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Managing Exchange Rates

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Introduction

The collapse of the fixed exchange rate system established under the Bretton Woods Agreement ushered in fluctuating exchange rate regimes. Although extreme volatility is managed by monetary authorities, fluctuations in exchange rates present unique challenges to the manager of a multinational corporation (MNC). This chapter reviews various types of exchange rate regimes and discusses the types of risk an MNC faces due to exchange rate fluctuations. Special attention is paid to how these risks are measured and ways in which they are hedged using available financial market instruments. The chapter also discusses exchange rate forecasting models that are frequently used.

I. Exchange Rate Regimes

Fixed Exchange Rate System

In a fixed exchange rate system, exchange rates are fixed by governments and are therefore held constant or permitted to float within very narrow boundaries in foreign exchange markets. Central banks have to intervene if market forces push the exchange rate away from the predetermined par values. Countries fixing their exchange rates however have no independent monetary policy instruments to affect employment and real output (Fратиanni, Salvatore, Hagen, 1997). This leads to incompatibilities in a country's economic policy and can give rise to currency crises as illustrated such by the collapse of the Bretton Woods system and the Asian financial crisis in 1997-1999.

Freely Floating Exchange Rate System

In a freely floating exchange rate system, the value of the currency is determined solely by the forces of supply and demand in the foreign exchange market. A freely floating exchange rate system allows monetary authorities to pursue their own internal policy objectives such as growth and full employment rather than just exchange rate stabilization. The exchange rate moves to maintain equilibrium in the balance of payments in. The system can also isolate a country from shocks emanating from the rest of the world (Friedman 1953, Sohmen 1961, Mundell 1963). With freely floating exchange rates, central banks do not need to hold foreign exchange reserves to defend the exchange rate, and the world economy can function without resorting to trade barriers and tariffs. However, constant changes in exchange rates may cause a high degree of uncertainty and discourage international trade and portfolio flows, and foreign direct investment.

Managed Floating Exchange Rate System

In practice, the freely floating exchange rate system has never been adopted under its purest form, with policy makers “managing” exchange rates when necessary. Managed floating exchange rate systems require monetary authorities to intervene in foreign exchange markets to smooth short-run fluctuations and prevent their currencies from moving too far from a perceived fundamental value. Under this system, monetary authorities can moderate the tendency for the nation’s currency to depreciate by selling or buying to change the volume of foreign currency reserves. The feasibility of this system rests on the fact that it does not require the monetary authorities to know the long-run trend in exchange rates. However, the effectiveness

of official intervention in foreign exchange markets is limited since official foreign currency reserves are much smaller than international capital flows.

Pegged exchange rate system

A modern day alternative to freely and managed floating systems is the pegged exchange rate system. In this system, the value of a country's currency is pegged to that of a foreign currency, usually the US dollar, and thus moves in line with that foreign currency against other currencies (Madura, 2007). Pegged rates require monetary authorities to manage the exchange rate and monetary policy simultaneously to keep the pegged rates stable. Economies like those of China, Hong Kong, Singapore, Malaysia and Argentina have either currently or in the past pegged their currency to the dollar. China's peg to the dollar was an attempt to maintain competitive pricing. Export oriented countries like Singapore and Hong Kong peg their currency to the dollar because a large proportion of their exports may be denominated in dollars. Malaysia pegged its currency to the dollar following the Asian financial crisis to restore a degree of confidence in their capital markets. Argentina pegged its currency to ensure that the value of its currency in international markets remained strong even when the domestic economy was experiencing hyperinflation. A problem with this system includes the emergence of a black market in pegged currencies, particularly if it is illegal to trade the currency at any rate other than the pegged rate, which may be quite different from the perceived market-determined rate. This system can also cause conflicts between exchange rate and monetary policy.

Since the breakdown of the Bretton Woods system of fixed exchange rates in the early 1970's when the values of the world's major currencies began to float

against each others, the shift from fixed to flexible exchange rates has been gradual. Most developing countries shifted from pegs to a single currency to pegs to a basket of currencies, such as to the IMF's special drawing right (SDR).ⁱ Since the early 1980s, there has been a shift away from currency pegs toward more flexible exchange rate arrangements due to the increasing globalization of financial markets. However, trade-offs exist between fixed and more flexible regimes; under a more flexible arrangement, monetary policy may be more independent but inflation can be higher and more variable.

II. Multinational Corporation Exchange Rate Exposure

A consequence of exchange rate fluctuations is that an MNC with operations resulting in cash flows denominated in currencies other than its home currency is exposed to a number of risks or exposures. This section discusses these exposures and how they are measured and managed by the manager of the MNC.

