Chapter -11

The Management of Short-Term Liabilities: Introduction

In Chapter 10, we developed methods of measuring the aggregate liquidity of the firm. These measured the relative nearness to cash of the firm's short-term assets versus the possible needs for cash from the firm's short-term liabilities. Given the availability of these measures, the firm's planned structure of assets, and the firm's target capital structure, the firm's management can determine its target level of aggregate liquidity.

In this chapter, we begin discussion of the structuring of the firm's current liabilities. This structure should achieve two goals. First, it should provide the necessary amounts of short-term financing. Second, it should be in keeping with the target level of aggregate liquidity. The challenge in the management of current liabilities is to *achieve these goals at a minimum cost.*

Before proceeding with the discussion of current liability structuring, one clarification of the material in the prior chapter is necessary. In that chapter, the firm's projected financial statements were used in two ways: to provide a basis for the measurement of aggregate liquidity and to estimate the amount of required financing. It should be recognized that, in the second application, the amount of financing estimated is only an approximation, since the firm's financial statements are computed on an *accrual basis* while the actual amount of financing needed must be calculated on a *cash basis*. This approximation was made in the interests of simplicity. More accurate estimates of the firm's cash financing needs can be obtained via cash forecasting, a topic that was discussed in Chapter 3.

This chapter covers two major topics. First, some commonly used sources of short-term financing for firms are listed and discussed. The availability and cost of these sources, we will see, varies considerably from firm to firm and from source to source. Second, a technique (the *sequential method*) for generating a minimum-cost structure of current liabilities in some situations is presented.

WHY USE SHORT-TERM FINANCING?

Before moving on to these major topics, it is useful to ask why firms use short-term financing at all. In considering this issue, it is useful to think of current debt as composed of two parts: *temporary* short-term financing and *permanent* short-term financing. Temporary short-term financing is used to provide funds for transient cash flow shortages, such as those caused by seasonality in sales. When it is cheaper to borrow funds to cover such deficits than to keep a reserve of funds against them, temporary borrowings are attractive to the firm.

Permanent short-term borrowings are another matter. They are used by firms on a continuing basis and are refinanced with new short-term debt as they mature. There are at least three reasons for the use of permanent short-term borrowings. First, as discussed in Chapter 5, there are minimum amounts of accounts payable and of accruals. It is uneconomical for the firm to reduce short-term debt below those levels. Second, as long as the yield curve is upsloping, the expected interest expense of short-term debt is less than that on long-term debt, though the use of short-term debt is riskier (this effect was discussed in Chapter 10). Finally, financing with permanent short-term debt allows the firm substantial *flexibility* in its package of permanent financing. Unlike long-term debt, the amount of short-term debt can be easily expanded or contracted to meet business conditions and opportunities. This flexibility is a big advantage to the firm in dealing with uncertain conditions in product and capital markets. For all these reasons, it makes sense for firms to use some permanent short-term debt financing. The next section provides discussion of the important sources of short-term financing for firms.

SOURCES OF SHORT-TERM FINANCING

In attempting to obtain an advantageous structure of short-term liabilities, the firm must consider its alternative sources of short-term debt. The characteristics of these sources vary considerably. They are of different maturity and cost. Also, some types of short-term financing are available only to certain firms. In this section, we discuss the availability, cost, maturity, and other characteristics of nine common types of short-term financing:

1. Commercial paper
2. Bankers' acceptances
3. Accounts payable
4. Accruals
5. Unsecured credit line borrowings
6. Unsecured notes and term loan borrowings

7. Secured borrowings with marketable securities as collateral
8. Secured borrowings with accounts receivable as collateral
9. Secured borrowings with inventory as collateral

The first six of these are unsecured borrowings, while the last three involve secured transactions. Together, these sources of short-term funding comprise the vast majority of the current debt of most business firms.

