Chapter Overview

This chapter focuses on the question of how price variability in international financial markets affects two prominent decision makers: the corporate treasurer and the investment manager. Specifically, it examines how variability in exchange rates and interest rates affects the market value of a firm.

The chapter begins with an introduction to a firm’s or portfolio’s exposure to foreign exchange risk and interest rate risk. Then it discusses the corporate treasurer’s financial risk management problem. A change in the exchange rate affects the market value of the firm to the extent that it affects the firm’s prices, revenues, and costs. The overall impact on a firm from exchange rate changes depends not only on how the firm reacts, but also on how the firm’s competitors, customers, and suppliers react. Exchange rate changes affects the value of a wide range of firms.

The chapter turns to accounting measures of foreign exchange exposure. Translation exposure focuses on the book value of assets and liabilities as measured in the firm’s balance sheet. Four alternative translation methods and their adoption in the United States are discussed. Transaction exposure focuses on the economic value of foreign currency denominated transactions that will affect the firm’s next income statement. FASB-8 and FASB-52 in the United States have different rules on reporting accounting gains and losses.

A firm’s economic exposure to exchange rate risk captures the entire range of effects on the future cash flows of the firm. It can be measured through either the regression approach or the scenario approach. The regression approach directly measures the economic exposure of a firm through estimating the relationship between the firm’s market value and the spot exchange rate. The scenario approach estimates the firm’s cash flow and its market value conditional on an exchange rate path. Empirical evidence on firm profits, share prices, and exchange rates shows that exchange rate changes can have a substantial impact on individual firms and a country’s economy as a whole.

Foreign exchange exposure has important implication for private enterprises and public policymakers. Once the economic exposure of the firm is estimated, a financial strategy can be adopted to reduce risk. In practice, the exposure coefficient is estimated with error, so that foreign exchange risk cannot be completely eliminated. Even a naive strategy to hedge all exposures is difficult to implement because some future cash flows are uncertain, and the firm must decide whether to hedge its cash flows far into the future or on a rolling basis. The financial exposure of pure financial positions can also be measured using the value-at-risk approach. VAR is useful for estimating the likelihood of possible price changes in a portfolio at different horizons. Public policymakers have stepped up their disclosure requirements for firms.
to report their financial positions in financial derivatives. Additional disclosures regarding the price sensitivity of these positions are likely to be required soon.

**Chapter Outline**

The Corporate Treasurer’s Financial Risk Management Problem
   The Market Value of the Firm and Channels of Risk
Accounting Measures of Foreign Exchange Exposure
   Exposure of the Balance Sheet: Translation Exposure
   Exposure of the Income Statement: Transaction Exposure
   U.S. Accounting Conventions: Reporting Accounting Gains and Losses
Economic Measures of Foreign Exchange Exposure
   The Regression Approach: The Basic Model
   The Regression Approach: An Application
   The Regression Approach: Three Extensions
   The Scenario Approach
   The Scenario Approach: Some Extensions
Empirical Evidence on Firm Profits, Share Prices, and Exchange Rates
Arguments for Hedging Risks at the Corporate Level
Financial Strategies Toward Risk Management
   The Currency Profile and Suitable Financial Hedging Instruments
Policy Issues - International Financial Managers
   Problems in Estimating Economic Exposure
   Picking an Appropriate Hedge Ratio
   The International Investor’s Currency Risk Management Problem
   The Value at Risk Approach
Policy Issues - Public Policymakers
   Disclosure of Financial Exposure
   Financial Derivatives and Corporate Hedging Policies
Summary
Appendix 16.1: A Scenario Analysis of Economic Exposure to Foreign Exchange Risk
Supplementary Notes

Types of foreign exchange exposure

1. **Translation exposure** arises from the need to report financial statements in a consolidated account denominated in one single currency.

2. **Transaction exposure** refers to gains or losses that arise from the settlement of transactions whose terms are stated in foreign currencies. Such transactions include imports and exports that are valued in foreign currencies; foreign currency loans and investments, etc.

3. **Economic exposure** refers to sensitivity of a firm’s market value to exchange rate movements.

Economic exposure

Economic exposure: How the market value of a firm is affected by exchange rate changes.

\[ CF_t = a + bEX_t + \mu_t \]

- **CF:** The dollar value of total affiliate (parent) flows in period t.
- **EX:** The average nominal exchange rate (dollar value of one unit of the foreign currency) during period t.

The output from such a regression includes three key parameters: (1) the foreign exchange rate beta, which measures the sensitivity of dollar cash flows to exchange rate changes; (2) the t-statistic, which measures the statistical significance of the beta coefficient; and (3) the \( R^2 \), which measures the fraction of cash flow variability explained by variation in the exchange rate.

