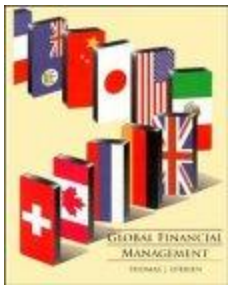

II-6. FX Operating Exposure and Operational Hedging

Introduction

A company's *FX operating exposure* is the impact of FX changes on the level of the firm's anticipated operating cash flow stream, measured in the firm's base currency. This chapter first covers FX cost exposure and then covers how FX revenue and cost exposures combine to determine a firm's operating exposure to a given foreign currency.

Operational hedging involves matching the currency of operating costs with the currency in which revenues are generated. Operational hedging is thus one approach to the management of FX exposure and is covered in this chapter. Financial hedging is the use of foreign currency-denominated debt and FX derivatives to augment, or instead of, operational hedging. Financial hedging is covered in the next chapter.

FX Cost Exposure

A firm's *FX cost exposure* is defined analogously to FX revenue exposure

covered in the prior chapter: A firm's FX cost exposure is the sensitivity of the firm's anticipated operating cost level to FX changes, viewed from the perspective of the firm's base currency. Financial costs, like interest on debt, are not part of operating costs and are treated separately in the next chapter.

For example, if a firm's operating costs, measured in the firm's base currency, increase by 5% in response to a 10% appreciation in the value of a foreign currency, then the firm's FX cost exposure is 0.50 to that currency. Let $C^{\$}$ represent the level of the operating costs measured in US dollars. Then a US firm's FX cost exposure to the euro would be denoted $B_{C€}^{\$}$ and would be computed as $\%\Delta C^{\$}/x^{\$/€}$.

A firm's cost exposure to FX changes often depends on the international locations of its own operations and those of its suppliers and potential suppliers. A firm with purely domestic production and with no imports of raw materials might have a cost exposure of 0 to any foreign currency. If a US firm imports raw materials whose currency of determination is the euro, that portion of the firm's costs will have an FX cost exposure of $B_{C€}^{\$} = 1$ to the euro. On the other hand a US importer of raw materials from Europe would have a FX cost exposure of 0, if the materials have a currency of determination of the US dollar.

Even a company with only domestic suppliers could have FX cost exposure, since the prices of the raw materials could be indirectly linked to FX rates, particularly if the domestic suppliers pass along their own FX cost exposures. For example, when paper prices were determined significantly by the value of the Swedish krona, a firm that used a great deal of paper could have operating costs exposed to the Swedish krona, even if the paper was supplied by a US paper company.

In terms of pass-through, a firm's FX cost exposure for an imported product is the reciprocal of the exporter's FX revenue exposure for the product. Consider the following illustration, based on the US firm Caterpillar and the Canadian distributor, Finning. Caterpillar sells tractors to

Finning, which Finning then sells in Canada. If the US dollar were to appreciate relative to the Canadian dollar, Caterpillar would pass-through some, but not all, of its revenue exposure to the Canadian dollar by raising the prices of tractors sold to Finning. If Caterpillar, for example, raises its prices so as to pass-through 40% of any FX change, Caterpillar is transferring 40% of the FX risk to Finning, and Caterpillar's revenues from Finning would have an FX revenue exposure of 0.60 to the Canadian dollar. From its perspective in Canadian dollars, Finning has an FX cost exposure of 0.40 to changes in the value of the US dollar, whereas from its perspective of US dollars, Caterpillar has an FX revenue exposure of 0.60 to the Canadian dollar.

There is more to Finning's FX cost exposure to the US dollar, however. Not only does the per-tractor cost in Canadian dollars change due to the pass-through of prices from Caterpillar, but Finning's total costs also change as sales volume changes reflect the indirect impact of changes in the value of the US dollar on the volume of business to Finning's Canadian customers. Thus, pass-through may be 40%, but Finning's FX overall FX cost exposure to the US dollar, considering both the pass-through and economic impact on sales volume, would be higher, e.g. $B_{C\$}^{C\$} = 0.65$. In this case, Finning's total operating costs would increase by 6.5% (on average) whenever the US dollar increases in value by 10% relative to the Canadian dollar. A description of Caterpillar-Finning is found in Gregory J. Millman, *The Floating Battlefield: Corporate Strategies in the Currency Wars* (New York: AMACOM, The American Management Association, 1990).

FX Operating Exposure

FX operating exposure also has a definition that is analogous to FX revenue and FX cost exposures. Let $O^{\$}$ represent the level of a firm's operating cash

flow stream measured in US dollars. Then the firm's FX operating exposure to the euro is denoted $B_{O€}^{\$}$ and is computed $\%\Delta O^{\$}/x^{\$/€}$. Since operating cash flow is revenue minus operating cost, it is reasonable to examine FX operating exposure as a combination of FX revenue exposure and FX cost exposure.

Consider first a firm with zero FX cost exposure. In this case, the firm's costs are "fixed" with respect to FX changes. As such, an *operating leverage* effect is at work, which you may recall from prior finance courses is that a relatively higher level of fixed operating costs results in greater sensitivity of operating income to fluctuations in revenues.

For example, consider a firm with an anticipated revenue level of $100 mm and operating cost level of $75 mm. Thus the anticipated operating cash flow level is $100 mm – 75 mm = $25 mm. Assume that the firm's FX revenue exposure to the euro is $B_{R€}^{\$} = 1$, and that operating costs are "fixed" relative to changes in the value of the euro, $B_{C€}^{\$} = 0$. Thus if the euro appreciates in value by 10% relative to the US dollar, the firm's US dollar revenue stream will rise 10% to a level of $110 mm, but costs will remain at $75 mm. Thus the firm's new operating cash flow level will be $110 mm – $75 mm = $35 mm.

In this case the operating cash flow has risen by $35 mm/25 mm – 1 = 0.40, or 40%, in response to the 10% appreciation of the euro. The firm's FX operating exposure, $B_{O€}^{\$}$, is thus 4. Since the FX revenue exposure is 1, the firm's FX operating exposure is 4x the FX revenue exposure. This "magnification factor" of 4 is a direct result of the ratio of revenues to operating cash flows before the movement of the euro, $100 mm/$25 mm = 4. Another way of saying this is that the "magnification factor" is the reciprocal of the operating margin, where *operating margin* is defined to be the ratio of expected operating cash flows to expected revenues, $O^{\$}/R^{\$}$.