Commercial Paper We briefly discussed this financial instrument and the following one (bankers' acceptances) in Chapter 2 as possible investment instruments for the firm's excess cash. Commercial paper is discounted large-denomination unsecured debt sold by corporations for financing purposes. Commercial paper has been one of the fastest growing sources of short-term financing for major firms. Most of the participants in the commercial paper market are bank holding companies, finance companies, or industrial firms. While longer maturities are possible, the most common maturity for commercial paper is 30 days.[1] Firms issuing commercial paper must have lines of credit available from their banks to substitute for their commercial paper borrowings if needed.

To use commercial paper to obtain short-term financing, the firm first applies for a commercial paper rating from one or more of the major rating services (Fitch, Moody's, or Standard and Poors). Firms that are not able to obtain satisfactory ratings may obtain a bank-guaranteed letter of credit which obligates the bank to make good on the commercial paper if the issuing firm does not. The dual responsibility of the firm and the bank is then sufficient to allow access to the market. Once the firm has obtained either the necessary rating or bank support, it must decide whether to sell its paper directly to investors or to use a commercial paper dealer. Large firms generally place their commercial paper directly with investors, while smaller firms use dealers.

The interest rate on commercial paper financing is generally below the banks' prime rate of interest. Even allowing for the cost of the required backup lines of credit and payments to rating agencies, the net cost of borrowing via commercial paper is usually cheaper than bank borrowing; this accounts for its substantial use.[2] However, there are some disadvantages in the use of

[1]For instruments with maturities longer than 270 days, the Securities and Exchange Commission requires a securities registration. To avoid the expensive and time-consuming registration process, commercial paper is not issued in maturities longer than this.

[2]The difference between bank lending rates and commercial paper rates stems from banks' reserve requirements and operating costs. If banks borrow to relend to firms, they must keep part of their funds in reserves. This, along with the costs of operating the bank, keeps the banks' lending rates above their cost of borrowing. Borrowers can avoid these higher bank lending rates by going directly to the money markets and borrowing via commercial paper.

commercial paper for financing. For all intents and purposes, only the largest firms and their financing subsidiaries can use it. Refunding is impractical, so once the paper is outstanding it generally remains so until maturity; this limits the flexibility of the issuing firm with respect to this financing. Still, for firms that are large enough to participate in this market, commercial paper is often a very advantageous form of short-term financing.

Bankers' Acceptances Like commercial paper, bankers' acceptances are negotiable discounted short-term instruments.[3] However, for bankers' acceptances the default risk *never* rests solely with the issuing entity; a bankers' acceptance is *always* backed by both a bank and a firm. This dual responsibility makes bankers' acceptances very safe, and consequently their interest cost is quite low.

Most bankers' acceptances are generated in connection with international trade. They exist because of two problems faced by exporting firms. First, terms of sale in international commerce are much longer than terms of sale for domestic transactions. Second, many firms that sell to buyers in other countries do not have the necessary expertise in the nondomestic accounting conventions, business practices, and so forth necessary to make reliable credit-granting decisions on export customers. Further, even if the exporting firm has the necessary expertise, credit information on international customers may be hard to obtain.[4] Consequently, selling firms need a method of obtaining guaranteed payment for goods and of receiving this payment in a reasonable amount of time.

The bankers' acceptance is a response to this need. The typical series of events that generates a bankers' acceptance starts once the exporter and importer agree to a shipment. The importer then arranges with its bank for a *letter of credit* to be issued. This letter of credit commits the importer's bank to make payment for the goods once proper documentation is presented. The exporter then ships the goods and forwards the shipping documents and a *time draft* through the exporter's bank to the importer's bank. (A time draft is similar to a note; it is a promise to pay a certain sum at a certain time.) The importer's bank then *accepts the draft* and sends the shipping documents to the importer who uses them to claim the goods when they arrive. The accepted draft is called a bankers' acceptance and obligates the importer and the importer's bank to make a set payment at a set time. At this point, the exporter usually sells the draft to the importer's bank on a discounted basis and takes the cash. The bank may resell the draft or hold it to maturity.