1. Translation exposure

Foreign subsidiaries of a MNC are required by local regulations to use local currencies in recording their financial transactions. Hence, their financial statements must be *translated* into the currency of the parent company at the end of each accounting period when the parent company prepares its consolidated financial statements.ⁱⁱ This translation can take place using either the historical exchange rate (the prevailing rate at the time of the transaction), the current exchange rate (on the date the balance sheet is composed), or average (mean) exchange rates over a period of time.

There are two issues worth mentioning in the translation process:

- (i) The use of different exchange rates (historical, current, or average) for different items causes imbalances in the translated balance sheet of the foreign subsidiary. To re-

balance the balance sheet, an account called *translation adjustment* is credited or debited. The exposure to translation adjustment is called balance sheet, translation, or accounting exposure. Net assets (liabilities) balance sheet exposure arises when assets (liabilities) translated at the current rate are greater than liabilities (assets) translated at the current rate.

- (ii) All balance sheet items translated at the current exchange rate, which can change from period to period, are exposed to translation adjustment.

Based on accounting theory and practice worldwide, there are different exchange rates and methods that a company can use in carrying out translations (Doupnik and Perera, 2008; Choi and Meek, 2008):

(a) Current/Noncurrent Method

Current assets and liabilities are translated at the current exchange rate (the exchange rate on the balance sheet date). Non-current assets and liabilities and stockholders' equity accounts are translated at historical exchange rates (the exchange rates that existed at the time the transactions took place). There is no theoretical basis for this method and it is seldom used in any country.

(b) Monetary/Nonmonetary Method

Monetary assets and liabilities are translated at the current exchange rate while non-monetary assets and liabilities and stockholders' equity accounts are translated at historical exchange rates. The translation adjustment measures the net foreign exchange gain or loss on current assets and liabilities as if they were carried on the parent company's books.

Neither method (a) or (b) are allowed under U.S. Generally Accepted Accounting Practices (GAAP) or International Financial Reporting Standards (IFRS).

(c) Current Rate Method

The objective of this method is to reflect the fact that the entire investment of the parent company in a foreign subsidiary is exposed to exchange rate risk. Hence, all assets and liabilities (monetary and nonmonetary, current and noncurrent) are translated at the current exchange rate. Stockholders' equity accounts are translated at historical exchange rates. Income statement items are translated at the exchange rate in effect at the time of the transaction.

(d) Temporal Method

This method translates financial statements as if the subsidiary had been using the parent company's currency at the times at which the transactions took place. Items carried on the subsidiary's books at historical cost, including all stockholders' equity items, are translated at historical exchange rates. Items carried on the subsidiary's books at current value are translated at current exchange rates. Income statement items are translated at the exchange rate in effect at the time of the transaction.

An important consequence of using either method (c) or (d) pertains to how the translation adjustment is reported. Under the Current Method, the translation adjustment is reported in the company's balance sheet (Shareholders' Equity - Other Comprehensive Income). Using the Temporal Method, it is reported in the income statement as a translation gain or loss.

US Generally Accepted Accounting Principles and Translation Adjustment

The relevant U.S. GAAP (FASB 2009) standards dealing with translation adjustments are the Accounting Standard Codification (ASC) Topic 830, Foreign Currency Matters, which integrates the new codification project FAS No. 52 (Foreign Currency Translation), and ASC Topic 220-10 (Comprehensive Income) which integrates FAS No. 130 (Reporting Comprehensive Income).

ASC 830 recognizes two broad classes of foreign operations. The first includes

foreign operations that are integrated within a country or economic environment. These are mostly independent from the parent company and use the local currency in their transactions. The second comprises foreign operations with most of their transactions in the currency of the parent company.

To determine whether a subsidiary operates independently (first class) or is integrated with the parent (second class), ASC 830 introduces the concept of *functional currency*. A company's *functional currency* is the primary currency of the foreign entity's operating environment. If the functional currency is the local foreign currency (first class), U.S. GAAP requires using the Current Rate Method. If the functional currency is the currency of the parent company (second class), ASC 830 requires using the Temporal Method of translation. U.S. GAAP (ASC 830-10-55-5) lists six different indicators that can help managers determine the functional currency of a foreign subsidiary (see table below). An exception to the general guidelines is that in highly inflationary economiesⁱⁱⁱ, U.S. GAAP (ASC 830-10-55-5) mandates the use of the Temporal Method for translation^{iv} without regard for the functional currency.

Table 1. Indicators to determine the functional currency of a foreign subsidiary

Indicator	Indication that the functional currency is the Foreign Currency	Indication that the functional currency is the Parent Company's Currency
Cash Flows	Cash flows related to the foreign entity's individual assets and liabilities are primarily in the foreign currency, and do not directly affect the parent entity's cash flows.	Cash flows related to the foreign entity's individual assets and liabilities directly and currently affect the parent company's cash flows, and are readily available for remittance to the parent company.
Sales Price	Sales prices for the foreign entity's products are not primarily responsive on a short-term basis to changes in exchange rates, but are determined more by local competition or local government regulation.	Sales prices for the foreign entity's products are responsive primarily on a short-term basis to changes in exchange rates. For example, sales prices are determined more by worldwide competition or by international prices.