As another example, consider a firm with an overall revenue exposure to an FX index, or "basket" of foreign currencies, of $B_{Rx}^{\$} = 0.50$. Assume that firm's operating margin is 1/3 (one-third), and that the FX cost

exposure is 0. Thus, the "magnification factor" is the reciprocal of 1/3, or 3. Thus the firm's FX operating exposure to a general currency index, $B_{Ox}^{\$}$, is 3x the FX revenue exposure, or 3(0.50) = 1.50. Thus if the "average" foreign currency depreciates by 20%, the firm's overall consolidated operating cash flow level would fall by 1.50(20%) = 30%, even though its overall consolidated revenue level would only fall by 0.50(20%) = 10%.

Assume that a firm has an overall revenue exposure to an FX index, or "basket" of foreign currencies, of $B_{Rx}^{\$} = 0.20$. Assume that the firm's operating margin is expected to be 20%. Given that the FX cost exposure is 0, find the firm's FX operating exposure to the index, $B_{Ox}^{\$}$. If the average foreign currency appreciates by 10% relative to the US dollar, what would be the percentage change in firm's operating cash flow level? *Answers: The FX operating exposure would be 5x the FX revenue exposure or 5(0.50) = 2.50. The company's consolidated operating cash flow level would rise by 2.50(10%) = 25%, even though consolidated revenues would only rise by 0.50(10%) = 5%.*

Generally, we know that a company's FX cost exposure to a currency is not necessarily 0, in which case there is a "modified" approach to the magnification factor idea. The general formula is shown in equation (6-1).

$$B_{O€}^{\$} = [B_{R€}^{\$} - B_{C€}^{\$}][R^{\$}/O^{\$}] + B_{C€}^{\$} \qquad (6\text{-}1)$$

To demonstrate equation (6-1), let us piece together some information we have already brought out about the Canadian heavy

equipment distributor, Finning. Recall that Finning had FX revenue exposure to the US dollar, an indirect economic exposure stemming from the situation that when the US dollar appreciated relative to the Canadian dollar, Finning's sales volume increases, and vice versa. Let us assume that Finning's revenues, measured in base currency of Canadian dollars (C$), increase by 8% when the US dollar appreciates by 10%, i.e. that $B_{R\$}^{C\$} = 0.80$. Next let us assume that Finning's FX cost exposure, considering both the impacts discussed above, the increased tractor cost passed-through by Caterpillar *and* the increased production volume because customers are order more equipment, of $B_{C\$}^{C\$} = 0.60$. In other words, Finning's total operating costs increase by 6% (on average) when the US dollar increases in value by 10% relative to the Canadian dollar. Let us assume that Finning's expected operating margin is 25%. Then, using equation (6-1), Finning's FX operating exposure to the US dollar would be [0.80 – 0.60][4] + 0.60 = 1.40.

The details of how equation (6-1) is derived are not covered, so to satisfy any curiosity about whether the equation works or not, let us go over a detailed numerical example. Assume that Finning's revenues are C$100 and operating costs are C$75, and thus operating cash flow is C$25 to start with. Given the assumed FX revenue exposure of 0.80 and FX cost exposure of 0.60, if the value of the US dollar appreciates by 10%, then the C$ revenue level rises by 8% to C$108 and the C$ total cost level rises by 6% to C$75(1.06) = C$79.50. Thus the operating cash flow level rises to C$108 – 79.50 = C$28.50. The new operating cash flow level represents a percentage change of C$28.50/C$25 – 1 = 0.14, or 14%. This movement reconciles with the operating exposure computed via equation (6-1).

Assume that Finning's FX revenue exposure to the US dollar, $B_{R\$}^{C\$} = 0.90$. Next let us assume that Finning's FX cost exposure, considering both the increased tractor cost charged by Caterpillar and the increased production volume, of $B_{C\$}^{C\$} = 0.50$. Assume that

Finning's expected operating margin is 20%. Find Finning's FX operating exposure to the US dollar. *Answer:* $B_{O\$}^{C\$} = [0.90 – 0.50][5] + 0.50 = 2.50.$

Note that if one assumes a negative or zero expected operating cash flow margin, then the exposure measure in equation (6-1) is meaningless. However, the operating margin concept here applies to long-term conditions, not temporary distress conditions. If a negative or zero operating margin is expected for the long haul, the operation's viability is questionable and should be reevaluated.

Let us now consider an illustrative example of the FX operating exposure of a classic importer with conversion exposure in its operating costs. Suppose, for example, that BTM Co. is a hypothetical US company with purely domestic sales. Assume that BTM has no FX revenue exposure, including no competitive or indirect exposures. Assume further that BTM has an expected operating margin of 20% and that raw materials imported from Japan make up 40% of operating costs. Thus, if 40% of BTM's operating costs have a conversion exposure of "1" to the yen, the firm's overall FX cost exposure to the yen is 0.40. Since the expected operating margin is 20%, expected revenues are 5 times the expected operating cash flows. Thus, using equation (6-1), the FX operating exposure to the yen would be [0 – 0.40][5] + 0.40 = - 1.60. This case represents the classic importer of raw materials with a foreign currency of determination. The FX cost exposure to the currency leads to a negative, or a "natural" short, FX operating exposure.

OPERATIONAL HEDGING OF FX RISK

To some extent, Finning has a choice of whether to distribute Caterpillar

tractors or Komatsu tractors, produced in Japan. If Komatsu tractors are sufficiently cheaper than Caterpillar's, that is a reason for Finning to import from Komatsu, other things equal. [Also, the presence of this competition is no doubt one reason why Caterpillar does not try to pass-through all FX changes in the value of the Canadian dollar to Finning.] But, even if there is not too much price difference to Finning between Caterpillar and Komatsu tractors at a point in time, then Finning may still favor an on-going relationship with Caterpillar, since Finning has FX revenue exposure to the US dollar but not to the Japanese yen.

The reason is operational hedging. Finning's FX revenue exposure to the US dollar is a given, an economic fact of life for Finning, since the demand by Finning's Canadian customers for tractors depends on the value of the US dollar. Thus, by distributing the Caterpillar tractors produced in the US, and thus having an FX operating cost exposure to the US dollar, Finning is hedging its FX revenue exposure to the US dollar. Finning is using operational hedging by arranging its operations so that the currency of its FX cost exposure matches the currency of its FX revenue exposure. If Finning imports tractors from Komatsu, Finning may be creating an FX cost exposure for itself to the yen, rather than hedging its FX revenue exposure to the US dollar.

To further see the effects of operational hedging, consider the following hypothetical scenario based on the Carrier Company (air-conditioners), a division of United Technologies Corporation (UTC). Let us focus on Carrier's European subsidiary, which is assumed to sell air-conditioners with a currency of determination in Europe that is exclusively the euro. In other words, the price of air-conditioners in Europe is stable in euros; there is no pass-through. For simplicity, assume that Carrier-Europe has no economic/competitive exposure and thus does not alter its production level with changes in the $/€ FX rate. Thus from UTC's viewpoint in US dollars, the FX exposure of the revenues earned by Carrier-Europe to the euro is $B_{R€}^{\$} = 1$.