Question:

If a U.S. firm produces in the U.S. and exports 50% of its production to Japan. How are its cash flows affected by the yen-dollar exchange rate? (EX is dollars/yen). Is \( b \) expected to be positive or negative? (positive)

Pricing strategy (market share, profit, intra-firm)
Demand elasticity
Exchange rate pass-through
**Pricing to market**

The corporate pricing behavior in which product prices are to a large extent determined by local market conditions, rather than by exchange rates and production costs or market prices in the home country. This concept is important because it implies that a company’s profit margin is dependent on the exchange rate. For example, if US consumer goods prices tend to be determined locally, then profit margins for Japanese firms will fall with yen appreciation and rise with yen depreciation.

**Exchange rate pass-through effect**

It describes the extent to which exchange rate changes are “passed through” into prices charged to local stores or distributors. This concept is important in that it helps the firm to understand how much operating exposure it carries. If there is 100% pass-through of exchange rate changes, then we would conclude that the product is really being priced in the exporter’s currency – and as such the exchange rate risk has been passed along to the consumer. If the pass-through is 0%, then we have “pricing-to-market (PTM)” – the good is really being priced in the importer’s currency and the exporter’s profit margin is completely exposed to exchange rate changes.

**Exchange rate pass-through and pricing-to-market: an example**

If a German exporter produces name brand car in Germany and sells in the U.S. Production cost is DM20,000. Sell price: DM25,000. Profit margin:

\[
\frac{\text{price} - \text{cost}}{\text{price}} = 20\%
\]

Exchange rate: $.40/DM Price in dollars: $10,000

Suppose the exchange rate changes from $.40/DM to $.50/DM. (the DM appreciated by 25%)

a. If the German firm keeps it DM price so as to keep its profit margin, then the dollar price becomes: $12,500, a 25% price increase.

25% appreciation of the DM leads to 25% dollar price increase: complete pass-through; no pricing-to-market.

What are the consequences?
If U.S. consumers like the German car so much and are willing to pay for it no matter what, then the German exporters' sale in the U.S. will not change.

If the German car faces very fierce competition and demand is very sensitive to price, then the German exporter will lose a lot of sales, or may even be wiped out of the market.

If U.S. consumers like the German car a lot but are also somewhat price sensitive, some of the consumers will switch to other cars (a Japanese one, perhaps) while some relatively wealthy consumers stick to the German car.

b. If the German exporter keeps the dollar price constant ($10,000), then its receipt in DM is now DM20,000 ($10,000/$.50), just enough to cover its production cost. Profit margin is zero.

25% appreciation of DM leads to no change in dollar price: no pass-through. The German firm prices to market.

c. If the German exporter changes its DM price to DM22,500 (10% reduction in DM price), then the dollar price is now $11,250.

Profit margin: 10% (reduced by half)
Dollar price change: 12.5%

A 25% appreciation of DM leads to a 12.5% increase in dollar price: partial or incomplete pass-through.

Why not complete pass-through: has to price to market, otherwise lose market.

Why not fully price to market: no profit

Result: Compromise, producer and consumers share the burden of the DM appreciation.

Foreign exchange rate exposure: a report from The Wall Street Journal


… [T]he dollar is down 17.02% against the Japanese yen, the currency of the second-largest U.S. trading partner. But it is up 18.68% against the Mexican peso, the currency of the third-largest U.S. trading partner…
And while the dollar will be a slight positive for Coca-Cola during the first quarter, it will be a negative for its carbonated rival PepsiCo. While the benefit or damage of currency swings is equally real for each company, it says nothing about the competitiveness of their marketing or operating plans.

“You have to separate out the effect of the currency and ask yourself: How would the company have done in local currency?” Says Terry Bivens, food, tobacco and beverage analyst for Argus Research. “If you see a company that has done badly because of currency translations, but is going strong in local terms, then you’re more reassured.”


Translation when local currency is the functional currency: The current rate method

1. Balance sheet:
   All foreign currency assets and liabilities are translated to dollars using the exchange rate prevailing as of the balance sheet date; capital accounts are translated at the historical rate.

2. Income statement:
   Revenues and expenses are translated using the exchange rate prevailing on the transaction date, although weighted average rates can be used for expediency.

3. Translation gains and losses:
   These are reported in the cumulative translation adjustment (CTA) account, a separate component of the consolidated stockholders’ equity. These adjustments bypass the income statement until the foreign operation is terminated.

Translation when U.S. dollar is the functional currency: The temporal method

1. Balance sheet:
   Monetary assets and liabilities are translated using the rate prevailing as of the financial statement date; nonmonetary items including capital accounts are translated at historical rates.

2. Income statement:
   Monetary items related to revenues and expenses are translated using average exchange rate for the period; nonmonetary items are translated using historical rates.

3. Translation gains and losses:
   These are reflected in current income.
Answers to end-of-chapter questions

1. Define foreign exchange exposure for a firm. Is a purely domestic firm subject to some foreign exchange exposure? If yes, why?