[3]Good discussions of both bankers' acceptances and commercial paper can be found in K. Brown and B. Summers, eds., *Instruments of the Money Market*, Fifth Edition (Richmond: Federal Reserve Bank of Richmond, 1981).

[4]We will discuss these problems in making international credit-granting decisions in Chapter 13.

The most popular maturity for bankers' acceptances is 90 days, although maturities of as short as 30 days or as long as 180 days are common. Bankers' acceptances are usually issued by moneycenter banks and are traded through dealers. Because both the importer and the importer's bank stand behind the instrument, interest rates on bankers' acceptances lie between the rate on treasury bills of similar maturity and the prime rate. However, borrowers must also pay a fee to their bank of about 1 percent per year for services in connection with generating these acceptances. Still, even with this fee, the net cost of borrowing via bankers' acceptances is often less than the prime rate.

Accounts Payable The trade credit granted from one firm to another for the purchase of goods provides more financing to businesses than all the other sources of short-term financing put together, including bank borrowing. The ready availability of trade credit relative to bank credit stems partly from the different margins experienced by selling firms and by banks in granting credit. The margin for banks is the difference between the interest cost of funds raised and the interest income from loans; this difference often averages about 3 percent. For firms, however, the margin is the difference between the selling price and the cash cost of the goods sold, which may be twenty percent or more. Consequently, firms often find it quite profitable to grant credit to buyers whose probability of default is sufficiently large that banks would deny credit. Further (as discussed in Chapter 5), even if buyers preferred to purchase goods for cash, imperfect knowledge by buyers of the quality of sellers' goods and the inconvenience of handling cash make the use of a minimum amount of trade credit almost mandatory. The ready availability of trade credit, along with the minimum mandatory use of this debt, accounts for its prevalence in providing short-term financing.

Strategies for the use of trade credit as a financing vehicle revolve around *the payment dates of invoices*. The later the firm pays, the more financing will be generated. For example, suppose the firm purchases $100,000 per year in goods from a particular supplier, with these purchases evenly distributed throughout the year. If this supplier is paid 10 days from the date of the invoice, the average amount of financing will be $2,777.78 (equal to $100,000 times 10/360). If the supplier is paid 30 days from the date of the invoice, the average financing will be $8,333.33 (equal to $100,000 times 30/360). This difference in the level of accounts payable is due solely to the different payment policies. Three typical policies for the payment of invoices (from the soonest possible payment to the latest) are:

1. Pay on the discount date of the invoice if the supplier offers a cash discount as part of its terms of sale.

2. Pay on the due date of the invoice.
3. Pay after the due date of the invoice.[5]

Let us discuss each of these policies in turn. Under the first policy, payment is made on *the latest date that will allow the buyer to take the cash discount* offered in the sellers' terms of sale. This usually entails mailing the check on the discount date; many U.S. firms have traditionally used the postmark date of checks as the date for assessing whether terms of sale have been honored.[6] Under this policy, the firm obtains financing from the time the goods are received until cash is deducted from the firm's bank account. It should be stressed that this financing *should not be regarded as free*. A possible alternative would be to arrange with the supplier to pay cash on delivery or in advance for goods, and receive an additional discount for this payment. However, the most common cash discount date is 10 days from the date of receiving the goods. For most firms, the additional discount that would be received from the seller for paying 10 days earlier *is much smaller than the costs associated with not being able to check the quality of the goods and the costs associated with the transmittal of cash*. However, the firm should investigate the possibility of cash payment with suppliers; there may be some cases where the total elimination of this trade credit may be of advantage.