The company has a choice of where to source compressors, a major input that accounts for about 30% of the cost of producing an air-conditioner. One alternative is to produce the compressors in the US, while the other choice is Ireland. Ireland is part of Euroland; thus the cost of manufacturing/sourcing a compressor in Ireland is assumed to be stable (or "fixed") in euros. Aside from compressors, we'll assume that all other inputs, especially labor, in the production of air-conditioners by Carrier/Europe are acquired in Europe and have unit costs that are "fixed" in euros. Assume that the firm's expected operating margin would be the same, 25%, regardless of from where the compressors are obtained.

If Carrier chooses to get compressors from Ireland, then the entire cost of producing an air-conditioner for the European market is "fixed" in euros. From the US dollar point of view of UTC, the FX cost exposure to the euro of Carrier-Europe would be $B_{C€}^{\$} = 1$, and the FX operating exposure would thus be $B_{O€}^{\$} = [1 – 1][4] + 1 = 1$, using equation (6-1). If Carrier chooses to get compressors from the US, then the cost of producing an air-conditioner for the European market is 70% "fixed" in euros and 30% "fixed" in US dollars. From the US dollar point of view of UTC, the FX cost exposure of Carrier-Europe to the euro would be $B_{C€}^{\$} = 0.70$, and thus the FX operating exposure would be $B_{O€}^{\$} = [1 – 0.70][4] + 0.70 = 1.90$, using equation (6-1).

Clearly, UTC's FX operating exposure from Carrier-Europe depends on where the compressors are sourced. If sourced from Europe, UTC's FX operating exposure to the euro (from the US dollar point of view) is lower, as more operational hedging is being used. Of course, there are many other considerations in the decision on where to source the compressors, including price and quality. But the focus here is only on the FX exposure considerations.

Consider the British subsidiary of a US firm that sells a product whose currency of

determination in the UK is the local currency, the pound. Ignore any other economic impact of FX changes on local pound revenues. Thus, the US parent firm's FX revenue exposure from its subsidiary's sales is 1. Let us say that at the current FX rate, the subsidiary has an expected operating margin of 25%. If all operating costs are incurred and stable in pounds with the pound, what is the US firm's FX operating exposure to the pound? *Answer, using equation (6-1): [1 – 1][R/O] + 1 = 1.*

Not every overseas subsidiary necessarily poses FX operating exposure to their parent. Consider again the US parent, Vulcan Materials. The currency of determination for the Vulcan's UK sales is not the pound but is instead the US dollar. Thus, as was pointed out in the prior chapter, the parent's FX revenue exposure to the pound, from the US dollar point of view, is 0 (roughly). Moreover, the market price for Vulcan's raw materials (scrap metal) is also relatively fixed in US dollars and thus in pounds adjusts with changes in the $/£ FX rate. Thus the costs of the UK subsidiary are also somewhat stable when viewed in US dollars and thus have an approximate FX exposure of 0 to the pound. Since the scrap metal is Vulcan's most significant operating cost, Vulcan's overall FX operating exposure of the subsidiary to the pound is insignificantly different from 0 (use equation (6-1), even though the subsidiary operates (sales and production) totally in the UK.

CONSOLIDATED FX OPERATING EXPOSURES OF A MULTINATIONAL

Assume that T Co. is a US multinational company with 3 divisions, TE in Europe, TJ in Japan, and TU in the US. Let us say that of the overall multinational company, TE is 15%, TJ is 35%, and TU is 50%.

When viewed from the US dollar perspective, each overseas division has FX operating exposure. Let us assume that the exposure of TE's

operating cash flows (measured in US dollars) to the value of the euro is 1.40, and that the exposure of TJ's operating cash flows (measured in US dollars) to the value of the yen is 1. We can think of TE as assembling and selling widgets in Europe, but sourcing some materials in the US, while TJ sources, produces and sells widgets entirely in Japan. Assume also that the operating exposure of the US division (TU) to the euro is 0.40 and to the yen is 0.25, due to the presence of foreign competition in the US. Assume for simplicity that TE has no FX exposure to the yen and TJ has no FX exposure to the euro.

The question is, what are the multinational's overall FX operating exposures to the euro and the yen? For the euro, the FX operating exposure is $B_{O€}^{\$}$ = 0.50[0.40] + 0.15[1.40] + 0.35[0] = 0.41. The multinational's overall FX operating exposure to the yen is $B_{O¥}^{\$}$ = 0.50[0.25] + 0.15[0] + 0.35[1] = 0.475.

Find T's overall FX operating exposures to the euro and the yen if TE has an exposure to the yen of 0.30 because of Japanese competition in Europe, and TJ has an exposure to the euro of 0.30 because of European competition in Japan. [These two exposures are measured from the viewpoint of T's base currency, US dollars.] *Answers:* $B_{O€}^{\$} = 0.50[0.40] + 0.15[1.40] + 0.35[0.30] = 0.515$. $B_{O¥}^{\$} = 0.50[0.25] + 0.15[0.30] + 0.35[1] = 0.52$.

EMPIRICAL ESTIMATION OF FX OPERATING EXPOSURE

This chapter mainly covers some underlying theory of FX operating exposure. Most real world firms, however, would have a difficult time measuring FX exposures analytically. Instead, a firm might estimate its aggregate FX

operating exposures with actual consolidated operating income data, as shown below for Gillette, Merck and GE.

Table 6-1 shows the estimated FX operating exposures to the yen, the pound, the German mark (as a proxy for the euro), and a crude index constructed of equal weights on the three currencies. Table 6-2 (in the appendix) shows the basic quarterly data from which the FX operating exposure estimates are made. The currency columns show quarterly historical percentage changes, while the columns for the 3 firms show the actual quarterly operating income (from Primark Disclosure Quarterly 10K Spreadhseets, 000s omitted) and the computed percentage changes.

The FX operating exposures in the Table 6-1 show high estimated exposures for GE. The estimates are relatively unreliable, however, judging from the standard errors. For example, GE's estimated FX operating exposure to the yen is 3.292 with a standard error of 2.830.

TABLE 6-1

	GILLETTE		**MERCK**		**GE**	
	$B_o^{\$}$	Std Err	***$B_o^{\$}$***	*Std Err*	***$B_o^{\$}$***	*Std Err*
Yen	***-0.306***	*0.697*	***2.711***	*1.243*	***3.292***	*2.830*
Pound	***1.208***	*0.926*	***-0.192***	*1.900*	***4.978***	*3.817*
Mark	***0.476***	*0.858*	***0.169***	*1.628*	***2.530***	*3.530*
"Index"	***0.454***	*0.997*	***1.856***	*1.866*	***5.236***	*4.033*

FACILITY LOCATION AND FX OPERATING EXPOSURE

Let us now revisit a couple of hypothetical economic situations from the prior chapter, involving UVM Co. and UVC Co., the US widget producer-exporters.