A firm has exposure to foreign exchange risk when the market value of the firm varies in response to exchange rate changes. A purely domestic firm could be exposed to foreign exchange risk, even though it has no foreign currency assets or liabilities of a real or monetary nature. The exchange rate change could affect the cost of domestic funds, customers, suppliers, and/or competitors, which in turn could affect the value of the purely domestic firm.

2. If Purchasing Power Parity holds, does the firm face any exchange rate risk?

If PPP holds, the real exchange rate remains unchanged and the value of real assets is preserved. If PPP holds only in the long run, the firm is exposed for the period that PPP is violated. The value of nominal assets need not be preserved under PPP, and so the firm is exposed to the extent that it holds nominal assets.

3. When the Fisher International Effect holds in the long-run, which accounting method for foreign exchange exposure is most appropriate?

When the Fisher International effect holds, monetary (that is, nominal) assets retain their value because the interest rate differential offsets the exchange rate change. A monetary/non-monetary accounting approach would be consistent with this.

4. What is the difference between translation risk and transaction risk? Define both.

Transaction exposure focuses on the economic value of foreign currency denominated transactions that are planned or forecast to occur within the next reporting period. Translation exposure focuses on the book value of assets and liabilities as measured in the firm's balance sheet. Translation exposure is a static measure, emphasizing the past actions of the firm, while transaction exposure is more forward looking, emphasizing future planned transactions.

5. What is the difference between accounting exposure and economic exposure? Define both. Which one is more accurate in describing the foreign exchange exposure of the firm?

Accounting exposure measures the net exposed assets minus exposed liabilities of a firm using the classification system of a particular accounting convention. Economic exposure measures the change in the market value of the firm conditional on a change in the exchange rate, or $\frac{\partial V}{\partial S}$, where V is the market value of the firm measured in US$ and S is the spot rate measured as US$/FC. Economic exposure provides a better estimate of the firm's true exposure to exchange risk.
6. Describe how the regression approach is used for measuring a firm's foreign exchange exposure.

Economic exposure measures the sensitivity of the firm's value to a change in the exchange rate. This has the same interpretation as a regression coefficient in a regression of the firm's value (V) against an exchange rate (S).

7. Explain the limitations of the regression method for measuring a firm's foreign exchange exposure.

The regression method depends on a stable relationship between V and S and sufficient historical data to accurately estimate the value of the regression coefficient. To be meaningful, this regression should produce a significant $R^2$, otherwise there is no economic exposure when $R^2=0$. The relationship between $V$ and $S$ must be stable in the future to use as a management tool.

8. What are the advantages of the scenario approach for measuring a firm's foreign exchange exposure?

The scenario approach may allow managers to use specific information about the expected reactions of domestic financial markets, customers, suppliers, and competitors when there is an exchange rate change. Managers may not have enough historical experience or confidence about stability to use the regression approach. However, the managers own planning models may contain information for calculating economic exposure.

9. In this chapter, the Marriott company was said to prefer using the Current / Non-Current accounting method rather than the Monetary / Non-Monetary method for accounting for its investment in a hotel in Germany, financed by a loan in DM. Explain that choice. Define both methods and single out their main differences.

Under the monetary/non-monetary approach, Marriott had a monetary liability without an offsetting asset (therefore a net DM liability position). Under the current/non-current approach, Marriott had a non-current asset and offsetting non-current liability implying no exposure. Marriott should have preferred the current/non-current approach since in economic terms their exposure was probably positive (long DM) based on the profitability of the hotel in DM terms.

10. Under FASB-52, what method are US companies required to adopt for measuring their exposure to foreign exchange risk. What is the rationale behind the use of functional currencies for international operations of US firms?

Under FASB-52, U.S. companies are required to adopt the All-Current or closing-rate method under which all foreign currency denominated balance sheet items are treated as exposed. The rational behind the functional currency approach is to treat operations that take place largely in another country or in a currency other than the US$ as a separate
subsidiary business. Once the book value of this separate subsidiary is computed (following the temporal approach), the parent's equity stake in the subsidiary is translated at the current exchange rate back into the parent's balance sheet.

11. In the 1994 annual report by RJR Nabisco, a large food and tobacco multinational company with headquarters in the United States, the translation adjustment account in the balance sheet showed a jump from $8.8 billion as of 12/31/93 to $10 billion as of 12/31/94. What is the translation adjustment account? What do you think are the likely reasons behind this change from 1993 to 1994?

The translation adjustment account is a separate component of equity on the parent's balance sheet that records the cumulative total of all unrealized foreign currency translation gains and losses. The change from $8.8 to $10.0 billion in the translation adjustment account at RJR Nabisco implies that the firm had unrealized foreign exchange gains of $1.2 billion in 1994. Based on the US$'s weakness against the DM and ¥ and its strength against the C$, RJR could have held long-term assets (for example, plant and equipment or an operating subsidiary) in Germany or Japan that appreciated in value (but were not sold) during 1994.