One way of generating additional short-term financing from trade creditors is to delay payment to trade creditors *beyond the discount date*. To do this, the firm could follow a policy of paying on the due date of invoices rather than their discount date; this is the second strategy listed above. This strategy is called *skipping the discount*. In doing this, the buyer still honors the seller's terms of sale, but incurs the penalty of having to pay more for the goods. For example, if the terms of sale are 2 percent 10 days, net 30

[5]Other policies are, of course, possible, but they make little sense except in very unusual circumstances. For example, the firm could elect to pay as soon as the goods are inspected (but before the discount date of the invoice). However, if the firm uses trade credit as a mechanism for monitoring goods and to avoid problems in transmitting cash, it makes sense to extend this utilization and generate financing if there is no penalty for doing so. The first penalty in utilizing trade credit almost always comes when the firm takes sufficiently long to pay an invoice so as to be unable to take the cash discount. Because there is no penalty for delaying payment up to the discount date of the invoice, most firms do not pay before this date, if they utilize trade credit at all. Similarly, if the firm takes sufficiently long to pay that it misses the discount date, the next date at which a penalty occurs is the due date. Therefore, if a firm misses the discount date, it makes no sense to pay before the due date.

[6]For survey results contrasting the views of credit managers and payables managers on the accepted payment date in honoring terms of sale, see N. Hill, W. Sartoris, and D. Ferguson, "Corporate Credit and Payables Policy: A Survey of Size and Industry Effects," paper presented at the Financial Management Association's 1983 Annual Meeting, and available from Hill at Brigham Young University.

days, and the invoice size is $1,000, the buyer will have to pay $20 more for the goods ($1,000 rather than $980) in order to delay payment for an additional 20 days.

Additional penalties are incurred if the buyer chooses to pay *beyond the due date*. This strategy is called *stretching accounts payable* (strategy number three above). Such a strategy may result in a lower credit agency rating for the buyer and, consequently, higher interest costs of borrowing from financial intermediaries. However, the primary effect of stretching accounts payable is a *loss of bargaining power with the seller*. In dealings between buyers and sellers, various aspects of the conditions of sale are continually being negotiated, including goods availability, shipping schedules, and so forth. Customers who pay in compliance with the seller's terms of sale are in a better position to negotiate these aspects than are customers who do not. The penalty costs of payment beyond the terms of sale therefore depend on the effects of these slow payments on bargaining, and may be substantial or trivial depending on the market conditions for the product in question. The firm must weigh these penalty costs against the financing provided in deciding whether to pay suppliers beyond their stated terms.

Accruals Accounts payable are generated when firms purchase goods and services on credit. However, firms also incur other types of debts for which immediate payment is not required. For example, the firm may obtain the labor of executive and hourly employees, incur liabilities for future tax payments, and accumulate interest expense on borrowed funds without paying cash for these items. Any such accrual involves a delay in payment, and thus it is a potential source of financing.

As with accounts payable, it would be uneconomical for the firm to avoid minimum levels of many accrued liabilities. For example, the firm could cut the size of accrued wages by paying each employee at the end of each day. By such a strategy, the firm might reduce its labor expense relative to that which would be required for longer pay cycles; employees who are paid more frequently may accept a lower wage, since they can spend or save their wages sooner. However, the paperwork expense of frequent payments to labor would probably outweigh any such savings. Similar minimum levels occur for many types of accrued liabilities.

Beyond these minimum levels of accruals, the firm needs to consider the penalty costs of extending payment in determining whether additional short-term debt should be raised in this fashion. The penalty cost will depend on the type of accrual under consideration. For example, the discounts given for the early payment of taxes are often very small; in such cases the firm may elect to pay later and obtain financing.

It should be noted that these minimum levels of accounts payable and accrued liabilities reduce the amount of other short-term financing that must

be obtained to achieve a specific level of total short-term debt. For example, if the firm desires that total short-term debt be $250,000 and has already determined that trade credit and accruals cannot economically be reduced below $50,000, the remaining $200,000 is the amount the firm must plan to raise. It is this $200,000 that is the subject of the remaining portion of the firm's planning process in the minimization of short-term debt cost.