Sales Market	There is an active local sales market for the foreign entity's products, although there also might be significant amounts of exports.	The sales market is mostly in the parent company's country or sales contracts are denominated in the parent company's home currency.
Expenses	Labor, materials, and other costs for the foreign entity's products or services are primarily local costs, even though there may be imports from other countries.	Labor, materials, and other costs for the foreign entity's products or services continually are primarily costs for components obtained from the country in which the parent entity is located.
Financing	Financing is primarily denominated in foreign currency, and funds generated by the foreign entity's operations are sufficient to service existing and normally expected debt obligations.	Financing is primarily from the parent company or other dollar-denominated obligations, or funds generated by the foreign entity's operations are not sufficient to service existing and normally expected debt obligations without the infusion of additional funds from the parent entity.
Intra-entity transactions	There is a low volume of intra-entity transactions and there is not an extensive interrelationship between the operations of the foreign entity and the parent entity. However, the foreign entity's operations may rely on the parent company's or affiliates' competitive advantages, such as patents and trademarks.	There is a high volume of intra-entity transactions and there is an extensive interrelationship between the operations of the foreign entity and the parent entity.

(Table from Accounting Standard Codification, FASB 2009)

As an example of how relevant the foreign currency translation adjustment can be in a company's financial statement, we present an extract from eBay Inc.'s 2008

Annual Report:

eBay Inc.			
CONSOLIDATED STATEMENT OF OTHER COMPREHENSIVE INCOME			
	Year Ended December 31,		
	2006	2007	2008
	(in thousands)		
Net income	\$1,125,639	\$ 348,251	\$1,779,474
Other comprehensive income:			
Foreign currency translation	588,150	645,202	(553,490)
Change in unrealized gains (losses) on investments	8,327	589,566	(464,171)
Change in unrealized gains (losses) on cash flow hedges	(194)	(175)	40,522
Estimated tax (provision)benefit on above items.	(3,216)	(229,514)	179,348
Net change in accumulated other comprehensive income (loss)	593,067	1,005,079	(797,791)
Comprehensive income	\$1,718,706	\$1,353,330	\$ 981,683

eBay Inc.'s translation adjustment in 2008 was equal to more than 31% of its net income for the period. The company's reporting of the translation adjustment among other comprehensive income items shows its use of the current method. Indeed, in the financial statements notes, the company explains that:

Foreign currency

Most of our foreign subsidiaries use the local currency of their respective countries as their functional currency. Assets and liabilities are translated at exchange rates prevailing at the balance sheet dates. Revenues, costs and expenses are translated into U.S. dollars at average exchange rates for the period. Gains and losses resulting from the translation of our consolidated balance sheet are recorded as a component of accumulated other comprehensive income.

Realized gains and losses from foreign currency transactions are recognized as interest and other income, net.

International Financial Reporting Standards

In November 2008, the Securities and Exchange Commission (SEC) released a proposed rule that lays down a roadmap for the use of financial statements prepared in accordance with IFRS for U.S. companies filing with the Commission^v. The roadmap includes the mandatory use of IFRS by U.S. filers by 2014, assuming that certain milestones are achieved. The potential mandatory adoption of IFRS in the U.S. calls for an analysis of the accounting rules for the recording of translation

adjustment under IFRS, and a comparison with US GAAP.

International Accounting Standard (IAS) 21, *The Effects of Changes in Foreign Exchange Rates*, is the relevant accounting standard on the subject. It uses the functional currency approach developed in the U.S. by FASB and includes a list, similar to the FASB list, of indicators for guidance in the functional currency decision. While U.S. GAAP and IFRS are similar in their accounting treatment of the effect of changes of foreign exchange rates, a notable difference is the IFRS requirement pertaining to hyperinflationary economies. IAS 21 requires the restatement of foreign financial statements for inflation according to IAS 29, *Financial Reporting in Hyperinflationary Economies*. This requires the use of the current exchange rate to translate the restated financial statements, including **all** balance sheet and **all** income statement accounts instead of the adoption of the Temporal Method as per US GAAP.

Hedging Translation Adjustment

To minimize the adverse effects that changes in exchange rates might have on cash flow and net income, firms enter into hedging contracts. The corresponding accounting issue is for a company to be able to record the gain or loss from the hedge and recognize it under net income in the same period as the loss or gain on the risk being hedged. This is referred to as hedge accounting. U.S. GAAP (ASC 815-10 and 815-20, Derivatives and Hedging) allows hedge accounting when three conditions are present: (a) the derivative contract is used to hedge either a fair value exposure or a cash flow exposure to foreign exchange risk (nature of the hedged risk), (b) the derivative contract is effective in offsetting changes related to the hedged item (hedge

effectiveness), and (c) the derivative contract is properly documented as a hedge (hedge documentation).

