absolute values are the same as in case 1, but in opposite direction. Therefore, Euro becomes weaker if Europe interest rate goes up. The longer the maturity, the weaker the EUR/USD FER becomes.

In conclusion, in any case, the changes in interest rates nearly have no effects on the value of the forward exchange rate in a short term period, such as 1 month and 3 months. This is a very favorable result in the next part.

Table 2

| | US interest rate increase by 25bp (fix EU interest rate) | | | | EU interest rate increase by 25bp (fix Us interest rate) | | | |
|---|---|---|---|---|---|---|---|---|
| | 1-month | 3-month | 6-month | 1-year | 1-month | 3-month | 6-month | 1-year |
| 5.25% | 1.3037 | 1.3070 | 1.3119 | 1.3217 | 1.3037 | 1.3070 | 1.3119 | 1.3217 |
| 5.5%/4% | 1.3040 | 1.3078 | 1.3135 | 1.3250 | 1.3034 | 1.3062 | 1.3103 | 1.3184 |
| Diff | +3bp | +8bp | +16bp | +33bp | -3bp | -8bp | -16bp | -33bp |

5.2 Internal hedging

Using external financial tools to hedge currency exchange risk is a way of hedging on one hand. On the other hand, internal hedging would also be an efficient way. Since this trading company knows the date when it pays out the highest amount of cash outflow, it can adjust the transaction date during a month to smooth the cash flow streams. There are four scenarios to be compared by the cash flow method in the next part.

5.3 Constructing hedging programs

This part is going to build up different hedging programs, with which results will be compared for selecting feasible hedging means. Hedging program is constructed from external instrument to internal instrument.

5.3.1 Hedging with forwards

As discussed in section 5.1, forwards contracts are often adopted for (perfect) hedging because all its parameters are tailored to the needs of clients, including the volume of the transaction, the maturity date and the certain type of currency. All these advantages are convenient to this small trading company to manage. This part will use forward contracts to fix the cash outflow in dollars exchanged into €4000 on 25$^{th}$ of each month. First of all, the unhedged position is analyzed, and secondly the hedged position.

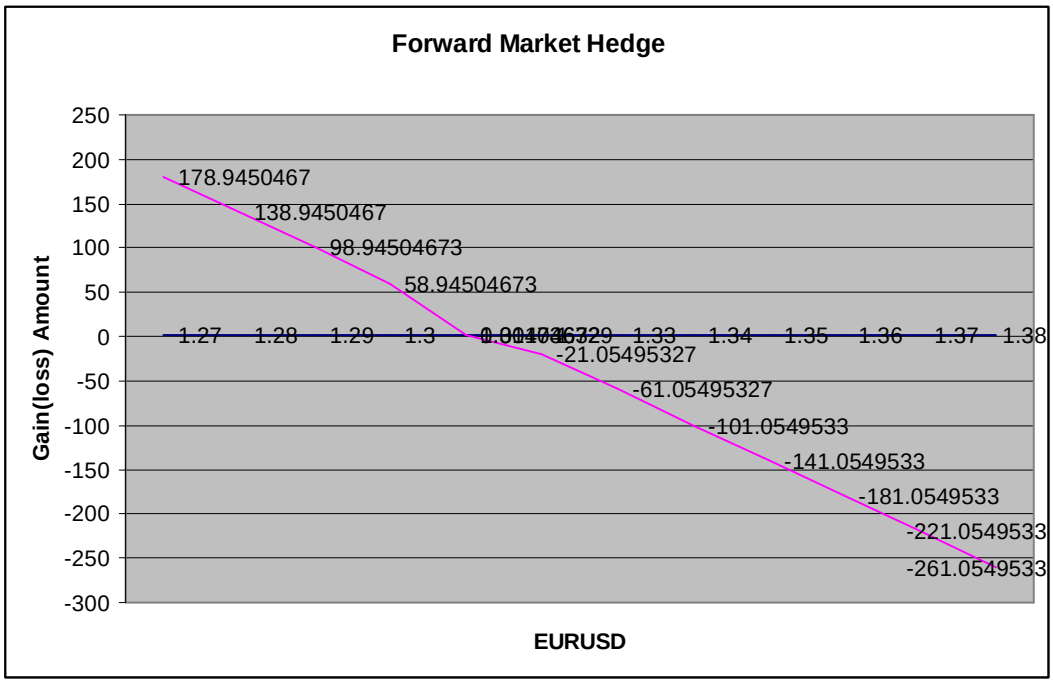
Firstly, the unhedged situation is presented. Suppose the changes in interest rates have no effect on a 1-month forward contract, as discussed in section 5.1.2. Other factors are also ignored in this analyzing part. Figure 6 shows how the forward market is used in hedging. There would be no gains or losses, if the forward exchange rate is at 1.3147[1], where the pink line across the horizontal axis. Under such situation, the company would have paid $5258.8. If the company stays uncovered with €4000 payable, its gain or loss positions are shown on the pink line in Figure 6. The horizontal axis is the exchange rate EUR/USD, and the vertical axis is the gain or loss amount at different exchange rate.