Unsecured Credit-Line Borrowings This is the simplest way to obtain financing from a financial intermediary. To use it, the firm presents its financial statements to its bank and requests a credit line. The lending officer then either approves or disapproves the request. No security agreements or complicated bookkeeping are required; the bank is a general creditor of the firm. The firm then draws on the credit line and repays as needed. Because of this simplicity, this type of borrowing arrangement is often the preferred lending method for many banks and the preferred borrowing method for many firms.

Unsecured credit-line borrowing is available to any firm with a sufficiently good financial position to justify the loan. There are two costs associated with unsecured credit-line borrowings: the *commitment fee* on the maximum credit line that has been arranged and the *interest cost* of borrowing.[7] The interest cost of borrowed funds is often based on the prime rate; large and financially strong firms pay the prime rate (or sometimes a little less). Less creditworthy firms pay based on a percentage of the prime (for example, 120 percent of prime) or on prime plus percentage points (for example, prime plus 3 percent).

While this source of short-term financing is simple to obtain and very flexible, it does have drawbacks. First, because of the narrow margin between their borrowing and lending rates, banks' credit criteria for unsecured lending is quite stringent; a strong financial position is required of unsecured borrowers. These financial requirements often prevent small and new firms from obtaining unsecured credit-line borrowing. Second, bankers usually regard credit-line borrowings as primarily intended to fund seasonal short-term financing needs rather than to provide permanent short-term debt. They prefer that permanent debt be arranged via long-term borrowing (at higher interest rates). Therefore, a common requirement is for the firm to be out of debt for a specific period of the year (often 60 or 90 days) to evidence that credit-line financings are temporary. If the firm uses an unsecured credit line containing this provision as part of its permanent short-term financing package, it needs to arrange for other financing during the out-of-debt period.

[7]As in prior chapters, we assume here that the bank does not use compensating balances to extract compensation for services, but instead uses fee-based procedures.

Unsecured Notes and Term Loan Borrowings These are other mechanisms used in borrowing on an unsecured basis from financial intermediaries. As in borrowing by the use of an unsecured credit line, the bank lends to the firm based on its overall financial position. However, in using unsecured notes and term loan borrowings, the financing and repayment schedules (and sometimes the interest rates) are set beforehand. For notes, one future repayment is scheduled to retire each note, whereas a term loan is retired via a schedule of several future payments. These prescheduled payments offer less flexibility than a credit-line arrangement that can be repaid at the borrower's option. However, the use of these notes and term loans avoids the commitment fees that the firm might have to pay in using credit-line borrowings. Note borrowings from intermediaries often carry a 90-day maturity; interest on notes may be on a discounted basis or may be payable when the notes are due. As with unsecured credit-line borrowings, the availability of short-term note and term loan borrowings is limited to firms that can meet the intermediary's credit criteria.

Secured Borrowings with Marketable Securities as Collateral The remaining three sources of short-term financing require that the firm pledge an asset as security for borrowing. Such a pledging of any asset improves the position of the lender. Since the lender has first claim on that asset, the lender is in a superior position to unsecured creditors in the event of the borrower's default. Because of this superior position, the terms of lending can be improved. More credit can be granted and/or credit can be granted at lower rates than if borrowings were unsecured. This increased availability or decreased interest rate is often of great advantage to the borrowing firm.[8]

The advantage to the lender in secured borrowing comes if the borrowing firm is liquidated. The proceeds from the liquidation of the assets that are security for the loan go to the secured lender. Thus, the more liquid and valuable is the security, the greater will be the dollar recovery in default. This means more advantage to the lender in holding a secured position; consequently the lender is able to offer better terms to the borrowing firm. Since current assets are the most liquid assets of borrowing firms, secured borrowings (particularly secured short-term borrowings) are frequently based on the use of current assets as security. Therefore, in our discussion of secured borrowing, we center on borrowing arrangements that are based on the pledg-