12. In the annual reports of Nestlé, a large, diversified food company based in Switzerland with operations in more than 100 countries, management states that it does not hedge foreign exchange exposure. What might be the rationale behind this policy?

Given the nature of its business, food manufacturing and sales, Nestlé probably generates costs and revenues in most of the more than 100 countries where it does business. Nestlé may feel that it lacks the expertise to forecast all of these currencies. The business is ongoing so these foreign currency costs and revenues represent a perpetual stream. So Nestlé may conclude that the gains and losses from not hedging will offset over time. Finally, Nestlé may feel that its shareholders value Nestlé's access to a well-diversified multi-national and multi-currency stream of cash flows. Hedging would raise costs but not value for such shareholders.

13. Describe the costs of financial distress.

The costs of financial distress include explicit costs such as attorney's fees and court costs in the case of bankruptcy. But it also includes the possible loss of key personnel, loss of suppliers, loss of trade credits from suppliers or banks, and the loss of customers who value a long-term business relationship or who value after-sales service. These losses may have a substantial impact on realized sales or the ability of the firm to compete in a market with rapid technological change.

14. How would you hedge a 3-year lease as opposed to a one-time export by a small firm? Explain.

A three-year lease could be hedged today by purchasing a strip of forward contracts, or by purchasing the present value of the funds needed to meet the lease payments, when
reinvested at prevailing forward interest rates. The three-year lease could also be hedged "progressively" over-time by hedging at the start of each year for the following one-year-ahead horizon. A one-time export is a one-period, one cash flow situation which could be hedged by a single forward contract.

15. Explain the difference between a Net Present Value approach to hedging and hedging each cash flow separately using financial instruments.

The Net Present Value hedge also requires the use of forward interest rates to lock in the yield on anticipated cash flows that are rolled over to complete the hedge. Hedging each cash flow separately raises the transaction cost and the counterparty exposure. In the textbook example, if the NPV of the foreign currency cash flows is zero, no foreign exchange contracts are needed for hedging purposes; only forward interest rate contracts are necessary for hedging.

16. Explain how to measure the gross VAR of a set of financial positions, and how to measure the net VAR. Why is net VAR always less then or equal to gross VAR?

**Gross VAR** is measured by taking the absolute size of each position ($|X_i|$), multiplying by the volatility of returns ($\sigma_i$) in the underlying asset, multiplying by a factor ($F$) that corresponds to the confidence interval we want to construct ($F=1.65$ for a 95% measure, $F=1.96$ for a 97.5% measure, and so on), and then adding together all of these terms across all $i=1, \ldots N$ positions. To put it into an algebraic formula,

$$\text{Gross VAR} = \sum_i X_i |\sigma_i| F = F \sum_i X_i |\sigma_i|$$

**Net VAR** is measured by taking the absolute size of the overall portfolio positions ($X = \sum |X_i|$), multiplying by the volatility of returns in the overall portfolio ($\sigma_p$, as defined in expression 16.13 on page 599 of the text), and then multiplying by a factor ($F$) that corresponds to the confidence interval we want to construct ($F=1.65$ for a 95% measure, $F=1.96$ for a 97.5% measure, and so on). To put it into an algebraic formula,

$$\text{Net VAR} = X \sigma_p F$$

Net VAR is always less than (or at most equal to) Gross VAR because the returns on the underlying assets in a portfolio are usually imperfectly correlated. Therefore, losses on one asset are offset by gains on another asset, and vice versa. Thus the risk of the overall portfolio (Net VAR) will be less than the sum of the risks of the individual assets in the portfolio (Net VAR). Only if the assets are all perfectly correlated will Gross and Net VAR be equal.

17. Discuss how you would use the regression approach, the scenario approach, and the VAR approach to decide whether or not to hedge and how to hedge.
The **regression approach** requires a set of historical data on the market value of a firm or a portfolio of assets, and the value of the exchange rate. Using this data, we run a regression like 16.9, 16.10 or 16.11. If the coefficient of the exchange rate term is significant, then we have identified an exposure meaning that the value of the firm has been linked in a predictable way to the exchange rate. The firm could reduce the sensitivity of its market value to exchange rate movements by hedging. The decision depends on many factors, including (1) whether the firm believes that the historical relationship will hold in the future, (2) whether there is a gain to the firm by reducing the variability in its market value, and (3) whether the gains from hedging exceed the costs.

The **scenario approach** requires a set of scenarios concerning critical variables for the firm, such as the exchange rate, its manufacturing costs, product prices, sales volume and so forth. Each scenario corresponds to a likely pattern of cash flows (see Appendix 16.1) and a net present value for the firm. If the firm does not hedge, there may be some scenarios where the market value of the firm drops substantially. The firm can analyze the impact of hedging directly by evaluating scenarios that include various hedging transactions (financial hedging) and certain operational strategies (changing its product prices, its sourcing of materials, and so forth). The decision to hedge can be based on whether the adverse scenarios are very likely and the costs of hedging to lessen the consequences of these adverse scenarios.