The company was expected the depreciation of the Euro, because it can buy the same amount of €4000 payable with less US dollars. For instance, it spent $5120 buying €4000 at an exchange rate of only $1.28/€ and it saved $138.8. However, when the Euro appreciated against USD, the company would pay more than if they hedged the payable by a forward contract. Since a small company is not able to predict the exchange rate precisely, it is suggested to use the forward contract to make sure certain cash flow. Also, €4000 is a fixed cash outflow every month, and thus it is worthy hedging it.

Secondly, it is introduced to adopt the external financial instrument, forward contracts, to hedge the payable. The company bought the forward contract on EUR/USD market always one month ahead; on 22$^{nd}$ December 2006 (25$^{th}$ Dec 2006 was a holiday) it bought a 1-month forward contract and on 25$^{th}$ Jan 2006 it bought another one delivered on 25$^{th}$ Feb 2006. Illustrating one example here and collecting the hedging results from February 2006 to February 2007 in Table 3.

[1] The historical forward exchange rate is not available any more on internet. Instead, the equation 1 is used to forecast the 1-month forward exchange rate.

Figure 6




*Spot exchange rate: 1.3131*
*Maturity period: 30 days*
*Transaction value: €4000*
*1-month forward exchange rate: 1.3147.*

*30days later, on 22nd January 2007*
*Spot exchange rate: 1.2957*
*Physical delivery: €4000 * ($1.3147/€) = $5258.8*
*Ideally losses (gains): €4000 * ($1.2957/€) - $5258.8 = - $76*

Table[2] 3 (fixed maturity and fixed transaction value)

| | Spot ER[3] | Forecasted 1-m FER | Physical delivery | Unhedged | Ideal losses (gains) |
|---|---|---|---|---|---|
| Feb_06 | 1.2252 | 1.227238178 | 4908.952714 | 4752.8 | -156.1527137 |
| Mar_06 | 1.1882 | 1.190423706 | 4761.694822 | 4813.6 | 51.90517779 |
| Apr_06 | 1.2034 | 1.205401497 | 4821.605988 | 4964.8 | 143.1940125 |

[2] The interest rates in both regions were raised as time went on. The real interest rates were used, and they can be found on these two websites: http://www.ecb.eu/stats/monetary/rates/html/index.en.html#data <1st July 2007> and http://www.economagic.com/em-cgi/data.exe/feddal/rmfedfun <1st July 2007>.

[3] The spot exchange rate is the one exactly a month ago. For example, the first spot exchange rate is not the one recorded on 25th Feb 2006, but the one on 25th Jan 2006.

| | | | | | |
|---|---|---|---|---|---|
| May_06 | 1.2412 | 1.243522412 | 4974.089647 | 5110.8 | 136.7103534 |
| Jun_06 | 1.2777 | 1.280356341 | 5121.425364 | 5008.8 | -112.6253638 |
| Jul_06 | 1.2522 | 1.254542507 | 5018.170027 | 5030.4 | 12.22997298 |
| Aug_06 | 1.2576 | 1.26021401 | 5040.856038 | 5106.8 | 65.94396175 |
| Sep_06 | 1.2767 | 1.279087843 | 5116.351372 | 5098.8 | -17.55137157 |
| Oct_06 | 1.2747 | 1.277084102 | 5108.336409 | 5036.4 | -71.93640898 |
| Nov_06 | 1.2591 | 1.261192832 | 5044.771328 | 5232.4 | 187.6286723 |
| Dec_06 | 1.3081 | 1.310274278 | 5241.097112 | 5252.4 | 11.30288801 |
| Jan_07 | 1.3131 | 1.315009369 | 5260.037474 | 5192 | -68.03747403 |
| Feb_06 | 1.298 | 1.299887412 | 5199.549647 | 5265.6 | 66.05035314 |
| Mar_06 | 1.3164 | | | | 248.6620599 |