[8]Historically, secured short-term borrowing was used by firms whose financial condition was so poor as to preclude unsecured financing. Banks were reluctant to charge appropriate interest rates to such high-risk customers, instead choosing to refuse credit entirely. However, during the 1970s, the advantages of secured short-term borrowing were discovered by many firms that could have borrowed on an unsecured basis. Today, secured short-term borrowing may be considered by any firm in pursuit of lower interest costs.

ing of the firm's major current assets as security for these borrowings: marketable securities, accounts receivable, or inventory.[9]

To finance with marketable securities as collateral, the firm could institute a reverse repurchase agreement (a reverse repo), pledging its marketable securities as collateral against a loan of short-term funds. However, the major volume of short-term secured borrowings use accounts receivable or inventories as security, since most firms have far larger holdings of these assets than they do of marketable securities.

Secured Borrowings with Accounts Receivable as Collateral In borrowing on a secured basis, lending does not depend only on this general financial position, but also on the value of the specific assets that are pledged as security. In the case of accounts receivable, the value of the asset (that is, its potential for recovery in liquidation) depends on the *number and type of customers to which the firm grants credit*. The more creditworthy the buyers of the borrower's products, the more that can be lent against receivables from those buyers.

The two methods of financing using accounts receivable as security are *pledging* and *factoring*.[10] Let us discuss pledging first. To institute this borrowing system, the firm contacts a financial intermediary who makes such loans. This is often a commercial lending company, but banks may also lend in this fashion. Participating banks may also choose to utilize, as their agents, other firms that are specialists in the monitoring of secured transactions. The lender or its agent then inspects the firm's accounts receivable portfolio and proposes a lending agreement based on this portfolio. This lending proposal will specify three important parameters that vary among such proposals: (1) the *receivables to be used as security*, (2) the *percent advance*, and (3) the *notification system*. The first of these is the designation of which receivables are to be pledged as collateral—all of the borrower's receivables portfolio or only part of this portfolio. The percent advance gives the amount of credit line to be granted relative to the receivables pledged. The more liquid the firm's receivables, the greater the advance. The notification system specifies whether the seller's customers will be notified to send remittances directly to the lender or will continue to send these payments to the borrowing firm.

The firm that finances by pledging accounts receivable can borrow up

[9]Cash, the remaining major current asset, cannot be used as security in borrowing arrangements from the firm's bank because it offers no advantage to the bank. In default, the bank will use its right of offset to seize the cash if any borrowings are outstanding, secured or unsecured. Since the bank will seize the cash in any case, offering this asset as security to a lending bank will not improve its position.

[10]For a good discussion of the basics of financing using accounts receivable and inventory as security, see G. Gallinger and P. Healey, *Liquidity Analysis and Management* (Reading, Mass.: Addison-Wesley, 1987), pp. 467–83.

to the advance at any time. For example, if the firm has $1 million in receivables outstanding and all the firm's receivables are to be used as security, with an advance rate of 80 percent, it may borrow up to $800,000, and will pay interest only on the borrowed amount. Interest rates in the pledging of accounts receivable are negotiated and are always lower than rates on the firm's unsecured borrowings.

Borrowing by pledging accounts receivable is a very useful strategy for many firms. If the firm's sales increase, so does needed financing, but so does the receivables collateral to obtain this financing. However, the paperwork necessary in the pledging of accounts receivable is substantial. The lender must be continually apprised of the state of the firm's accounts receivable portfolio. As receivables are paid, the firm's credit line decreases; new invoices and shipping papers must be presented to the lender as sales occur in order to restore the amount of available credit.

The *factoring* of receivables is substantially different from pledging receivables. In fact, factoring is not really secured borrowing at all. In factoring, the firm *sells its receivable asset to the financial intermediary* (the factor). Essentially, the factor takes over the firm's credit-granting function (for the receivables to be factored) and buys the resulting assets.