The **VAR approach** requires knowledge of the volatility of the underlying assets in the portfolio. Assuming that these can be estimated with some precision, the firm can use VAR to estimate the probability of losses of a given size over the next day, week, or month. If the magnitude or probability of loss is too great (relative to some benchmark) the manager can analyze the impact of hedging transactions, and then recalculate VAR. A complete or perfect hedge would reduce VAR to zero, so there is some amount of hedging that would reduce VAR to acceptable limits. (See exercise 3 in this Chapter.)

18. Why might public disclosure of a firm’s exposure to financial risks (say, using a VAR approach) create confusion about the firm’s economic exposure?

Public disclosure of financial risks could create confusion about the firm's economic risk, if the firm is using financial contracts to hedge future transactions, or operational risks that are not quantified on the firm's accounting statements. For example, if a firm plans to borrow next year to build a factory, it might use interest rate futures to hedge this anticipated borrowing. This futures position would appear risky and would generate gains or losses for the firm as interest rates fluctuated. However, the futures are really offsetting another risk (of the cost of the planned borrowing) so the firm is really acting to reduce its economic exposure. Or consider the case of a firm that has no financial risks as measured by accounting rules, and therefore makes no public disclosure of risk. The firm could still have substantial exchange rate or interest rate exposure that effects its future operating cash flows and its present market value.

**Additional questions with answers**

16-11
19. How does financial hedging compare with operational hedging? In which case do these methods best apply?

Financial hedging suggests the use of financial instruments such as futures, options, and swaps to reduce the imbalance between foreign currency payables and receivables -- either currency-by-currency and period-by-period, or on a NPV basis. Operational hedging suggests making changes to the product pricing, product design, or product markets to affect the foreign currency cash flows associated with the "natural" business operations of the firm. Financial hedging is more appropriate in the cash of nominal exchange rate changes, or real exchange rate changes that are temporary in nature. Operational hedging is more costly to implement. It is more appropriate for real exchange rate changes, especially those that are permanent in nature.

20. Suppose a Japanese firm is selling cars for $15,000 in the US. The current exchange rate is ¥100/$. Explain the situation for the firm as the exchange rate drops to ¥80/$. How will the firm decide its pass-through decision? What are the main factors it faces in making its decision?

If the ¥ appreciates from 100 ¥/$ to 80 ¥/$, the yen revenues from each car sale drops from ¥1,500,000 to ¥1,200,000. To recover fully from the ¥ appreciation, the firm would have to raise the US selling price to $18,750 from $15,000. To make its decision, the firm needs to assess whether the exchange rate change is real or nominal, temporary or permanent. If the exchange rate change is nominal, then it compensates for higher US inflation; PPP holds and the real rate is constant. Since US prices have been rising, the Japanese firm can raise its US$ prices and keep its competitive position. If the exchange rate change is real, the firm must consider the price elasticity of demand for its product. If demand is inelastic, raising the price will actually raise total US$ revenues, even though it lowers the number of cars sold and market share. If the exchange rate change is temporary, the firm may be reluctant to raise US$ prices, since a roll-back in US$ prices will be called for when the ¥ depreciates back toward 100 ¥/$.

21. In the example of SONY (Table 16.8a), suppose that SONY produces a VCR model that incorporates voice-command programming, and that SONY holds an exclusive patent on voice command technology for VCRs. How will this affect the pass-through decision for SONY as the ¥/US$ exchange rate changes?

If the SONY VCR has a special patented feature (voice-command programming), its product is differentiated and it may be priced higher to appeal to higher income, high-tech consumers. The product probably has a low price elasticity of demand. SONY would be more likely to pass-through a permanent, real exchange rate change. SONY may still be reluctant to pass-through a temporary exchange rate change, because of the cost to dealers and customers associated with volatile pricing.

22. ABC Corporation manufactures outboard engines for recreation boats. All of its engines are manufactured in the United States and 40% of them are exported for sale to independent
distributors in foreign countries. Discuss whether ABC should set the invoice prices of its engines for export in US$ or foreign currency terms.

If ABC Corporation sets its engine prices in US$, the exchange rate risk is automatically passed on to foreign distributors and customers. This may have a negative effect on the willingness of distributors to stock ABC's engines in comparison with locally produced brands. ABC's decision may depend, in part, on the nature of the competition and other firm's pricing practices. If there is local competition, ABC may have to price in foreign currency to be competitive. But competition may come mostly from the US with engines priced internationally in US$ terms.

23. Right now, the spot rate for the Mexican peso is 6.0 MP/US$, while the 6-month forward rate is 25% higher at 7.5 MP/US$. Does this information suggest that the cost of hedging Mexican peso exchange risk is very high?

