

Economic Exposure

1. Introduction and Overview

Operating or economic exposure is simply defined as the effect of exchange rate changes on the expected value of a firm's future operating cash flows¹. The changes in operational cash flows ultimately affect the firm value. Unexpected changes in exchange rates may represent real macroeconomic shocks similar to changes in interest rates, inflation, or changes in widely used commodity prices such as oil. Any significant change in these key macroeconomic variables may cause fundamental shifts in cost of capital, manufacturing costs, consumption patterns and can result in changes in the value of firms' expected future operating cash flows. While most firms are exposed to macroeconomic shocks triggered by exchange rate changes, the impact on each firm depends on a complex set of firm specific factors.

A key attribute of the economic exposure is that exchange rate changes constitute a real economic shock. A real shock is a “real change” in exchange rates rather than a “nominal change”. A real change in exchange rates alters the relative prices of the goods and services consumed and produced by firms. An example may help to clarify the concept: Let's assume that US experiences 10% inflation whereas prices in Canada remain unchanged over a year. In the meanwhile, the value of USD in CAD terms increases by 5% from CAD 1 per USD to CAD 1.05. The combination of the nominal change in the value of dollar, and inflation rate differential, increases relative prices of US goods by 15.5%². In very simple terms, this change in relative prices is likely to have a negative impact on the competitiveness of US manufactured goods. In contrast, if the value of USD changes from CAD 1 to CAD 0.909, the change in the value of USD only reflects the inflation rate differential. The offsetting change in exchange rate implies that relative prices do not change, and the shift in the exchange rate is said to be nominal rather than real. In the wake of nominal exchange rate changes relative prices do not necessarily change. Accordingly, firms and consumers have no reason to change their production and consumption decisions. Consequently, nominal exchange rate changes do not alter firm's expected future cash flows and therefore its value.

¹ To avoid confusion in the forthcoming discussion, please note that the terms “operating” and “economic” exposure will be used interchangeably.

² The price of US manufactured goods from Canadian perspective has increased $(1.1 \times 1.05) - 1 = 15.5\%$

To further clarify the foregoing discussion, it is important to emphasize that operating exposure arise when exchange rates deviate from purchasing power parity. In other words, if PPP held at all times, exchange rate changes would be nominal, and would not change relative prices. In contrast, any deviation from PPP, leads to real exchange rate changes and affect the revenues and costs and alter firm's cash flows. These changes consequently affect the firm value.

Please note that real exchange rate changes occur even when nominal exchange rates remain fixed. When inflation rate differentials are not offset with corresponding exchange rate changes, changes in relative prices introduce real exchange rate shocks to the economy. It is also important to recognize that the relative price changes can be triggered by factors such as technological innovations and demographic shifts. These changes can be powerful enough to affect firms' operating cash flows and alter their value.

Estimating a firm's operating exposure requires an assessment of the responsiveness of operating cash flows to a given real change in exchange rates. The major categories of inflows and outflows are revenues and costs, respectively. Let's explore this in the context of a US company operating in the US but exporting half of its output to UK. Assume that all the inputs the US firm uses are domestically procured and the firm incurs labor costs in USD terms. Also assume that the exports destined to British market are priced in British Pound (GBP). Let's consider the case of US dollar appreciation against Pound:

When dollar appreciates, the firm has two options: increase the foreign currency price or keep foreign currency price constant. First option preserves the dollar revenues from the foreign market if the demand does not decline. In most likely case, British consumers will scale back their purchases in response to higher prices, and demand will decline! Second option leads to a decline in dollar revenues even if the demand remains leveled. Even if prices kept constant, depreciation of Pound reduces purchasing power of British consumers that may have a negative impact on demand and may reduce Pound revenues. This in turn reduces the dollar cash flows generated from the UK market further.

In the preceding example decline in US dollar revenues in response to USD appreciation indicates that US companies' cash flows are negatively exposed to changes in the value of USD. When the USD appreciates or Pound price of USD goes up, the USD cash flows of the firm declines

regardless how the firm responds to the USD appreciation. While this makes perfect sense on the surface, further consideration of the underlying dynamics reveals that it is rather too simplistic and misleading.

The simplistic view does not fully reflect the possible reactions by consumers, competitors, suppliers and government. Each constituent group reacts to permanent shifts in real exchange rates and their collective reactions influence the net impact on the cash flows.

Let's revisit the case where USD appreciates against Pound or Pound depreciates against USD. The real depreciation of Pound reduces purchasing power of GBP against USD. Relative prices of imports increase, and consumers may reduce their consumption of imported goods. Regardless of the U.S. company's pricing strategies, overall British demand may decline. The extent of decline depends on a number of factors such as availability of close substitutes.