In conclusion, hedging currency exchange risk by the use of the forward contracts for this small trading company is possible and efficient. The total ideal losses or gains were positive, which does not mean that the company does not need to take hedging actions. Since the total surplus is only $248.66 through a whole year, which stays under the purple shadow on the right corner in Table 3. Thus this external financial instrument will be taken into considerations as a feasible hedging tool.

5.3.2 Hedging internally

Except for the help from external hedging instruments, the company can also hedge its exchange risk internally. There are four scenarios to be discussed and analyzed. Let's look at the plain scenario 0 at first.

Scenario 0: the company does nothing during the month, merely accumulates the net daily exposures at the end of the month. It had $16,636 and -€2000. It is suggested to exchange $10,000 into Euro at the exchange rate $1.2948/€ on 29$^{th}$ Jan, which solved two problems. The first one is the huge amount of US dollars. As long as this Dutch trading company holds about $5,000 at the end of each month, it can manage the cash flow next month. Moreover, the longer the company holds US dollars, the more value the US dollar depreciates in terms of Euro. The second problem is solved is the company had enough Euro to pay the only cash outflow in Euro. Anyway, this plain scenario is certainly not efficient for the company's operation. Thus, a couple of internal hedging methods are discussed as follows.

Scenario 1: what would be the monthly results if the daily position in $ is always lower than the daily expected highest cash outflow in that month on a certain day? That is to say, once the net daily exposure is exceeded the expected highest cash outflow; the residual would be exchanged into Euro at the exchange rate of that day. Thus, the company would have more Euros to freely operate its business through the whole month.

For example, $ 10,000 is the highest cash outflow in January 2007, so everyday the

maximum net exposure is equal to or lower than $ 10,000. When the net position is positively at $10,000, the company would not worry about the highest payment.
On 17th Jan 2007, the net exposure $14,909 firstly exceeds the highest amount $10,000, the company would exchange $4,909 into €3,787.46 at the exchange rate of $1.2948/€. At the end of January, the company already saved €7,823.99 and thus had enough Euros to pay out the monthly fixed cash outflows €4,000. As a result, the company had $9,093 and €3,823.99 for the next month transaction. This result looks more reasonable than the plain scenario. Apparently, a Dutch company is willing to hold more Euros on hands for its business operation, and less US dollars for depreciation of US dollar against Euro.

Scenario 2: based on scenario 1, scenario 2 paid cash outflow some days later. There are two sub-scenarios.
Scenario 2.1: all cash outflow are paid 3 days later.
Scenario 2.2: if the cash outflow is lower than $500, it is paid out 3 days later;
If the cash outflow is higher than $500, it is paid out 10 days later.

Scenario 3: exchange US dollars into Euro twice a month, one is on 15th and the other one is at the end of the month. Actually, the company would not change all USD cash into Euro; it would save the initial amount $2,450 for cash transactions. The results of all these 4 scenarios are listed in Table 4.

Table 4

| | January 2007 | | February 2007 | |
|---|---|---|---|---|
| | USD | Euro | USD | Euro |
| Scenario 0 | $16,636 | -€2000 | $31,496 | -€6000 |
| Scenario 0 Adjusted | $6,636 | € 5,723 | $21,496 | € 1,723 |
| Scenario 1 | $9,093 | € 3,823.99 | $12,080 | € 8,849.56 |
| Scenario 2.1 | $5,409 | € 15,142 | $11,825 | € 16,866.27 |
| Scenario 2.2 | $5,548 | € 7,633 | $13,830 | € 10,119.76 |
| Scenario 3 | $9,747 | € 3,333 | $7,225 | € 12,567 |

5.4 Results
Comparing the results of these six scenarios, scenario 0 is apparently not satisfying because of the negative position of Euros. The cash position of the adjusted scenario 0 seems much better than the plain situation. But entering the deal of exchange US dollars into Euros only one time in a month is not the right way of reducing the risk exposed to the currency exchange rate.