The sunk cost of hedging is measured by the forward premium, which in this case is 25%. The economic cost of hedging is measured by the difference between the forward rate and the expected future spot rate. If the forward rate and the expected future spot rate are roughly equal, there is no economic cost to hedging. The firm can reduce its risk without incurring an expected, ex ante financial cost.

24. How would you use the ECU to hedge foreign exchange exposure in a firm's European operations?

The ECU could be a useful tool for hedging currency exposure in a firm's European operations. If the European cash flows mimic the composition of the ECU, then the net exposure could be hedged using the ECU to lower transaction costs.

25. "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." Discuss the arguments that would support this claim.

These statements posit a situation where there is no cost of financial distress, so firms need not manage their exposure to a diversifiable risk (that is, a risk that does not carry a systematic risk premium as a reward). The statements would be true in a perfect capital market, where foreign exchange risk was fully diversifiable. In the real world, costs of financial distress are present, so firms may add value for shareholders by hedging certain risks.
1. Suppose a US firm decides to invest in Germany to produce its finished products for sale in Germany. Following is the stream of cash flows for the seven-year life of the investment and two interest rate scenarios:

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Flows (€)</td>
<td>-1,000</td>
<td>-100</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>400</td>
<td>2,000</td>
</tr>
<tr>
<td>Interest Rates--- Scenario 1</td>
<td>8%</td>
<td>9%</td>
<td>10%</td>
<td>10.5%</td>
<td>11%</td>
<td>11%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Interest Rates--- Scenario 2</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
</tr>
</tbody>
</table>

a. Calculate the Net Present Value in € for the project using both scenario of interest rates.

b. Does this project give the firm a positive or negative foreign exchange exposure?

c. Describe how the firm could hedge this exposure using only a current spot € contract.

d. Describe how the firm could hedge this exposure using a group of seven € forward contracts.

e. Describe how the firm could hedge this exposure using only one forward € contract with a seven year maturity.

f. Discuss the advantages and disadvantages of the approaches in c, d, and e.

SOLUTIONS:

a. With scenario 1, the rising yield curve, the project yields a Net Present Value of € 751.31, calculated as in the table below.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Value Factor</td>
<td>1.0</td>
<td>0.9174</td>
<td>0.8264</td>
<td>0.7412</td>
<td>0.6587</td>
<td>0.5935</td>
<td>0.5346</td>
<td>0.4817</td>
</tr>
<tr>
<td>Present Value</td>
<td>-1,000</td>
<td>-91.74</td>
<td>82.64</td>
<td>148.23</td>
<td>197.62</td>
<td>237.38</td>
<td>213.9</td>
<td>963.32</td>
</tr>
<tr>
<td>NPV</td>
<td>751.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

With scenario 2, the flat yield curve, the project yields a net present value of € 1,063.70.
b. In both cases, the project gives the firm a positive foreign exchange exposure to the €.

c. The firm can hedge its exposure by establishing a liability (or liabilities) in € to offset its net € asset position. With NPV = €751.31, if the firm borrows this amount it will have zero net exposure.

d. The firm could engage in seven forward € contracts, one to buy 100 € in year 1, and six to sell the indicated amount of € in years 2, 3, .. and 7.

e. The firm could hedge its € exposure by selling forward the future value (FV) of its € cash flows, with € re-invested at prevailing short-term interest rates, estimated from the term structure of interest rates.

f. Uncertainty about future € interest rates makes the NPV or FV of the project uncertain. If the firm uses seven forward contracts to offset the estimated € cash flows at each horizon, it is not subject (directly) to this re-investment risk. The firm has some residual risk since there may be uncertainty about the future cash flows.

2. Suppose a US auto parts manufacturer established a subsidiary in the maquiladoras, on the US-Mexican border. Parts are produced in Mexico, shipped to the US and Canada and then assembled into more finished parts. These units are then sold to US-owned manufacturers located in Canada and the US. No parts are sold in Mexico. Following is the balance sheet of the subsidiary, in thousands of Mexican Pesos (MP):

<table>
<thead>
<tr>
<th>BALANCE SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSETS</td>
</tr>
<tr>
<td>Cash</td>
</tr>
<tr>
<td>Securities</td>
</tr>
<tr>
<td>Receivables</td>
</tr>
<tr>
<td>Inventories</td>
</tr>
<tr>
<td>Plant &amp; Equipment</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIABILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payable</td>
</tr>
<tr>
<td>Accrued Wages</td>
</tr>
<tr>
<td>Long-Term Debt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQUITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>150,000</td>
</tr>
</tbody>
</table>

300,000
Assumptions:

· To set up the subsidiary in Mexico, the US parent has granted a long-term loan to its subsidiary. The loan is denominated in US$. The amount outstanding is MP 50 million at the current exchange rate. The interest rate is 10%.
· The firm also obtained long-term funds from Mexican banks. Loans outstanding are MP 50 million. The interest rate on these funds is 20%.
· The Mexican subsidiary imports its inputs from its US parent, payable in US$. Inputs are 50% of total costs.
· Labor and overhead are incurred in MP and represent 50% of total cost.
· Receivables are denominated in US$ (80%) and in Canadian dollars (20%).
· Budgeted sales for the current year are MP 100 million. The gross profit margin is 20%.
· The firm has cash and securities totalling MP 25 million: MP 5 million in cash, MP 10 million in Mexican banks CDs, and MP 10 million worth of US dollar CDs.