In contrast, relative increase in purchasing power of USD may increase demand in the US. This may sound counterintuitive, because traditional view on the dollar appreciation suggests that imported goods prices decline and domestic producers lose market share to importers. However, real appreciation of the local currency (USD in this particular case) also increases U.S. consumers' consumption power and potentially offsets the negative impact of import competition³. Consequently, the net impact of the real appreciation of USD depends on the net impact of the changes on the cash flows from British and US markets.

While consumer reactions to relative price changes are important, a significant determinant of the operating exposure is the nature of competition in the industry. For instance, in the foregoing example, if the US company's major competitors are British firms; real depreciation of Pound enhances their competitive position in the domestic and international markets. This may prove to be detrimental to the U.S firm as it faces the risk of losing market share to its British competitors in the UK and potentially in the US. If the US firm is a producer of routine manufacturing goods with no clear differentiation of its products or services, this constitutes a particularly potent risk for the US firm. On the

³ The validity of this argument largely depends on the economic circumstances at the time of real appreciation. When a real appreciation overlaps with a period of economic expansion, the increase in domestic demand may well offset the negative impact of import competition for US MNCs. Luehrman (1987) argues that the real appreciation of USD in 1984 "had put such purchasing power in the hands of the huge pool of U.S. consumers that the general economic expansion in the U.S. may have helped many firms more than imports hurt them".

other hand if the major competitors are the US MNCs, the real appreciation of dollar may not provide a decisive cost advantage to them.

A third factor that deserves consideration is the impact of real exchange rate shock on the firm's suppliers. In general, real appreciation of US dollar reduces cost of imported inputs for US companies. US MNCs competing against rivals with no import content, may gain relative cost advantage over their competitors. The extent of the advantage captured depends largely on the suppliers' reaction to exchange rate changes. Some suppliers competing on the basis of price may keep their prices constant in local currency terms and accept lower USD proceeds. Others with differentiated products with limited substitutes may adjust their prices to preserve their dollar revenues, which in turn may not create any significant cost advantages. In general, the location of suppliers, their cost structures, and the types of demand they face determine their customers' exposures.

Finally, government response to real exchange rate shock should also be given a careful consideration as it may have a significant impact on the firm's operating exposure. The real shifts in exchange rates may provoke interventions in currency markets, barriers to capital flows or protectionist trade policies. Recent attempts by Bank of Japan to weaken Japanese Yen, Costa Rican Central Bank's frequent interventions to prevent further appreciation of Colon, and US government's long standing threats to declare China as a "currency manipulator" are vivid examples of government responses to real changes in exchange rates that cannot be ignored in assessment of operating exposure.

The following example illustrates the concept of economic exposure and the issues

Case Example: Entropy USA

Entropy USA manufactures chip sets for cable top devices. Large US market absorbs roughly half of its production. The other half of its output is exported to UK. Currently Entropy produces about 1,000,000 chipsets annually and UK prices of the chipsets are GBP10 per unit. Dollar-Pound exchange rate is \$1.50 per pound. At the current exchange rate, Entropy generates \$15 revenue per unit sale in UK. Suppose, US and UK inflation rates are equal and exchange rate changes from GBP/USD 1.5 to 1.45. Since the inflation rates are equal, nominal appreciation of USD also represents a "real appreciation". The exchange rate change has an impact on relative prices in US and UK. If Entropy keeps its UK prices unchanged at GBP10 per unit, its USD revenues decline. If Entropy decides to

change its UK price from GBP10 to GBP 10.34, it may preserve its USD revenues. Let's consider following scenarios:

- Scenario-1: Entropy does not change its Pound price, and demand in the US and UK remain as it was before
- Scenario-2: Entropy does not change its Pound price, but real depreciation of Pound reduces purchasing power of British consumers, and the demand declines to 450,000 units in UK.
- Scenario-3: Entropy does adjust its Pound price to 10:34; because of real depreciation of Pound which reduces purchasing power of British consumers, and higher nominal pound price, the demand declines to 400,000 units in the UK. In contrast, real appreciation of USD increases purchasing power of US consumers, and US demand increases to 650,000 units.

For simplicity, assume that resulting operating cash flows are perpetual and Entropy's cost of capital is 15%. What are the value implications of USD appreciation and Entropy management's strategic responses?