Recall first that the monopolist UVM Co. had an FX revenue

exposure to the euro of about ***1.62***, resulting from a combined impact of economic and conversion effects. Recall that if the FX rate is 1 $/€, then UVM produces 750 widgets and receives revenues, when measured in US dollars, of about $1.613 mm. At the production cost per widget of $1400, the total cost of producing widgets is ($1400)(750) = $1.050 mm, and the firm's operating cash flow in US dollars is thus $1.613 mm – $1.050 mm = $0.563 mm.

If the FX rate is 0.80 $/€, then UVM Co. produces 575 widgets and receives US dollar revenues of about $1.070 mm. Since the total cost of producing widgets is ($1400)(575) = $0.805 mm, the operating cash flow (if the FX rate is 0.80 $/€) is $1.070 mm – $0.805 mm = $0.265 mm.

If the FX rate is 0.80 $/€, the firm's operating cash flow in US dollars drops from $0.563 mm to $0.265 mm, a percentage decline of $0.265 mm/$0.563 mm – 1 = - 0.529, or – 52.9%. Since the operating cash flow level drops by 52.9% as the value of the euro depreciates by 20% (from 1 $/€ to 0.80 $/€), UVM's FX operating exposure to the euro is $B_{O€}^{\$}$ = -0.0529/-0.20 = ***2.65***. Equation (6-1) is not used to measure the FX operating exposure here because the FX cost exposure has a "volume effect", so it is easier here to measure FX operating exposure directly using percentage changes in operating cash flows.

Since production is in the US, UVM's FX revenue exposure of ***1.62*** is magnified by an "operating leverage effect", since production costs (per widget) are "fixed" in US dollars while the revenue (per widget) varies with the FX rate.

If UVM were to move production to Europe, there would be two effects on FX operating exposure. (Of course, shipping costs would drop, but that is obvious.) From the last chapter, we know that the economic incentive to adjust production and price as the FX rate changes would no longer be present. In that case, we saw that UVM's FX revenue exposure to the euro would fall from about ***1.62*** to a pure conversion exposure of 1. From this chapter, we also know that UVM would be using operational hedging, by

"fixing" production costs per widget in euros, eliminating the "operating leverage effect" of production costs (per widget) that are "fixed" in US dollars when the revenue varies with the FX rate. Thus, UVM's FX cost exposure to the euro, after moving production to Europe, would be $B_{C€}^{\$}$ = 1, and UVM's FX operating exposure to the euro, using equation (6-1), would be [1 – 1][$O^{\$}/R^{\$}$] + 1 = 1. Note (from equation (6-1)) that when the FX revenue exposure and FX cost exposure are equal, it does not matter what the operating margin is, and the FX operating exposure is equal to the FX cost exposure.

Combining the effect of eliminating the economic FX revenue exposure with the operational hedging of "fixing" widget costs in euros, UVM would reduce its FX operating exposure from about ***2.65*** to 1 by relocating its production to Europe.

Suppose UVM's widget assembly plant is moved to Euroland, but that 30% of the cost of producing a widget is still "fixed" in US dollars, as the Euroland plant sources a number of widget parts from the US. Thus only 70% of the cost of producing widgets is "fixed" in euros. Assume that the other economic exposure effects of this situation are negligible, so that UVM's revenue stream (in US dollars) from widget sales in Euroland has a simple conversion exposure of 1 to the euro. Assume an operating margin of 25%. What is UVM's FX operating exposure to the euro from the perspective of US dollars? *Answer using equation (6-1):* $B_{O€}^{\$} = [1 - 0.70](4) + 0.70 = 1.90$.

The duopolist UVC Co. would experience an even larger reduction of FX operating exposure by moving production from the US to Europe. Recall from the previous chapter that when producing in the US, UVC had an average FX revenue exposure to the euro of about ***2.63***, larger than

monopolist UVM's ***1.62***, owing to the additional economic impact of the competitive situation with FNR that UVC faces. Recall that at an FX rate of 1 $/€, UVC's production is 500 widgets and revenue in US dollars is $950K. The cost of producing 500 widgets would be ($1400)(500) = $700K and thus the operating cash flow level would be $950K - $700K = $250K.

If the FX rate is 0.80 $/€, and thus UVC produces 267 widgets, the revenue level in US dollars is $430K. The total production costs at 267 widgets would be ($1400)(267) = $374K and thus the operating cash flow level, in US dollars, would be $430K - $374K = $56K. Thus UVC's operating cash flow level changes by about $56K/$250K – 1 = -0.776, or – 77.6%, when the value of the euro drops by 20%, and UVC's FX operating exposure to the euro is about $B_{O€}^{\$}$ = -0.776/-0.20 = ***3.88***.

If UVC were to relocate the widget production process to Europe, UVC's FX operating exposure would drop from ***3.88*** to 1. The drop would be for two reasons. First, the impact of the competitive exposure on revenues would be eliminated, lowering FX revenue exposure from 2.63 to 1. Second, widget production costs would be "fixed" in euros instead of US dollars, eliminating the operating leverage magnification effect and implementing the operational hedging effect. Together, the UVC and UVM scenarios demonstrate that other things equal, *the FX exposure-reducing benefits of operational hedging may be greater when a local competitor is present*.

The scenarios demonstrate an additional important point concerning managing corporate FX exposure operationally. Although the strategy of matching costs with revenues in terms of currency reduces the FX operating exposure, even when *all* operating costs are "fixed" in euros, the FX operating exposure is not 0. In fact, FX operating exposure cannot be made to go lower than 1 via operational hedging, given an FX revenue exposure of 1. This situation points out that complete hedging of the FX exposure cannot be handled operationally. Instead, financial hedging will be necessary to complete the job, if eliminating the impact of FX changes is desired. Financial

hedging of a company's remaining operating exposure, on top of whatever amount operational hedging a firm chooses, will be addressed in the next chapter.