Derivative contracts for which the company wants to adopt hedge accounting must be designed as either a fair value hedge or a cash flow hedge. Fair value hedges are used when changes in exchange rates can affect the fair value of an asset or liability reported in the balance sheet. When the fair value risk has the potential to affect net income if not hedged, it qualifies for hedge accounting (for example, accounts receivable in a foreign currency). Cash flow hedges are used when changes in exchange rates can affect the amount of cash flow to be realized from a transaction, with the change in the cash flow to be recognized in net income. Accounting procedures are different for the two types of hedges. Gains and losses of fair value hedges are recognized in net income at the time they are incurred, while gains and losses on cash flow hedges are recognized in other comprehensive income. Foreign currency derivatives that do not meet the three conditions described above are recorded as if they had been designed as fair value hedges, with gains and losses recognized immediately in net income. What follows is an example of hedge accounting disclosures for an MNC:

Nestle 2008 Annual financial statements (Nestle 2008)

Hedge accounting

The Group designates and documents certain derivatives as hedging instruments against changes in fair values of recognized assets and liabilities (fair value hedges), highly probable forecast transactions (cash flow hedges) [...]. The effectiveness of such hedges is demonstrated at inception and verified at regular intervals and at least on a quarterly basis, using prospective and retrospective testing.

Fair value hedges

The Group uses fair value hedges to mitigate foreign currency and interest rate risks of its recognized assets and liabilities. The changes in fair values of hedging instruments are recognized in the income statement. Hedged items are also stated at fair value in respect of the risk being hedged, with any gain or loss being recognized in the income statement.

Cash flow hedges

The Group uses cash flow hedges to mitigate foreign currency risks of highly probable forecast transactions, such as anticipated future export sales, purchases of equipment and raw materials, as well as the variability of expected interest payments and receipts. The effective parts of the changes in fair value of hedging instruments are recognized against equity, while any ineffective part is recognized immediately in the income statement. The gains or losses previously recognized against equity are included in the measurement cost of the asset or of the liability when the hedged item results in the recognition of a non-financial asset or liability. Otherwise, the gains or losses previously recognized against equity are removed from equity and recognized in the income statement at the same time as the hedged transaction.

2. Transaction Exposure

Transaction exposure refers to cash flow risk which is reflected on transaction accounts related to receivables (export contracts), payables (import contracts), or repatriation of dividends. An exchange rate change in the currency of denomination of any such contract will result in a direct transaction exchange rate risk to the firm. Transaction exposures treat both the quantity sold and the sales price as independent of exchange rate changes. Transaction exposures thus include only the valuation effects of exchange rate changes, while price and quantity effects are neglected completely (Oxelheim, Wihlborg, 2008).

The effect of transaction exposure depends on how long the exchange rate effects are considered. Short-term exposure to exchange rate changes may have a greater influence on an MNC's contractual payments than long-term exposure because the firm can adjust its investment strategy and operational management to hedge the exposure in the long run.

Measuring Transaction Exposure

Two methods are commonly used to measure transaction exposure, which are net translation exposure measurement and value-at-risk measurement.

a. Net Translation Exposure Measurement

To correctly measure the potential risk caused by transaction exposure before hedging, MNCs need to consolidate the subsidiary reports of inflows and outflows on a currency-by-currency basis. This enables them to identify the expected net positions in each foreign currency during several upcoming periods. After the consolidated net currency flow for the MNC as a whole has been determined, each net flow is converted into a point estimate (or range) for a particular currency. An MNC's transaction exposure can then be measured by considering the proportion of each currency together with the currency's variability and the correlations among the movements of the currencies. The following formula can be used to calculate the portfolio exposure of a two-currency portfolio to the exchange rate fluctuations (Madura, 2007):

$$\sigma_p = \sqrt{w_x^2 \sigma_x^2 + w_y^2 \sigma_y^2 + 2w_x w_y \sigma_x \sigma_y CORR_{xy}}$$

where w is the weight of each currency in the portfolio, σ is the standard deviation or measure of currency variability, and $CORR_{xy}$ is the correlation between the two currencies or degree to which the two currencies move in relation to each other. The more positively (negatively) correlated the currencies in a portfolio are, the higher (lower) is the MNC's exposure. The variability and correlation vary between currencies and time periods. To illustrate, consider a portfolio containing British Pounds and Canadian Dollars in equal proportions. If the monthly standard deviations of the British Pound and Canadian Dollar are 0.0148 and 0.011 respectively and the correlation between them is 0.35, the transaction exposure of the

portfolio is calculated as:

$$\sigma_p = \sqrt{0.5^2 * 0.0148^2 + 0.5^2 * 0.011^2 + 2 * 0.5 * 0.5 * 0.0148 * 0.011 * 0.35} = 0.01$$

b. Value-At-Risk (VAR) Method

The Value at Risk (VAR) measure of exchange rate risk is used by firms to estimate the riskiness of a foreign exchange position resulting from a firm's activities (Papaioannou, 2006). It makes use of currency volatility and correlations to determine the potential maximum one-day loss over a given target time horizon and confidence limit in the value of an MNC's positions that are exposed to exchange rate movements. The maximum one-day loss of a foreign currency, x , can be calculated according to the formula:

$$P = E(e_x) - Z_{[p]} * \sigma_x$$

where $E(e_x)$ represents the expected percentage change in currency x over the next day, $Z_{[p]}$ can be set at 1.65 for a 95% confidence level^{vi}, and σ_x is the standard deviation of the daily percentage change in currency x . For example, suppose a firm wants to forecast the maximum one-day loss due to a potential decline in the value of the British Pound mentioned before, based on a 95 percentage confidence level. The standard deviation of the daily percentage change is known to be 0.0148. If daily percentage changes are normally distributed, the maximum one-day loss is about 1.65 standard deviations away from the expected percentage change in the value of the pound. Assuming an expected percentage change of -0.3 percent during the next day, the maximum one-day loss is:

$$P = E(e_x) - Z_{[p]} * \sigma_x = -0.3\% - (1.65 * 1.48\%) = -0.027 \text{ or } -2.7\% .$$

Assuming the spot rate of the British Pound is \$1.63, the VAR method implies a value of the British Pound of

$$BP = S * (1 + Max.Loss) = \$1.63 * (1 - 0.027) = \$1.58599 .$$

The VAR method can also be used to measure exposure to a portfolio of currencies and over longer time horizons using the formula $p = E(e_p) - Z_{[p]} * \sigma_p$, where $E(e_p)$ is the expected percentage change of the portfolio p , $Z_{[.95]} = 1.65$ and σ_p is the standard deviation of the percentage change in the portfolio.

Managing Transaction Exposure

MNCs may choose to use internal or commercial instruments to manage their transaction exposure. These can include changes in the contract currency, the matching of revenues and costs in current operations, the matching of net flows in current operations with net flows on the financial side, and changes in the payment cycle internally and externally. Two of the most commonly used methods are to transfer exposure by quoting the sales price in the foreign currency, or by demanding immediate payment and netting out transaction exposure. Netting transaction exposure on a currency-by-currency basis refers to the consolidation of all expected inflows and outflows of a MNC for a particular time and currency. If one subsidiary of the MNC has net receivables in the British Pound while another subsidiary has net payables in British Pound, both for three months, the transaction exposure is fully offset internally. Transaction exposure can be further reduced when payments and receipts are in many different currencies. The larger the set of different currencies in which the MNC transacts, the more likely it is that the exposure may be efficiently

diversified as negatively correlated currencies may lower the transaction exposure mentioned above.

Managing Transaction Exposure Using Derivative Market Hedges

MNCs cannot fully hedge transaction exposures using internal and commercial instruments due to limits to such adjustments. This forces them to enter contracts with external financial institutions or firms that offer fast, cheap, and liquid positions (opposite to the spot position) on a currency derivative. These include forward, futures, options, and money market hedges. Other types of derivative instruments include swaps, foreign currency loans, export financing arrangements, factoring including currency adjustment, leasing including currency adjustment, fixed versus adjustable interest loans, and interest rate options.

A forward market hedge is created by buying/selling foreign currency (today) on the forward market for future delivery at a set date and price. When a firm enters a forward contract, a contract is entered into with a bank for a specific denomination of currency and for a specific time. For example, if a French firm expects revenues of \$1 million in 60 days time, they can sell \$1 million today on the forward market at the rate given for a 60 day contract. This will give the firm the right to sell the dollars at the given rate in 60 days thus locking in a known future value of that revenue. With this forward contract the firm is fully hedged. However, the high cost of forward contracts, the risk of the exchange rate moving in the opposite direction, and the fact that contract terms are designed to meet the buyer's needs and thus the contract may not readily tradable, means that they have serious disadvantages.

Futures are exchange-traded contracts specifying a standard volume of a particular currency to be exchanged on a specific settlement date. They are similar to

forward contracts in that they allow a firm to fix the price to be paid for a given currency at a future point in time. Futures contracts are however less flexible since they are limited to the range of available traded currencies and standard settlement dates. They also require buyers to deposit a certain share of the contract with the exchange and add to the deposit if the value of the contract falls (marking to market).