	Base Case	Scenario-1	Scenario-2	Scenario-3
Exchange rate, GBP/USD	1.5000	1.4500	1.4500	1.4500
Sales volume (units)	1,000,000	1,000,000	950,000	1,050,000
US Sales	500,000	500,000	500,000	650,000
Exports	500,000	500,000	450,000	400,000
US Sales Price per unit (USD)	15	15.00	15.00	15.00
Export Sale Price per unit (GBP)	10	10.00	10.00	10.34
Direct cost per unit (USD)	5	5	5	5
Sales revenues	15,000,000	14,750,000	14,025,000	15,750,000
Direct cost of goods sold	5,000,000	5,000,000	4,750,000	5,250,000
Cash operating expenses (fixed)	1,500,000	1,500,000	1,500,000	1,500,000
Depreciation	500,000	500,000	500,000	500,000
Operating Profits	8,000,000	7,750,000	7,275,000	8,500,000
Taxes (35%)	2,800,000	2,712,500	2,546,250	2,975,000
Profit after tax	5,200,000	5,037,500	4,728,750	5,525,000
Add back depreciation	500,000	500,000	500,000	500,000
Cash Flow from Operations ⁴	5,700,000	5,537,500	5,228,750	6,025,000

⁴ For simplicity, net working capital investments and net fixed asset investments were assumed to be zero throughout the life of the firm. Obviously these are not realistic assumptions, and they play a significant role in determination of Free Cash Flows.

Source: Author's own calculations

The above table indicates that Entropy's operating cash flows decline under scenarios 1 and 2, but increase under scenario 3. If we simply assume that these cash flows are expected to occur perpetually, value implications of scenario 1, 2 and 3 can be summarized as follows:

- Scenario-1: Incremental Cash Flows : 5,537,500 – 5,700,000=(162,500)
Value implication=(162,500)/0.15 =(1,083,333)
- Scenario-2: Incremental Cash Flows : 5,228,750 – 5,700,000=(471,250)
Value implication=(471,250)/0.15 =(3,141,667)
- Scenario-1 Incremental Cash Flows : 6,025,000 – 5,700,000=325,000
Value implication=325,000/0.15 = 2,166,667

As it is clear from the analysis above, USD appreciation has a negative impact on firm value under scenarios 1 and 2, and positive impact under scenario 3. Note that under each scenario various assumptions were made. These assumptions include:

1. Entropy management's response to exchange rate appreciation
2. Change in US demand
3. Change in UK demand

Firm and industry specific conditions determine the actual results; these scenarios were used to illustrate the impact of real exchange rate changes on the firm value.

2. Measuring Economic Exposure

Economic exposure refers to any change in the value of a firm resulting from changes in the future operating cash flows caused by an unexpected change in the exchange rates. In other words, economic exposure measures the degree to which operating cash flows are affected by unexpected changes in exchange rates.

$$V_{\$,t=0} = \sum_{i=1}^N \sum_{t=1}^T \frac{FCF_{i,t} \times S_{i,t}}{(1+k_i)^t} + \sum_i^N \frac{TV_{T,i}}{(1+k_i)^T}$$

The sensitivity of the firm value “V” in the above valuation model of a multinational firm generating cash flows in N different countries, to percentage change in the exchange rate “S” captures the degree of economic exposure. More specifically we can define this sensitivity as:

$$\gamma = \frac{\partial V_t^{\$/} / V_t^{\$/}}{\partial S_{\$/i} / S_{\$/i}}$$

- $V_t^{\$/}$ = Value of the firm defined as PV of future cash flows
- $S_{\$/i}$ = is the exchange rate defined as local currency (reference/parent currency) per foreign currency
- γ is an elasticity, it measures % change in the value of the firm (in \$) for a given percentage change in the value of currency i.

A practical way to measure this exposure elasticity γ is to regress firm value on the exchange rate changes. Since firm value is not an observable quantity, it is plausible to use an accessible proxy for firm value. A convenient and noncontroversial choice is the stock price. Since both stock prices and exchange rates are publicly available, the following regression can be used to estimate exposure elasticity.

$$R_{i,t} = \alpha_i + \gamma_i S_t + \varepsilon_{i,t}$$

Where R_t represents percentage change in the firm i’s value (or stock returns from time t-1 to t); s_t represents percentage change in the exchange rate. The gamma coefficient, γ , measures the sensitivity of the firm value to changes in exchange rates. The higher the gamma coefficient, the greater the impact of changes in exchange rates on the operating cash flows and the value of a company. The economic relevance of the model and the gamma estimate depends on the t-statistic of the gamma coefficient (or exposure coefficient) and the R^2 . The R^2 will tell a firm if the exposure is important to evaluate the overall risk of the firm. Suppose that the gamma coefficient is large and significant, but the R^2 is low, say 1%. Despite the evidence that exchange rates affect firm value, the influence on cash flow variability is so low, that a firm should not spend resources to manage economic exposure.