FX Operating Exposure of a Foreign Subsidiary

Let us now reconsider the widget company FNR, the French competitor of UVC. If UVC produces in the US and exports to France, we already know from the prior chapter that at an FX rate of 1 $/€, FNR produces 500 widgets and sells them for €1900 per widget for expected revenue of €950K. Since costs are €1400 per widget, FNR's expected operating cash flows are 500(€1400) = €700K, and thus operating cash flows (in FNR's home currency of euros) are €950K - €700K = €250K. Recall also that at 0.80 $/€, which is 1.25 €/$ in direct terms from FNR's euro point of view, FNR's output is 617 widgets, and revenues are €2016(617) = €1,244K. FNR's total costs are 617(€1400) = €863.8K, and thus operating cash flows are €1,244K - €863.8K = €380.2K. FNR's operating cash flows rise from €250K to €380.2K, an increase of about 52%, when the value of the foreign currency (the US dollar) rises from 1 €/$ to 1.25 €/$, an appreciation of 25%. Thus FNR's FX operating exposure to the US dollar is $B_{O\$}^{€}$ = 0.52/0.25 = ***2.08***. Note that FNR has an "operating leverage" effect since its revenues have FX exposure to changes in the value of the US dollar while its cost per widget is fixed in euros. FNR's revenue exposure, measured last chapter as $B_{R\$}^{€}$ = 1.25.

Now we ask the question, if FNR were acquired by a US multinational, what would be the parent's FX operating exposure to the euro from owning FNR? The key pieces of information are that FNR has operating income of €250K, when the FX rate is 1 $/€, and €380.2K, when the FX rate is 0.80 $/€. Thus, measured in US dollars, FNR's operating profits are €250K(1 $/€) = $250, when the FX rate is 1 $/€, and €380.2K(0.80 $/€) = $304.16K,

when the FX rate is 0.80 $/€. Thus FNR's owner would see operating profits, measured in US dollars, rise from $250K to $304.16K, a percentage change of 21.66%, when the euro depreciates in value by 20%. The parent's FX operating exposure to the euro is $B_{O€}^{\$}$ = 0.2166/-0.20 = ***- 1.08***.

Notice that FNR's US owner has a *negative* FX operating exposure to the euro! The reason is that FNR competes with a US company (UVC), producing in the US and exporting to France. When the value of the euro falls, FNR makes more profits. In fact, since the sensitivity of FNR's profits (in euros) to FX changes is 2.08, the increase in profits swamps the fact that the profits are worth less in US dollars when the euro depreciates. Thus when the euro falls in value, the US owner of FNR has higher operating profit in US dollars, and vice versa. Thus the US owner has a negative FX operating exposure to the euro, despite the fact that FNR is its overseas subsidiary.

If UVC were to move its production over to Euroland, then FNR would produce and sell 500 widgets regardless of the FX rate, as shown in the prior chapter. FNR in this case would have stable operating profits of €250, and no FX operating exposure to the US dollar. Thus a US owner of FNR would now have an FX operating exposure of 1 to the euro. When the value of the euro drops by 20% to 0.80 $/€, the operating profits of FNR's US owner would drop by 20% in US dollar terms.

Thus a US owner of the French widget-maker, FNR, will have an FX operating exposure to the euro of 1 if FNR's US competitor produces locally in France, and an FX operating exposure of – 1.08 to the euro if FNR's US competitor produces in the US!

OPERATING FLEXIBILITY

The UVM and UVC scenarios above are simple in that only export operations are considered. To add another layer of realism, consider the AEM scenario,

where AEM sells widgets in *both* the US and France. If AEM has a plant in Europe to produce the widgets, then AEM is reducing its FX operating exposure by operational hedging, but there may also be another gain to this arrangement in the form of what is called *operating flexibility*. Operating flexibility could be achieved if the US and French production facilities have excess capacity. If so, then AEM has the flexibility to choose the lower-cost production site as the euro fluctuates in value.

For example, the more the euro appreciates in value relative to the US dollar, the more expensive that production in France becomes. If there were excess capacity in the US plant, AEM could reduce the level of widget finishing in the French plant and increase it in the US plant. Thus some of the finished widgets from the US plant would be exported to France. On the other hand, if the euro depreciates in value enough to make widget finishing cheaper in France than in the US, AEM could go back to finishing its European widgets in France. Moreover, if there were excess capacity in the French plant to finish more widgets than needed for the European market, AEM might even save costs by shipping components from the US to France for finishing, and then shipping the finished widgets back to the US market.

PROS AND CONS OF FX HEDGING

While operational hedging and financial hedging are two distinct, and sometimes complementary, ways to manage FX risk, there is a fundamental question of whether a company should hedge FX exposure at all.

Some companies have decided not to worry about FX exposure. One reason given is that the cash flows are uncertain for so many other reasons besides exposure to FX changes, that hedging FX risk really does not reduce overall risk very much. (This is sometimes called the Copeland/Yoshi argument.) Another argument is the “long-run” view that the impact of FX

changes will “wash out” over time, put forth by Froot in the context of portfolio hedging of FX changes. The argument is that FX changes tend to go up and down, and thus the firm’s cash flows go up and down, but good years will make up for bad years. Finally, there is a theoretical argument that managers should not be too presumptuous about the wishes of the shareholders for hedging. The argument is that many shareholders may want the FX exposure in a company’s stock for whatever reasons. Any shareholders that do not like the FX exposure are free to manage it themselves via financial hedging with forward FX contracts and the like. This argument is taken to an extreme when perfect markets are assumed, in which event shareholders have the same information as managers and thus are equally as equipped to hedge FX risk as a portfolio exercise.

Finally, note that finance theorists have argued that in efficient markets, corporate FX hedging does not impact the value of the firm. Of course, financial hedging of FX exposure will affect the future value of the firm, but the theorists mean that it does not affect the current value of the firm whether the firm hedges or not.

On the other hand, many firms have chosen to reduce or eliminate the impact of FX exposure by operational hedging, financial hedging (as shown next chapter), or both. Merck at one time was an example of a firm whose corporate strategy does not allow it to weather ups and downs that “wash out” over time and in the long run. The reason was that the firm had to plan to have a minimum cash flow stream (for certain) to support an R&D level that will keep the company competitive with other pharmaceutical firms. Merck analyzed operational hedging versus financial hedging possibilities, and concluded that operational hedging by producing overseas would not work for it, given the need to centralize R & D efforts. Hence Merck employed financial hedging.

The stabilization of the cash flow stream, to the greatest extent possible, appears to be the primary motivation behind many corporate FX

hedging programs. Since “Wall Street” values a stability feature in dividends and reported earnings (in addition to a growth feature), firms believe that stabilizing the cash flow stream has a desirable impact on stock value. Also, stabilizing the cash flow stream reduces the potential costs of financial distress. Firms have also argued that shareholders cannot be expected to hedge FX exposure on their own, if they so desire. The argument is that the FX exposure is too complex for shareholders to understand, and that trying to provide shareholders with the information to measure the exposures would be too expensive and would also reveal strategic information to competitors. There is evidence that hedging may be beneficial to the value of the firm by reducing the noise (market inefficiency) in stock prices.