It can be concluded that scenario 2.1 is the best one. As mentioned before, this trading company is located in the Netherlands, holding relatively more Euros and proper

amounts of US dollars is an efficient way of operating itself in an international environment.
In addition, scenario 3 is the alternatively best one. The amounts of Euros under scenario 3 are less than those under scenario 2.1 in both January and February 2007. However, a favorably common phenomenon under these two optimal scenarios is the amount of Euros is increasing from January to February. If this phenomenon was hold throughout the whole year and the amounts of US dollars was hold at current levels, this company would steadily improve its profits and expand its business in the future.

Scenario 2.2 represents the same disadvantage as scenario 3 in comparison with scenario 2.1, and the same advantage as stated in scenario 3 or in scenario 2.1. Nevertheless, the company would have the highest amount of US dollars and the lowest amount of Euros in February 2007 under scenario 2.2, comparing with scenario 2.1 and scenario 3. Therefore, the cash flow method under scenario 2.1 will not be considered, although its cash position in January looked even better than the one under scenario 3. The expected future cash position under scenario 3 would be more efficient than the one under scenario 2.2.

Briefly, the idea of currency hedging is a way of eliminating losses in annual revenue due to the fluctuation of the unfavorable exchange rate. Also, it is a way of enhancing the liquidity of a company's cash position. The liquidity of a company is very important for its business operations. Thus, scenario 2.1 and scenario 3 will be the feasible cash flow methods in hedging the currency exchange risks, and also because they are easy to operate in practices. Moreover, the external hedging instrument forward contracts will be a feasible approach as well, since the changes in interest rates nearly have no effects on the value of the forward exchange rate in a short term period.

# 6. Conclusions and recommendations

This study case shows that this small Dutch trading company does face the transaction exposures, or the currency exchange risk of Euro against US dollar for its main business done with Thailand in US dollars. Since a small sized company exposes more risks than a big one according to a number of empirical researches. Because it is a small company, it has centralized decision making that is an advantage in controlling currency exchange risks. Centralization is a tool to see the total cash, borrowings and currencies position, to attain economies of scales in large transactions.

This paper examines the feasibilities, at a non-financial corporate, in adopting an internal or external instrument to eliminate the transaction exposures by comparing the advantages and the disadvantages of each instrument. The results suggest that forward contracts as an external hedging instrument are the best one in this study. Since forward contracts are a tailored hedging instrument, and they are also can be bought or sold at any amount without any cost. These three advantages indeed meet the needs of this small trading company. Additionally, the value of short term forward exchange rate is not influenced by the change in interests from either side. As a result, the positively practical results told that hedging exchange risks with forward contracts for this small trading company is feasible.

The internal hedging method is conducted by the cash flow method with time matching. Because this company does not have daughter companies, the netting method is not possibly to be used. There were six scenarios analyzed and compared, the results suggest that the best one is if all cash outflows were paid three days later (scenario 2.1). The alternatively best one is if exchanged US dollars into Euros twice a month, one is on $15^{th}$ and the other one is at the end of the month. These two scenarios are both easy to operate for a small scaled company. Furthermore, corporate hedging can smooth the reported net income; can predict the minimum of internally generated cash flows of the company. In conclusion, corporate hedging is suggested to adopt by this small Dutch trading company.