Example: GE’s Economic Exposure

The following regression measures GE's economic exposure to changes in the Trade Weighted US dollar (TWXD). In the estimation model 48 monthly observations from the most recent past were used (T-statistics in parenthesis).

$$R_{i,t} = 0.523 + 0.423_i s_t$$

$$R^2 = .168. \quad (.89)$$

(2.79)

The foreign exchange exposure coefficient is statistically significant. GE stock returns sensitivity to changes in trade weighted US dollar is estimated to be 0.423. This means that a 1% appreciation of the TWXD will increase US dollar value of GE by 0.423%. The R^2 tells us that changes in exchange rates explain 16.8% of the variability in GE value, which is not negligible.

3. Managing Economic Exposure

The operating exposure was defined as the sensitivity of the firm's operational cash flows to changes in the exchange rates. The impact of the real exchange rate changes on the firm's long term cash flows depends on the firm's strategic responses to sudden changes in its competitive position in the market. A flexible business configuration would allow the firm to adjust its operations, production, sourcing and marketing to changing conditions and limit the deterioration of its competitive position in the market. Alternatively, such flexibility also allows the firm to take advantage of favorable changes in its competitive position. These changes may be implemented preemptively in anticipation of possible adverse movements in exchange rates to create maneuvering room for the firm, or may be implemented reactively to limit the damage or maximize the gains⁵. It is important to understand that operational hedges, i.e. reconfiguration of production, sourcing, and marketing, may change the nature of the underlying business, or affect the firm behavior. In contrast, financial hedges do not have such impact on the underlying business or the economic behavior of the firm.

⁵ Preemptive responses in anticipation of exchange rate shocks create real options for the firm. These real options increase the firm value.

a. Strategic Management of Economic Exposure:

Strategic management of economic exposure requires certain operating responses, including, for example, changes in pricing, sourcing, and product mix. As it was illustrated in the Entropy example, changes in real exchange rates, often force firms to make a choice between market share and profit margin. To what extent exchange rate changes are passed through will depend on demand elasticity and persistence of the exchange rate change. The longer the exchange rate change is expected to persist, the greater the price elasticity of demand. This combination obviously will have significant impact on volume and affect the cash flows. The decision to absorb the changes in the profit margins by delaying the price adjustments will depend on the persistence of the real exchange rate change. If the real exchange rate change is temporary, prices may be kept constant to preserve the market share and to create real options. However, if the changes are permanent, decay in profit margins may weaken firm's position in the market and the firm will have to consider structural adjustments beyond pricing policies.

When exchange rate shocks are persistent, severe and long lasting, the firm may reduce its exposure by reconfiguring its supply chain and/or reallocating production in its network. Supply chain reconfiguration may help to match revenues and costs, stabilize profit margins and reduce firm's vulnerability to future exchange rate shocks. Shifting sourcing towards markets where the company generates foreign currency cash-inflows reduces the net exposure and enhances competitive position in foreign markets. Reallocation of production within the multinational network may also help the firm to regain competitiveness. A firm with a multinational network of plants can always produce at capacity in the location where costs are low, and meet additional demand from progressively higher cost locations. Firms without such networks may build foreign production capacity through licensing or foreign acquisitions.

Another strategic avenue is to diversify into activities with offsetting exposures to the exchange rate. A possible scenario is to combine the production and export of a particular good with imports of competitive products from foreign producers. This so called "natural operating hedge" would keep total dollar cash flows stable when real exchange rates change. While there are some advantages of this approach, it may prove to be a costly hedge. The most obvious downside of this strategy is loss of focus and being forced to enter into new activities in which the firm has no particular comparative advantage. Even when firm views new activities as complementary, prolonged cross subsidization may conceal the economic viability of each operation on its own.

As the foregoing discussion makes it clear, for practical purposes the extent of a company's foreign exchange exposure and its effective management depends on firm's ability to adjust its prices expediently to offset the impact of exchange rate

shocks, the extent of diversification of its factor and product markets and consequently its ability to change sources of inputs and markets for outputs

Since the executives who can supply the best estimates on these issues tend to be those directly involved with purchasing, marketing, and production, management of economic exposure is not a task that can be handled by financial managers alone. It should be a collective responsibility as finance managers who focus exclusively on credit and foreign exchange markets may easily miss the essence of corporate foreign exchange risk.

b. Financial Management of Economic Exposure

Traditional foreign currency derivatives such as options, futures and forwards are often not sufficient to hedge long term cash flow exposures. The maturities associated with these products rarely extend beyond a year or two, and since for most firms future cash flows are hardly predictable, such contracts give rise to new exposures.