Current exchange rates are MP 3.40/$ and MP 2.60/$.

Answer the following questions:

a. Determine the cash-flow statement for the firm.

b. Determine the translation exposure for the US parent using the Current / Non-Current method. Determine the translation gain or loss from a 100% devaluation of the Mexican Peso.

c. Determine the translation exposure for the US parent using the Monetary / Non-Monetary method. Determine the translation gain or loss from a 100% devaluation of the Mexican Peso.

d. Determine the translation exposure for the US parent using the All Current method. Determine the translation gain or loss from a 100% devaluation of the Mexican Peso.

e. Determine the effect of a 100% devaluation of the Mexican Peso against the US dollar and the Canadian dollar on the income statement of the Mexican subsidiary.

f. How would you hedge your Mexican exposure?

g. What questions remain about the magnitude of the impact you calculated in part e.
SOLUTIONS:

a. Cash flow statement (in MP)

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>100</td>
</tr>
<tr>
<td>COGS</td>
<td>80</td>
</tr>
<tr>
<td>Raw Materials</td>
<td>40</td>
</tr>
<tr>
<td>Labor/Overhead</td>
<td>40</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>20</td>
</tr>
<tr>
<td>Interest expense, MP (20%)</td>
<td>10</td>
</tr>
<tr>
<td>Interest expense, US$ (10%)</td>
<td>5</td>
</tr>
<tr>
<td>Profits Before Taxes</td>
<td>5</td>
</tr>
</tbody>
</table>

b. Translation exposure: Current / Non-Current method

Under the C/NC method, all items are valued at the current exchange rate except for fixed assets, long-term receivables and long-term debt, which are valued at their historical rates. Items in non-peso terms are not exposed.

On the asset side, MP cash and securities and inventories are considered exposed. Other assets are considered non-current. On the liability side, accrued wages and long-term debt denominated in MP are considered exposed.

Total exposure is: (5 + 20) - (10 + 50) = 30.

The US parent has an asset exposure of MP 30,000,000. If the peso devalues by 100%, the US parent will incur a translation loss under the current/non-current method of:

\[30 \times (1/6.80 - 1/3.40) = (-$4.4118)\]. Loss is $4.4 million.

c. Translation exposure: Monetary / Non-Monetary

Under the M/NM method, MP cash, securities in MP, accrued wages and long-term debt are considered as exposed.

Total exposure: (5 + 10) - (10 + 50) = -45

Liability exposure for MP 45 million.

Effect of devaluation: -45 \times (1/6.80 - 1/3.40) = 6.617

Translation gain of $6.6 million associated with 100% MP devaluation.
d. Translation exposure: All Current

Under the all current method, all items in the balance sheet are considered exposed.

Total exposure: \( (5 + 10 + 75 + 100) - (10 + 50) = 130 \), or MP 130 million.

Effect of devaluation: \( 130 \times (1/6.80 - 1/3.40) = 19.1176 \)

Translation loss of $19.12 million.

e. Income Statement, post devaluation

Effects of devaluation:

· Sales are up 100% in Mexican Peso terms
· Costs denominated in foreign currency go up 100% (raw materials from US)
· Interest payments on US$ debt is up 100%.
· Eventual transaction gain once CDs are repaid.

<table>
<thead>
<tr>
<th>(in MP)</th>
<th>Pre- Devaluation</th>
<th>Post Devaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>COGS</td>
<td>80</td>
<td>120</td>
</tr>
<tr>
<td>Raw Materials</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Labor and Overhead</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>MP (20%)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>US $ (10%)</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Profits Before Taxes (in MP)</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>Profits Before Taxes (in $)</td>
<td>@3.40; $1.47</td>
<td>@ 6.80; $8.82</td>
</tr>
</tbody>
</table>

Economic effect of devaluation is highly positive because sales (in MP) rise by the full amount of the devaluation and MP costs are assumed unchanged.

f. Whether or how to hedge in this situation is ambiguous since the economic effect of an MP devaluation is positive, while the accounting effect is sometimes positive, sometimes negative, depending on the method for calculating exposure.