# Appendix 1 Scenario 1

| BeginCashF | $2,450 | € 2,000 | | | Daily Cash Exposures | | Daily Net Exposures | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Cash Inflo | Cash Outflows | | Date | | | | | | | | |
| 2-Jan-07 | $200 | $550 | | 2-Jan-07 | $2,650 | ($550) | $2,100 | | | | | |
| 3-Jan-07 | $310 | $2,000 | | 3-Jan-07 | $2,410 | ($2,000) | $410 | | | | | |
| 5-Jan-07 | $4,000 | $500 | | 5-Jan-07 | $4,410 | ($500) | $3,910 | | | | | |
| 6-Jan-07 | $560 | $670 | | 6-Jan-07 | $4,470 | ($670) | $3,800 | | | | | |
| 7-Jan-07 | $0 | $600 | | 7-Jan-07 | $3,800 | ($600) | $3,200 | | | | | |
| 8-Jan-07 | $780 | $0 | | 8-Jan-07 | $3,980 | $0 | $3,980 | | | | | |
| 9-Jan-07 | $909 | $10,000 | | 9-Jan-07 | $4,889 | ($10,000) | ($5,111) | | | | | |
| 12-Jan-07 | $5,550 | $560 | | 12-Jan-07 | $439 | ($560) | ($121) | | | | | |
| 13-Jan-07 | $3,100 | $0 | | 13-Jan-07 | $2,979 | $0 | $2,979 | | | | | |
| 15-Jan-07 | $6,700 | $340 | | 15-Jan-07 | $9,679 | ($340) | $9,339 | | USD | Euro | | |
| 17-Jan-07 | $12,345 | $6,780 | | 17-Jan-07 | $21,684 | ($6,780) | $14,904 | $10,000 | $4,904 | $3,787.46 | | |
| 19-Jan-07 | $450 | $0 | | 19-Jan-07 | $10,450 | $0 | $10,450 | $10,000 | $450 | $347.01 | | |
| 20-Jan-07 | $100 | $0 | | 20-Jan-07 | $10,100 | $0 | $10,100 | $10,000 | $100 | $77.18 | | |
| 21-Jan-07 | $0 | $224 | | 21-Jan-07 | $10,000 | ($224) | $9,776 | | | | | |
| 22-Jan-07 | $0 | $389 | | 22-Jan-07 | $9,776 | ($389) | $9,387 | | | | EndExposures Jan_07 | |
| 23-Jan-07 | $342 | $0 | | 23-Jan-07 | $9,729 | $0 | $9,729 | | | | | |
| 25-Jan-07 | $900 | $90 | -€ 4,000 | 25-Jan-07 | $10,629 | ($90) | $10,539 | $10,000 | € 539 | € 415 | **€ 3,823.99** | |
| 27-Jan-07 | $1,550 | $0 | | 27-Jan-07 | $11,550 | $0 | $11,550 | $10,000 | € 1,550 | € 1,197 | | |
| 29-Jan-07 | $0 | $907 | | 29-Jan-07 | $10,000 | ($907) | $9,093 | | | | **$9,093** | |
| 1-Feb-07 | $780 | $0 | | 1-Feb-07 | $9,873 | $0 | $9,873 | | | | | |
| 2-Feb-07 | $0 | $50 | | 2-Feb-07 | $9,873 | ($50) | $9,823 | | | | | |
| 3-Feb-07 | $3,200 | $200 | | 3-Feb-07 | $13,023 | ($200) | $12,823 | | | | | |
| 5-Feb-07 | $0 | $500 | | 5-Feb-07 | $12,823 | ($500) | $12,323 | | | | | |
| 6-Feb-07 | $1,368 | $630 | | 6-Feb-07 | $13,691 | ($630) | $13,061 | | | | | |
| 8-Feb-07 | $380 | $0 | | 8-Feb-07 | $13,441 | $0 | $13,441 | | | | | |
| 9-Feb-07 | $90 | $1,000 | | 9-Feb-07 | $13,531 | ($1,000) | $12,531 | | | | | |
| 10-Feb-07 | $550 | $900 | | 10-Feb-07 | $13,081 | ($900) | $12,181 | | | | | |
| 12-Feb-07 | $310 | $720 | | 12-Feb-07 | $12,491 | ($720) | $11,771 | | | | | |
| 15-Feb-07 | $0 | $12,080 | | 15-Feb-07 | $11,771 | ($12,080) | ($309) | | | | | |
| 16-Feb-07 | $600 | $0 | | 16-Feb-07 | $291 | $0 | $291 | | USD | Euro | | |
| 18-Feb-07 | $18,887 | $0 | | 18-Feb-07 | $19,178 | $0 | $19,178 | $12,080 | $7,098 | $5,404.29 | | |
| 19-Feb-07 | $550 | $0 | | 19-Feb-07 | $12,630 | $0 | $12,630 | $12,080 | $550 | $418.76 | | |
| 20-Feb-07 | $500 | $0 | | 20-Feb-07 | $12,580 | $0 | $12,580 | $12,080 | $500 | $380.69 | EndExposures Feb_07 | |
| 22-Feb-07 | $0 | $212 | | 22-Feb-07 | $12,080 | ($212) | $11,868 | | | | | |
| 23-Feb-07 | $942 | $0 | | 23-Feb-07 | $12,810 | $0 | $12,810 | $12,080 | $730 | $554.54 | **€ 8,849.56** | |
| 25-Feb-07 | $1,500 | $255 | -€ 4,000 | 25-Feb-07 | $13,580 | ($255) | $13,325 | $12,080 | $1,245 | $946.12 | | |
| 27-Feb-07 | $1,750 | $0 | | 27-Feb-07 | $13,830 | $0 | $13,830 | $12,080 | $1,750 | $1,321.15 | **$12,080** | |