Another important hedging instrument is the foreign currency option. This gives the buyer the right to buy or sell a currency at a specific price on a specific date. If the exchange rate moves in favor of the option holder, the holder can exercise the option and is thus protected from the loss. On the other hand, if the rate moves against the holder, the holder can let the option expire but profit from selling the foreign currency in the spot market. Hedging in the options market can thus reduce losses caused by unfavourable exchange rate changes while preserving gains from favourable exchange rate changes. However, this flexibility comes at a cost. Whether or not the option is exercised, the company bears the option premium and commission costs. If the option market is efficient, the net monetary benefit of an option hedge to the company is negligible or slightly negative due to transaction costs.

A currency swap is another hedging instrument in the forward market. It refers to holding two opposite positions with different maturities on the same currency. Common foreign exchange swaps are long-term standardized or tailor-made transactions between a bank and a firm, or between two firms using a bank as a possible intermediary. The implication of the latter exchange is that the two parties agree to pay each other's loans in different currencies. Two firms in different countries with access to local credit markets but without access to foreign markets could each borrow in their local currency and swap obligations for payments on the

loans. In this way the two firms gain access to foreign currency loans or credit conditions in foreign markets (Oxelheim, Wihlborg, 2008)

Money Market Hedges

A money market hedge involves the simultaneous borrowing and investing of funds via money markets and using the spot rate to lock in a home currency value of a future foreign currency cash flow. MNCs that have access to money markets for different currencies often choose this hedge method. They do however need to ensure that the dates of expected future cash flows and the maturities of money market transaction match with each other.

If an inflow of foreign currency is expected, a firm first borrows the present value of the foreign currency at a fixed interest rate, converts it into its home currency and deposits this at a fixed interest rate. When the foreign currency is received, the firm can use it to pay off the foreign currency loan. If a firm is faced with an expected outflow of foreign currency, it first needs to determine the present value of the foreign currency to be paid using the foreign currency interest rate as the discount rate. It then borrows the same amount of home currency, converts it into the present value equivalent of the foreign currency, and makes a foreign currency deposit. On the payment day, the firm withdraws the foreign currency deposit and makes the payment. For example, a homemade forward contract can be created by borrowing the present value of the future revenue, say \$1 million. The loan may be converted at the spot market and invested at 60-day interest in the home market. This will give a known value in 60 days. The revenue obtained in 60 days is used to repay the loan.

Comparison of Derivative and Money Market Hedges

Since there are various hedging techniques available, the manager of the MNC has to make a choice. If interest rate parity holds and there are no transaction costs, the MNC is indifferent between a forward market and a money market hedge. The reason for this is that the forward premium on the forward rate reflects the interest rate differential between the two currencies. The hedging of future payables with a forward purchase will be similar to borrowing at the home interest rate and investing at the foreign interest rate. In practice however, since there are transactions costs and inefficiencies in financial markets, firms find that hedges using derivative instruments are more profitable than money market hedges. According to the Bank of International Settlements (BIS), Over-the-Counter (OTC) derivatives serve as the main hedging instrument for most U.S. firms, with OTC currency forwards being the most popular instrument, followed by OTC currency options and OTC swaps (Papaioannou, 2006). The purpose of currency forwards is to eliminate volatilities arising from a firm's contractual commitments (accounts receivable/payable, and repatriations). Options are used to cover economic exposures by hedging uncertain foreign currency-denominated future cash flows. These are usually related to anticipated transactions more than one year away. Due to the relatively higher liquidity and depth of forward markets forwards are in general preferable to options and swaps. In addition, it appears that managerial sentiments and recent hedging histories are key factors in determining what form of derivative a MNC might use. The 2009 financial statement of Procter & Gamble, a leading MNC, captures the typical preference of managers towards their choice of hedging instruments:

“We choose to use forward contracts and options with maturities of less than 18 months. In addition, we enter into certain currency swaps with maturities of up to five years to hedge our exposure to exchange rate movements on intercompany financing transactions. We also use purchased currency options with maturities of generally less than 18 months and forward contracts to hedge against the effect of exchange rate fluctuations on intercompany royalties and to offset a portion of the effect of exchange rate fluctuations on income from international operations.”

Financial hedging may not always be possible or may be too expensive under certain circumstances. For example, forwards, futures and options may not be available for some currencies or for long maturities. If a firm cannot engage in financial hedging, it may resort to operational hedging techniques of risk sharing and currency collars.^{viii} Under risk sharing, a customized hedge contract in the form of a Price Adjustment Clause is developed in which the base price is adjusted to reflect certain exchange rate changes. If the rate falls outside the set range, the two parties agree to share the difference equally so that the cost to either party resulting from an unfavourable change in the exchange rate is shared. A currency collar can be used to set a minimum value for the base currency payables and receivables at the expense of setting a maximum value. It thus provides protection against currency movements outside the agreed-upon price range.