SUMMARY

This chapter has covered the topic of a company’s FX operating exposure and is potential sources. Also covered was the concept of operational hedging. One form of operational hedging is locating production in a foreign country. This strategy also has an impact on the economic exposure of revenues. The next chapter extends the FX exposure concept to company’s equity value, and brings in currency denomination of debt and financial hedging.

Glossary

FX Cost Exposure: The variability in a firm’s ongoing operating costs, caused by uncertain FX rate changes.

FX Operating Exposure: A type of long-term exposure that focuses on the variability in a firm's ongoing operating cash flow stream, caused by uncertain FX rate changes.

Operating Cash Flow: Revenues (from sales) minus operating costs.

Operational Hedging: The arranging of a firm's cost exposure to match the currency of its revenue exposure.

Operating Leverage Effect: The principle that a relatively higher level of fixed costs results in greater sensitivity of operating income to fluctuations in revenues.

Discussion Questions

1. Explain in words why a classic exporter may have a positive FX operating exposure to a currency and why a classic importer would be likely to have a negative FX operating exposure.

2. Explain in words the circumstances for how an overseas subsidiary would *not* impose any FX operating exposure to its parent. (Hint: Use the Vulcan scenario discussed in the chapter.)

3. Explain in words how a company can have an FX operating exposure greater than 1. Could a purely domestic company, with no foreign trade or FX transactions, have an FX operating exposure greater than 1? Explain.

Problems

1. Find a company's FX operating exposure to the euro if the FX revenue exposure to the euro is 1, the FX cost exposure to the euro is 0.50, and the expected operating margin is 0.10. What would be the percentage change in the expected base currency operating cash flows if the euro depreciates by 7% relative to the company's base currency?

2. Laker Airways, discussed in the previous chapter, had more FX exposure than the indirect negative revenue exposure to the US dollar. Laker also had significant US dollar costs in the form of airplanes ordered from an American manufacturer and priced (currency of determination) in US dollars. When the US dollar appreciated, not only did Laker lose customers (the economic effect on revenues), but a significant portion of its costs had conversion exposure. Let us fabricate some numbers. Let the expected operating margin be 25%. Let Laker's FX revenue exposure be -0.35 to the US dollar, and let the US dollar airplane costs be 60% of expected operating costs. If the rest of Laker's operating costs are fixed (with respect to FX changes) in pounds, what is the company's FX operating exposure to the US dollar?

3. Consider the US subsidiary of a UK multinational selling products in the US with a currency of determination of the US dollar. Thus, assuming no other economic effects, from the UK parent's point of view in pounds, the company has FX revenue exposure of its subsidiary's sales to the US dollar of 1. Assume that the subsidiary has an expected operating margin of 25%. If all the subsidiary's operating costs are incurred in the US and are "fixed" (with respect to FX changes) in US dollars, what is the parent's

FX operating exposure to the US dollar due to the subsidiary?

4. Consider a Japanese exporter that sells products in the US, and competitive forces cause the selling price to be 60% determined by the US dollar and 40% by the yen. Assume no volume effects of FX changes. Let us say that at the current FX rate, the firm has an expected operating margin of 25%. The firm imports raw materials from the US, with the US dollar as the currency of determination, constituting 30% of the firm's expected operating costs. If all other operating costs are incurred in Japan (and not subject to any FX exposure), what is the firm's FX operating exposure to the US dollar?

5. Suppose that the US firm, RAM Co. has an expected operating cash flow margin of 12.5%. Assume that the impact of Japanese competition is such that the product's currency of determination is the 40% Japanese yen (and 60% the US dollar), resulting in a FX revenue exposure of 0.40 to the yen. Assume that raw materials imported from Japan make up 30% of operating costs. Thus, 30% of operating costs have an FX conversion exposure of 1. What is RAM's FX operating exposure to the yen?

6. Suppose that UVM's widget assembly plant is moved to Euroland, but that 20% of the cost of producing a widget is still "fixed" (with respect to FX changes) in US dollars, as the Euroland plant sources a number of widget parts from the US. Thus only 80% of the cost of producing widgets is "fixed" in euros. Assume that the economic exposure effects of this situation are negligible, so that UVM's revenue stream from widget sales in Euroland has a simple conversion exposure of 1 to the euro. Assume an operating margin of 25%. What is UVM's FX operating exposure to the euro from the perspective of US dollars?

7. Use the information in the text on the multinational firm, T. Find T's overall FX operating exposures to the euro and the yen, assuming that TE has an FX operating exposure to the yen of 0.30 due to Japanese competition in Europe, and TJ has an FX operating exposure to the euro of 0.30 due to European competition in Japan. [These two FX operating exposures are measured from the viewpoint of T's base currency, US dollars.]

Answers to Problems: 1. 5.50; 38.5%. 2. – 3.20. 3. 1. 4. 1.50. 5. 1.10. 6. [1 – 0.80](4) + 0.80 = 1.60. 7. $B_{O€}^{\$}$ = 0.50[0.40] + 0.15[1.40] + 0.35[0.30] = 0.515. $B_{O¥}^{\$}$ = 0.50[0.25] + 0.15[0.30] + 0.35[1] = 0.52.

COMPREHENSIVE SCENARIOS (See Other Chapters)

SCENARIO 1: AEM

AEM currently produces export widget components at a facility in Alabama. The components currently account for 60% of the cost of producing a widget, or $780 per widget. The components are sent to a plant in Virginia, where they are assembled and then shipped directly into the European export market. This assembly is the other 40% of the current cost of producing a widget in the US, or $520 per widget. What is AEM's FX operating exposure to the euro?

Answer: ***2.642***. When AEM sells 700 units, operating costs are 700($1300) = $910,000, and operating profit is $1.40 mm - $910,000 = $490,000. When AEM sells 537.5 units, operating costs are 537.5($1300) = $698,750, and operating profit is $929,875 – 698,750 = $231,125. The % change in operating profit is $231,125/490,000 – 1 = -0.5283 = - 52.83%. FX operating exposure is –0.5283/-0.20 = 2.642.

AEM actually consists of 2 divisions. There is a US division that distributes widgets solely in the US, and with component and assembly plants west of the Mississippi River. The economic value of the US division is $100 mm, and the division is assumed to have no FX exposure at all to the euro. The export division was described above. Assume further that the export division has an economic value of $50 mm. What is the FX operating exposure of the entire company to the euro?

Answer: ***0.88***. Since 2/3 of the company (by value) has no FX exposure to the euro while 1/3 has an FX operating exposure to the euro of 2.642, the overall FX operating exposure to the euro is 0.667(0) + 0.333(2.642) = 0.88.