## References


- Andrew. P. Marshall, *Foreign Exchange Risk Management in UK, USA and Asia Pacific Multinational Companies,* Journal of Multinational Financial Management 10, pp185-211, 2000.
- Christine R. Hekman, *Foreign Exchange Risk: Relevance and Management,* Managerial and Decision Economics, Vol.2, No. 4, Multinational Business, pp256-262, Dec. 1981.
- D.K. Eiteman, A.I. Stonehill, and M.H. Moffett, *Multinational Business Finance,* 10th edition, Addison-Wesle Longman, 2004.
- F.M. Lee, A. Marshall, Y.K. Szto and J. Tang, *The Practice of Financial Risk Management: An International Comparison.* Thunderbird International Business Review, Vol. 43(3), pp365-378, May-June 2001.
- G.. Dufey and S.L. Srinivasulu, *The Case for Corporate Management of Foreign Exchange Risk,* Financial Management, pp54-60, Vol.12, No.4, 1983.
- H.Y. Teoh and M. Er, *Impact of Floating Exchange Rates on Company Risk Management Practices: The Australian Experience.* Working Paper Series, No. 2, Department of Accountancy and Legal Studies, University of Wollongong, 1988.
- J. Batten, R. Mellor, and V. Wan, *Foreign Exchange Risk Management Practices and Products Used by Australian Firms,* Journal of International Business Studies, pp557-573, Vol. 24, No. 3, 1993.
- J.E. Hodder, and L.W.Senbet, *International Capital Structure Equilibrium.* Journal of Finance 45, no. 5 (December): 1495-1516. 1990.
- K. Froot, D. Scharfstein, and J. Stein, *A Framework for Risk Management,* Harvard Business Review, Nov. 1, 1994.
- Mayers, D., and C.W. Smith, *On the Corporate Demand for Insurance,* Journal of Business, 55, pp281-296, 1982.
- Mihir A. Desai, *International Finance: A Casebook,* 1st ed., John Wiley & Sons, Inc., 2006.
- Niclas Hagelin and Bengt Pramborg, *Hedging Foreign Exchange Exposure: Risk Reduction from Transaction and Translation Hedging,* Journal of International Financial Management and Accounting 15:1, 2004.
- Norman S. Fieleke, *Foreign-Currency Positioning by U.S. Firms: Some New Evidence,* The Review of Economics and Statistics, pp35-42, Vol. 63, No. 1, Feb 1981.
- P.A. Belk, *The Organisation of Foreign Exchange Risk Management: A Three-country Study,* Loughborough University Business School, pp 43-52, Vol. 28, No. 11, 2002.
- Pinches, GEE, *Financial Management,* Harder Colleens College Publishers, pp265-274, 1994.
- S. Kedia, and A. Mozumdar, *Froeign Currency Denominated Debt: An Empirical Examination,* Journal of Business, Vol. 76, No. 4, 2003
- Shehzad L. Mian, *Evidence on Corporate Hedging Policy,* The Journal of

Financial and Quantitaive Analysis, pp419-439, Vol. 31, No.3, Sept 1996.

- T. Aabo, *The Importance of Corporate Foreign Debt as an Alternative to Currency Derivatives in Actual Management of Exchange Rage Exposures,* http://ssrn.com/abstract=467422.
- http://www.wachovia.com/corp_inst/page/0,,7_19_208_1745_1757,00.html <1st June, 2007>
- http://thismatter.com/Money/Forex/fx_forwards.htm <1st June, 2007>