3. Operating exposure

Operating exposure refers to the potential loss in the present value of a firm’s future operating cash flows (domestic sales and exports revenues, and operating expenses) from exchange rate movements. The appreciation of a local currency

results in a reduction in both cash inflows and outflows, while the depreciation of the local currency leads to an increase in both cash inflows and outflows. Unlike transaction exposure which is related to short run cash flows, operating exposure is related to the effect of exchange rate fluctuations on a firm's long-term cash flows and is therefore difficult to ascertain and not easily hedged. Surveys indicate that while practitioners are aware of the significance of operating exposure, they do not do much to shield their firms against it.

Measuring operating exposure

Regression analysis is commonly used to measure an MNC's operating exposure. Operating exposure can be measured as the slope coefficient in a regression of a firm's stock returns (PCF_t) against exchange rate changes (e_t) (Adler and Dumas (1984)):

$$PCF_t = a_0 + a_1 * e_t + u_t$$

If the coefficient a_1 is positive and significant, it implies that a positive change in the currency's value (positive movement in exchange rate) has a favourable effect on the firm's stock returns. If it is zero, the firm is not sensitive to currency surprises. If a_1 is negative this indicates negative exposure to currency surprises. If additional currencies are to be assessed, they can be included in the model as additional independent variables (Madura, 2007).

To assess the short-term and long-term effects of changes in exchange rates, data ranging from one month to sixty months is used in the regression analysis. All of the variables are inflation adjusted. Sensitivity analysis is also employed by MNCs to measure operating exposure. This method separately considers how the earnings forecast in the firm's income statement changes in response to alternative exchange

rate scenarios. In general, firms with greater foreign costs than revenues tend to be unfavourably affected by stronger foreign currencies.

Price and Quantity Response to Managing Operating Exposure

For a firm with foreign currency cash flows that are known with certainty and where the sole source of uncertainty is the exchange rate, operating exposure can be hedged using derivatives or money market hedges as discussed above. However, these instruments cannot eliminate risk if the quantity of the foreign cash flows is also uncertain and not perfectly correlated with the exchange rate. The operating exposure to currency risk depends on the effect of unexpected changes in the exchange rate on the firm's output prices (e.g., product prices) and input costs (e.g., raw materials and labor costs). MNCs can only manage operating exposure through operational hedges, such as shifting the sources of costs or revenue to other locations so that foreign currency inflows and outflows are matched and the amount of exposed cash flows is reduced.

Since market segmentation largely affects the correlation of prices with exchange rates, operating exposure depends on whether input costs and output prices are determined locally or globally. Firms facing substantial operating exposure can use combined operating strategies. These can include marketing strategies based on pricing and the location of markets, and production based strategies related to the location of production and sourcing. However, such an operational hedge is usually costly to implement and lengthy in implementation time. Smaller firms may not have the financial capability or managerial resources to construct and manage international facilities. Firms with operations spread over many currency and business areas are in a better position to hedge operationally since they have a larger portfolio of

alternatives to devise effective operational hedges. Their operating flexibility allows them to react effectively to exchange rate changes by deciding where to shift production, source for inputs, or declare profits among the different locations in which they operate.

III. Exchange Rate Forecasting

Critical to a discussion on how exchange rates can be managed by policy makers and MNC managers is exchange rate forecasting. Measuring translation gains and losses and transaction and operating exposures requires an accurate estimate of future exchange rates. A hedged position may result in a loss if future realized exchange rates consistently differ from exchange rate forecasts.

Empirical results from exchange rate forecasting models in the finance and economics literature have not yielded satisfactory results. There is some evidence that exchange-rate movements may be predictable over long time horizons and when parity conditions hold. However, studies generally conclude that the spot exchange rate follows a random-walk process and that structural exchange rate models cannot significantly outperform a simple random-walk model. Studies that find good in-sample fit of exchange rate models have shown poor out-of-sample prediction analysis.

Lam, Fung and Yu (2008) compared the forecast performance of five models with benchmarks given by the random-walk model and the historical average return. The models studied are the (1) Purchasing Power Parity (PPP) model, (2) Uncovered Interest Rate Parity (UIP) model, (3) Sticky Price (SP) Monetary model, (4) Bayesian

Model Averaging (BMA) technique model, and (5) the composite specification incorporating the above four models.

The PPP model is a theoretical exchange rate model and explains movements in the exchange rate between two economies' currencies in terms of changes in the countries' price levels. The UIP model describes how the exchange rate moves according to the expected returns of holding assets (interest rate) in two different currencies. The SP model can be interpreted as an extended PPP model by replacing the price variables with macroeconomic variables that capture money demand and over-shooting effects. The BMA method has a mechanism to select different combinations of the underlying models based on their performance over time. The combined model is constructed by assigning different weights to the forecasts obtained from the above models. The weights are assigned based on the relative mean squared forecast error (MSE) of the models' forecasts in the past. The smaller the forecast's MSE, the larger is the weight assigned to that particular forecast.