AEM is considering selling the export division's assembly plant in Virginia, building/buying an assembly plant in Germany, and in the future, ship the components to the plant in Germany for final assembly. Assume the projected cost of assembly of a widget in Germany is €520. Assume the FX rate is currently 1 $/€. Find AEM's export division's new FX operating exposure to the euro, using a depreciation of 20% of the euro as the "what if" scenario. Be sure to consider the new economic impact on FX revenue exposure as well as the operational hedging.

Assume that AEM moves the assembly process of exported widgets to Germany, as described above, while the FX rate is still 1 $/€. Assume that the economic value of the export division immediately rises (at time 0) from $50 mm to $60 mm. [The NPV of the capital budgeting decision to relocate the assembly is $10 mm.] Now again consider AEM in the whole, including both its US operation and its export operation. What is the FX operating exposure of the entire company to the euro?

Answers: ***2.037; 0.7639***. Setting MR of 1 $/€ (€2700 – 2Q) equal to MC of $780 + 1 $/€(€520), results in Q = 700. Thus the price charged per widget is €2700 – 700 = €2000. In US dollars, the exporting revenue is 1 $/€(€2000)(700) = $1.4 mm. Operating profits are $490,000, as in #2. Now assume the euro depreciates by 20%. Setting MR of 0.80 $/€ (€2700 – 2Q) equal to MC of $780 + 0.80 $/€(€520) results in Q = 602.50. Thus the price charged per widget is €2700 – 602.50 = €2097.50. In US dollars, the exporting revenue is 0.80 $/€(€2097.50)(602.5) = $1,010,995. Operating costs, measured in US dollars, are 602.50($780 + 0.80$/€(€520)) = $720,590, and operating profit is $290,405. AEM's export revenues fall by $1,010,995/1.4 mm – 1 = - 0.2779, or – 27.79%, when the euro depreciates by 20%. AEM's export division's FX revenue exposure division to the euro is –0.2779/-0.20 = 1.389. AEM's export division's operating profit falls by $290,405/490,000 – 1 = - 0.4073, or – 40.73%, when the euro depreciates by 20%. AEM's export division's FX operating exposure to the euro is –0.4073/-0.20 = 2.037.

The FX operating exposure the euro for entire company is (10/16)(0) + (6/16)(2.037) = 0.7639.

SCENARIO 2: AWC/EWC

Review the details of the scenario in the previous chapter. What is AWC's FX operating exposure to the euro and EWC's FX operating exposure to the US dollar?

Answers: ***4.306; 2.084***. When the FX rate is 1 $/€, AWC has operating profits of $720K - 400($1400) = $160K. When the FX rate is 0.80 $/€, AWC has operating profits of $255,560 – 166.67($1400) = $22,222., a percentage change of –0.861, or – 86.1%. Since the euro fell by 20% and AWC's operating profits fell by 86.1%, AWC's FX operating exposure to the euro is 4.306. When the FX rate is 1 $/€, EWC has operating profits of 500(€1800 - 1300) = €250K. When the FX rate is 0.80 $/€, EWC has operating profits of 616.67(€1916.67 - 1300) = €380,282, a percentage change of 0.521, or 52.1%. Since the US dollar rose by 25% and EWC's operating profits rose by 52.1%, EWC's FX operating exposure to the US dollar is 2.084.

What would be the FX operating exposure to the euro of a US owner of EWC?

Answer: ***- 1.084***. When the FX rate is 1 $/€, EWC's profits of €250K are worth $250. When the FX rate is 0.80 $/€, EWC's profits of €380,282 are worth $304,224. Measured in US dollars, EWC's profits changed by $304,224/250,000 – 1 = 0.2169, when the euro depreciated by 20%. The FX operating exposure to the euro, of a US owner of EWC, is - 1.084.

GWC

Suppose that AWC merges with EWC to form GWC ("Global Widget Company"). Assume that AWC's economic value is $80 mm, while EWC's economic value (in US dollars) is $100 mm. From the US dollar point of view, what is the FX operating exposure of the new company to the

euro.

Answer: ***1.312***. (0.80/1.80)(4.306) + (1/1.80)(-1.084) = 1.312.

Note that the merged company, GWC, may also obtain some benefit from operating flexibility, if there is any excess capacity at AWC or EWC. This operating flexibility may make the "whole worth more than the sum of the parts", and it also may make the overall FX exposure of GWC somewhat different than 1.312.

APPENDIX

Kodak Joins Hedging Club as Euro Nips Revenue: Currency Focus

By Mark Tannenbaum

New York, April 28 (Bloomberg) -- A weak euro cost Eastman Kodak Co. millions of dollars in the first quarter. It's not taking the same risk again.

The world's largest photography company, which generates about a quarter of its revenue in Europe, this month joined a list of major U.S. firms hedging to protect themselves against the plunging currency.

``It's becoming the in thing these days,'' said Bob Brust, chief financial officer of Rochester, New York-based Kodak. ``I would have never guessed the euro would be down where it is.''

Merck & Co., Johnson & Johnson, and Minnesota Mining and Manufacturing Co. are among other companies that have hedged euro exposure, according to their most recent filings.

Kodak is also not alone in reporting revenue declines caused by the sagging euro, which touched a record low today and has lost 22 percent of its value against the dollar since its debut last year.

Procter & Gamble Co. said the weak euro contributed to a 2 percent sales decline in the January-March quarter, and DuPont Co. said the

currency was the primary reason for a 10 percent drop in revenue from Europe in dollar terms.

Gerber Scientific Inc., a South Windsor, Connecticut maker of automated manufacturing systems, will cut jobs and warned profit will drop in the quarter ending April 30, partly because of the euro.

Game Plan

The currency's decline, and recent accounting changes that make hedging less cumbersome, ``are causing a lot of CFOs and treasurers to say, `We've got to have a game plan to deal with this unpredictable currency market,''' said Anil Agarwal, a currency specialist at Brown Brothers Harriman & Co.

In Kodak's case, a euro worth about 95.5 cents, its level on March 31, would cut earnings 22 cents a share for the full year, the company said.

It began using so-called forward contracts this month that lock in levels more favorable than current rates. The euro has dropped another 5 percent since the start of the second quarter.

Kodak was aggressive in hedging currencies in the early 1990's, then slimmed down its hedging program after Harry Kavetas became chief financial officer around the start of 1994, a spokesman said. Kavetas was CFO until his death last year.

The euro's 9.5 percent slide this year came after firms such as Goldman, Sachs & Co. and Deutsche Bank AG predicted in December the currency would rise to about $1.10 or $1.12 in the first quarter.