Multinational firms with foreign subsidiaries often take advantage of local financial markets to create natural hedges. If the foreign subsidiary generates sizable profits within the multinational network, local currency appreciation may reduce the local currency value of cash flows generated by the foreign subsidiary. Borrowing in foreign currency creates liabilities in foreign currency that can be serviced with foreign currency cash flows generated by the subsidiary. This combination reduces net exposure of the firm to the subsidiary country currency and protect the firm from permanent shifts in exchange rates.

A case in point is the strategy adopted by Disney Japan. Disney was concerned about impending Japanese Yen depreciation in 1985. Disney generated substantial revenues in Japanese Yen, and it was concerned that the dollar value of these Japanese Yen cash flows would decline precipitously in the years ahead and have an adverse effect on firm value. Disney considered a 10 year JPY denominated bond issue that would allow it to use JPY cash flows to service the interest and principle associated with the bond. Disney would also be able to convert proceeds from the JPY bond issue into US dollars, practically capturing present value of future JPY cash inflows in US dollar terms. Disney was not only be able to implement the strategy, but also did it at a surprisingly low cost by using a cross currency swap engineered by Goldman Sachs bankers. So called “Disney Yen Swap” involved Disney to issue ECU denominated bonds, and to swap these bonds to JPY. The cross currency swap involved two steps:

1. Exchanging ECU proceeds with JPY at the prevailing spot rate
2. Make semi-annual JPY payments in exchange for annual ECU receipts that would allow Disney to service its ECU interest and principle. The first five years of payments involved only interest payments, but last five years involved 20% of the principle into a sinking fund.

In the final analysis, Disney reduced its exposure to JPY substantially in the next 10 years, and isolated its cash flows from depreciation risk. It is important to understand that while this strategy reduced the downside risk, it also eliminated the upside, namely windfall cash flows that could result from JPY appreciation.

Summary

Operating exposure should be thought of as the response of a firm's expected future operating cash flows to a real macroeconomic shock, i.e., a real change in exchange rates. Real exchange rates change when changes in nominal exchange rates fail to comply with Purchasing Power Parity. As a result, changes in the relative prices of goods and services lead to changes in operating cash flows, and ultimately affect the firm value.

Unlike transaction exposure, economic/operating exposure cannot be effectively managed by using currency derivatives. When exchange rate shocks are significant and persistent, deterioration in competitive position in the market can be prevented through market selection, pricing, sourcing and production decisions. These decisions require cross functional collaboration across the divisions in the firm and cannot be seen solely a financial management problem.

While operating exposure management requires strategic responses, under some circumstances financial solutions such as changing currency mix of firm's liabilities, currency swaps or back to back loans can be successfully deployed to mitigate economic exposure.

A real change in exchange rates leads to the following fundamental type of change in relative prices: the real appreciation of a currency, say the US\$ vs. the DM, makes exports from the U.S. to Germany relatively more expensive for German consumers and imports from Germany to the U.S. relatively less expensive for U.S. consumers. Under many plausible scenarios, this results in a reduction of US\$ cash flows to a firm producing goods in the U.S. for sale in Germany. The US\$ operating cash flows of the firm are said to be negatively exposed to the DM/US\$ exchange rate. The magnitude of the exposure is equal to the amount by which the value of the cash flows changes following a given shift in the exchange rate, and it is typically measured in the foreign (DM) currency. This simple relationship underlies the traditional view of operating exposure, namely that a home currency appreciation reduces the cash flows of home country firms engaged in exporting or competing with imports.

However, there are many complicating factors which can make this traditional conclusion misleading. A significant change in relative prices represents a real macroeconomic shock to which many people will respond. It is important to examine the reactions of consumers, suppliers, competitors, and governments and to assess the impact of these reactions on the particular firm's operating cash flows. It is also necessary to consider possible changes in the investment behavior of a

firm and its competitors in addition to the more obvious changes in production and consumption decisions.

Finally, the effects of real exchange-rate changes should not be taken out of their proper macroeconomic context. In particular, if real interest rates change simultaneously, the appropriate discount rate for future operating cash flows may change as well. The complications just described are capable, separately or together, of either offsetting or reinforcing the firm's basic operating exposure. Note that if they completely offset it, the traditional view predicts both the wrong sign and the wrong magnitude of actual operating exposure.