The exchange rates used in the study were the Euro, British pound and Japanese yen against the US dollar. The period 1973 to 1997 was used for estimation purposes and a range of time horizons from 1998 to 2007 was used for forecasting purposes. The simple random walk model and historical average return were used as benchmarks. Using several measures of forecast accuracy, findings indicated that while forecasts from the models outperformed the common benchmarks, no single method dominated. For example, using the root mean square as a measure of forecasting accuracy, all models outperformed the two benchmarks. No single model performed best for all time horizons but for longer horizons, the PPP and combined model outperformed the others while for shorter horizons, the BMA demonstrated the

best performance. Model forecasts were better in the case of the euro against the dollar compared to forecasts for the pound against the dollar. For the yen against the dollar, all models performed more poorly for long time horizons than for short horizons. The PPP model and the SP model underperformed the benchmarks for long horizons. The empirical findings corroborate earlier findings in the literature that the efficacy of any model of exchange rate forecasting is currency and horizon dependent and thus has to be utilized with caution when forecasting exchange rates in practice.

References

1. Accounting Standard Codification (ASC), Financial Accounting Standard Board (FASB), asc.fasb.org.
2. Adler, Michael, Bernard Dumas (1984). “Exposure to Currency Risk: Definition and Measurement”, *Financial Management*, Summer.
3. Choi, F. and G. K. Meek (2008), *International Accounting*, 6th edition, Pearson Education, NJ.
4. Douppnik, T. and H. Perera (2008), *International Accounting*, 2nd edition, McGraw-Hill Irwin, NY.
5. Fratianni, Michele, Dominick Salvatore, Jürgen von Hagen (1997), “Macroeconomic Policy in Open Economies”, Green Wood Press, May.
6. Financial Accounting Standard Board (FASB) 2009, US GAAP, Norwalk, CT: FASB.
7. Friedman, M. (1953), “The Case for Flexible Exchange Rates”, *Essays in Positive Economics*, The University of Chicago Press, Chicago.
8. Hull, John (2005). *Fundamentals of Futures and Options Markets*, 5th ed. Upper Saddle River, NJ: Prentice Hall.
9. Madura, Jeff (2007), “International Finance”, Mason, OH: South-Western/Cengage Learning.
10. Lam Lillie, Laurence Fung and Ip-Wing Yu (2008), “Comparing Forecast Performance of Exchange Rate Models”, *Hong Kong Monetary Authority Working Paper*, June.
11. Mundell, R.A. (1963), “Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates”, *Canadian Journal of Economics and Political Science*, 29(4).
12. Nestle SA 2008 Financial Statements, (<http://www.nestle.com/InvestorRelations/Reports/ManagementReports/2008.htm>).
13. Oxelheim, Lars, Clas Wihlborg (2008), “Corporate Decision-Making with Macroeconomic Uncertainty: Performance and Risk Management”, Oxford; New York: Oxford University Press.
14. Papaioannou, Michael (2006), “Exchange Rate Risk Measurement and Management: Issues and Approaches for Firms”, *International Monetary Fund Working Paper*, November.

15. Procter & Gamble 2009 Financial Statements,

(<http://www.annualreport.pg.com/annualreport2009/financials/mda-oi.shtml>)

16. Sohmen, E. (1961), “Flexible Exchange Rates: Theory and Controversy”,
University of Chicago Press, Chicago.

Endnotes

ⁱ The SDR is an international reserve asset, created by the IMF in 1969, to supplement its member countries' official reserves. Its value is based on a basket of four key international currencies. SDRs can be exchanged for freely usable currencies (www.imf.org).

ⁱⁱ This is not the only adjustment required to consolidate financial statement of foreign subsidiaries. Many countries adopt different accounting rules that are necessary to consider before translating the financial statements of the subsidiaries.

ⁱⁱⁱ A “highly inflationary economy” is one with a cumulative three-year inflation exceeding 100%.

^{iv} Indeed, if the Current Method were used, the value of the assets of the subsidiary translated into the parent’s company currency would be very small due to the rapidly increasing exchange rate.

^v 17 CFR Parts 210, 229, 230, 240, 244 and 249 [Release Nos. 33-8982; 34-58960; File No. S7-27-08] RIN 3235-AJ93 “Roadmap for the Potential Use of Financial Statements Prepared in Accordance with International Financial Reporting Standards by U.S. Issuers.”

^{vi} If $U \sim N(0,1)$, then $\Pr(U < Z_{[P]}) = P$ for a 95% confidence level, therefore $Z_{[.95]} = 1.65$.

^{vii} A collar uses options to limit the range of possible positive or negative returns on an investment in an asset to a specific range. To do this, an investor who owns an asset simultaneously buys a put option and writes a call option on the same asset. The strike price on the call needs to be above the strike price for the put, and the expiration dates should be the same (Hull, 2005).