Misplaced Optimism

Instead, the euro sank to its weakest levels yet, touching as low as 90.33 U.S. cents and 96.505 yen this week. It started out last year at $1.17 per euro and 133 yen, amid optimism that even had some analysts suggesting it would supplant the dollar as the currency of choice on world financial markets.

The euro has been pummeled as growth in the 11-nation single currency region failed to pick up as quickly as some investors and analysts had expected.

At the same time, the U.S. economy keeps steaming ahead, luring investors. The Federal Reserve is also expected to keep U.S. rates higher than those in Europe, and that rate gap makes dollar-denominated deposits more attractive.

European Central Bank officials have repeatedly said the euro will strengthen in the months ahead, as the U.S. economy eventually slows and euro-region growth picks up.

Some corporate treasurers agree. We take a long-term view," said Alan Resnick, treasurer at Bausch & Lomb Inc., the Rochester, New York maker of eye care products. ``At some point the euro is going to turn around."

Don't Panic

While the euro's decline can reduce the company's revenue in dollar terms,

that is offset to some degree by lower manufacturing costs in Europe created by the drop, Resnick said.

Some analysts also advised against panicking as the euro spirals down, adding that corporations must be careful about what kind of financial instruments they choose.

Firms that opted not to hedge euro exposure till now might be better off avoiding locking in a rate at such low levels, said Agarwal at Brown Brothers. He suggested the more flexible approach of using options to hedge, rather than locking in a rate through forward contracts.

Agarwal said by using forward contracts, ``you could get killed twice,'' by first getting hurt from the euro's descent, and then also missing out on any rebound, he said.

To use options to protect a sum of $1 million in euros from a decline in the euro below the current rate for the next six months, it would typically cost about 2.5 percent, or $25,000, he said.

In one sign of how much hedging get done worldwide, instruments such as forward contracts account for about 60 percent of the $1.5 trillion in daily foreign exchange transactions, according to figures from the Bank for International Settlements.

TABLE 6-2

	Yen	Pound	Mark	"Index"	GILLETTE		MERCK		GE	
					Op. Income	%Change	Op. Income	%Change	Op. Income	%Change
Dec-89	0.010	0.016	0.122	0.049	172000		552300		718000	
Mar-90	-0.063	0.018	0.019	-0.009	206600	0.201	602700	0.091	1396000	0.944
Jun-90	-0.003	0.053	0.013	0.021	172800	-0.164	696800	0.156	1621000	0.161
Sep-90	0.110	0.099	0.072	0.094	188100	0.089	673800	-0.033	3208000	0.979
Dec-90	0.034	0.023	0.048	0.035	205200	0.091	678100	0.006	-748000	-1.233
Mar-91	-0.025	-0.052	-0.071	-0.049	220700	0.076	720500	0.063	1515000	-3.025
Jun-91	-0.017	-0.094	-0.096	-0.069	201300	-0.088	814300	0.130	1668000	0.101
Sep-91	0.041	0.047	0.053	0.047	208300	0.035	790400	-0.029	3379000	1.026
Dec-91	0.049	0.058	0.083	0.064	231300	0.110	784500	-0.007	-911000	-1.270
Mar-92	-0.036	-0.057	-0.059	-0.051	248500	0.074	816700	0.041	1570000	-2.723
Jun-92	0.047	0.076	0.057	0.060	222100	-0.106	931700	0.141	1639000	0.044
Sep-92	0.035	-0.005	0.084	0.038	236600	0.065	892800	-0.042	1639000	0.000
Dec-92	-0.012	-0.160	-0.083	-0.085	259900	0.098	850300	-0.048	679000	-0.586
Mar-93	0.060	-0.058	-0.039	-0.012	262400	0.010	890300	0.047	1467000	1.161
Jun-93	0.089	0.032	-0.005	0.039	244200	-0.069	987400	0.109	812000	-0.446
Sep-93	0.017	0.011	0.020	0.016	266800	0.093	1006400	0.019	1783000	1.196
Dec-93	-0.039	-0.022	-0.052	-0.038	313900	0.177	1029800	0.023	1929000	0.082
Mar-94	0.046	0.000	0.012	0.019	297100	-0.054	1036500	0.007	1549000	-0.197
Jun-94	0.025	0.023	0.039	0.029	293000	-0.014	1245700	0.202	2285000	0.475
Sep-94	0.038	0.026	0.050	0.038	297700	0.016	1211000	-0.028	1971000	-0.137
Dec-94	-0.014	-0.005	-0.014	-0.011	338900	0.138	1105800	-0.087	7975000	3.046
Mar-95	0.107	0.027	0.118	0.084	329100	-0.029	857900	-0.224	2121000	-0.734
Jun-95	0.069	-0.003	0.003	0.023	321900	-0.022	1210400	0.411	2636000	0.243
Sep-95	-0.158	-0.022	-0.040	-0.074	338100	0.050	1213200	0.002	2433000	-0.077
Dec-95	-0.013	-0.012	0.014	-0.004	382200	0.130	1314100	0.083	2751000	0.131
Mar-96	-0.039	-0.009	-0.025	-0.024	374600	-0.020	1133500	-0.137	2378000	-0.136
Jun-96	-0.028	0.009	-0.033	-0.017	369400	-0.014	1331100	0.174	2896000	0.218

Sep-96	-0.009	0.011	0.013	0.005	394700	0.068	1346400	0.011	2765000	-0.045
Dec-96	-0.036	0.067	-0.029	0.001	910600	1.307	1369900	0.017	3036000	0.098
Mar-97	-0.072	-0.033	-0.084	-0.063	466000	-0.488	1352300	-0.013	4386000	0.445
Jun-97	0.074	0.022	-0.019	0.026	517500	0.111	1524300	0.127	5167000	0.178
Sep-97	-0.055	-0.027	-0.033	-0.038	575100	0.111	1463600	-0.040	4866000	-0.058
Dec-97	-0.068	0.036	0.004	-0.009	765400	0.331	1523500	0.041	3084000	-0.366
Mar-98	0.005	0.001	-0.026	-0.007	434000	-0.433	1439600	-0.055	5016000	0.626
Jun-98	-0.080	-0.007	0.019	-0.023	595000	0.371	1587200	0.103	5819000	0.160
Sep-98	0.044	0.019	0.055	0.039	575000	-0.034	717100	-0.548	5670000	-0.026
Dec-98	0.149	-0.007	0.017	0.053	720000	0.252	2896400	3.039	6341000	0.118
Mar-99	-0.020	-0.030	-0.071	-0.040	447000	-0.379	1786400	-0.383	8077000	0.274
Jun-99	-0.010	-0.016	-0.047	-0.024	492000	0.101	1980900	0.109	1553000	-0.808
Sep-99	0.129	0.019	0.012	0.053	590000	0.199	1990000	0.005	6277000	3.042