Once the method is decided upon by the Treasurer at the US parent, if hedging is necessary, the use of forward contracts (to offset the amount of translation exposure) to reduce asset exposure is advised.

g. One could doubt whether labor and overhead charges or MP interest rates will stay fixed in MP terms after a 100% devaluation. Inflationary pressures may build and nominal interest rates may rise. So profit margins in MP terms may not reach the magnitudes suggested in the calculation.
Additional exercises with answers

3. Consider the situation of Toyota Motors of Japan. Toyota exports a significant portion of its car production to the US. Many of Toyota's production costs are denominated in Yen but its revenues from US sales are in dollars. Assume that the total cost of one model is ¥1.0 million and that this model is sold to US importers (for the sake of the example, importers and car dealers are the same) for ¥ 1,250,000. The current exchange rate is ¥ 100/$. Cars are sold to the US consumers after a mark-up of 30%.

a. Determine the sales price of the car in the US in this base scenario.

Assume that the yen appreciates to ¥ 80/$. Toyota and the US importers are faced with the question of who will carry the burden of the higher yen through the pass-through policy.

b. Determine the sale price to the US dealers (in ¥ and $) and the final sales price to the US customers, assuming that the customers bear 100% of the burden of the higher yen.

c. Determine the sale price to the dealers (in ¥ and $) and the final sales price to the US customers, assuming that the dealer (importers) bears 100% of the burden of the higher yen.

d. Determine the sale price to the dealers (in ¥ and $) and the final sales price to the US customers, assuming that Toyota bears 100% of the burden of the higher yen.

SOLUTIONS:

US IMPORTS AND STRONGER YEN

<table>
<thead>
<tr>
<th>Yen / $</th>
<th>Cost</th>
<th>Sales Price to Dealer</th>
<th>Cost to Dealer</th>
<th>Dealer’s Price</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>¥ 100/$</td>
<td>¥ 1,000,000</td>
<td>¥ 1,250,000</td>
<td>$ 12,500</td>
<td>$16,250</td>
<td>Base Case</td>
</tr>
<tr>
<td>¥ 80/$</td>
<td>¥ 1,000,000</td>
<td>¥ 1,250,000</td>
<td>$ 15,625</td>
<td>$ 20,312</td>
<td>Total Pass through Burden on customers</td>
</tr>
<tr>
<td>¥ 80/$</td>
<td>¥ 1,000,000</td>
<td>¥ 1,250,000</td>
<td>$ 15,625</td>
<td>$ 16,250</td>
<td>No Pass through Burden on dealers</td>
</tr>
<tr>
<td>¥ 80/$</td>
<td>¥ 1,000,000</td>
<td>¥ 1,000,000</td>
<td>$12,500</td>
<td>$ 16,250</td>
<td>No Pass through Burden on Toyota</td>
</tr>
</tbody>
</table>

a. $16,250
b.,c.,d. See table.
4. Consider the situation of Moët-Hennessy, a French champagne producer. Moët exports champagne to Japan. Costs are denominated in French francs (FFr) but revenues are in Yen. The total cost per case for Moët is FFr 500. The champagne is sold to importers for FFr 1,000. (Assume that Japanese champagne importers and retail dealers are the same.) The current exchange rate is FFr 5/100 Yen. Japanese importers sell Moët champagne at prices reflecting a 1/3 mark-up over cost.

a. Determine the sales price in Japan wine distributors in this base scenario. Assume that the Yen appreciates to FFr 5.50/¥100. Moët and the Japanese importers are faced with the question of who will benefit from the stronger yen through the pass-through policy.

b. Determine the sales price to the distributors (in ¥ and FFr) and the final sales price to the Japanese customers, assuming that customers enjoy 100% of the gain.

c. Determine the sales price to the dealers (in ¥ and FFr) and the final sales price to the Japanese customers, assuming that importers enjoy 100% of the gain.

d. Determine the sales price to the distributors (in ¥ and FFr) and the final sales price to the Japanese customers, assuming that Moët enjoys 100% of the gain.

**SOLUTIONS:**

**FRENCH EXPORTS AND STRONGER YEN**

<table>
<thead>
<tr>
<th>FF / ¥</th>
<th>Cost</th>
<th>Sales Price</th>
<th>Cost to Importer</th>
<th>Importer’s Price</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFr 5/¥</td>
<td>FFr 500</td>
<td>FFr 1,000</td>
<td>¥ 20,000</td>
<td>¥ 30,000</td>
<td>Base Case</td>
</tr>
<tr>
<td>FFr 5.5/¥</td>
<td>FFr 500</td>
<td>FFr 1,000</td>
<td>¥ 18,182</td>
<td>¥ 24,242</td>
<td>Gain to consumers</td>
</tr>
<tr>
<td>FFr 5.5/¥</td>
<td>FFr 500</td>
<td>FFr 1,000</td>
<td>¥ 18,182</td>
<td>¥ 30,000</td>
<td>Gain to dealer</td>
</tr>
<tr>
<td>FFr 5.5/¥</td>
<td>FFr 500</td>
<td>FFr 1,100</td>
<td>¥ 20,000</td>
<td>¥ 30,000</td>
<td>Gain to Moët</td>
</tr>
</tbody>
</table>

a. ¥30,000/per case of champagne  b.,c.,d. See table.