The procedures for factoring are outlined in the factoring agreement between the firm and the factor, but the events in the factoring of a receivable usually occur in the following sequence. When an order is received from a potential buyer, the seller requests permission from the factor to ship the order. If the factor approves the order, the order is shipped and the firm presents the paperwork (the invoice and the shipping documents) to the factor. The firm may then wait until the invoice matures and obtain the face value of the invoice less the factor's fee. The factor's fee compensates the factor for credit investigation expense, bad debt expense, and other expenses related to credit granting, and averages about 1 percent of the face value of the invoice.[11] Waiting to obtain the funds until the maturity of the invoice is called *maturity factoring*. The seller also has the option of taking cash for the receivable at the time the paperwork is presented to the factor. The amount of cash received for each invoice will be the face value of the invoice less the factor's fee and an interest charge. Taking a cash settlement when the receivable is presented to the factor is called *discount factoring*. In either case, the factor may retain a percentage of the face value as a holdback against material quality problems (which remain the seller's responsibility); this holdback is remitted to the selling firm when the invoice is actually paid by the buyer.

[11]See E. Farragher, "Factoring Accounts Receivable," *Journal of Cash Management* (March/April 1986), page 39. We assume in this discussion that the firm is factoring *without recourse*; when this is true, the factor bears the bad debt expense. If factoring is done *with recourse*, the firm bears the bad debt expense, but the factor's fees are lower.

Factoring is widely used by some firms in some lines of business, but is not an attractive financing vehicle for all firms because of noninterest costs, the constraints that factoring imposes on the seller, and the amount of paperwork entailed. If a firm factors all its receivables, it may eliminate the expense associated with its credit-granting function. However, such credit-granting expenses rarely total as much as the factor's fee. Also, when the firm factors its receivables, it subjects itself to the *factor's* credit-granting criteria. These may be considerably different from the credit-granting criteria which *the firm* finds to be optimal. In particular, the factor may institute credit criteria which are much more stringent than those preferred by the firm since its factoring fee is much smaller than the firm's margin on goods sold. Finally, there is usually a substantial paperwork cost entailed in passing invoices, shipping records, credit requests, and other documents back and forth between the firm and the factor. These disadvantages must be set against the reduction in interest expense and increase in availability that comes with factoring.

Secured Borrowings with Inventory as Collateral As with any secured financing system, the advantage for the lender of having the security determines how much will be lent and the interest rate that will be charged. Since the advantage to the lender revolves around the liquidation value of the asset, *the type of inventory that the firm holds will be a major determinant of the availability and cost of financing* when using inventory as collateral. The more salable the inventory, the more it is worth as security. Work-in-progess inventory rarely has any resale value, and therefore is useless as collateral. However, firms with substantial raw materials and finished goods inventories may find this form of financing of use. The more fungible these inventories, the more advantageous the financing that will result.

Besides its liquidity, another characteristic of the firm's inventory that will have a major impact on its value as collateral is *the ease with which the inventory can be monitored and controlled by the lender*. To make inventory worthwhile as security, the lender must be able to claim and liquidate the inventory if the borrower defaults. From the lender's view, the safest situation is when the lender can hold title to the goods or have them stored by a trusted third party. For example, in some states autos are titled and cannot be sold without these titles. If these titles are held by the lender, the inventory is fairly safe from misappropriation. Another strategy to secure the collateral is to use a *bonded warehouse* or *field warehouse* to store the goods until they are needed by the borrower. These are warehouses controlled by bonded personnel. Inventory stored there can be released to the borrower only by the lender. Such control insures inventory security.

However, arrangements can be made so that inventory that is not titled and does not lend itself to warehousing can, nevertheless, be used as collateral. For example, assume that the borrower is a retailer of ap-

pliances; an inventory of appliances would make excellent collateral, since appliances have substantial liquidation value. However, if it is necessary to display these goods in order to make sales, it would not be feasible to keep substantial amounts of this inventory in a warehouse. Further, appliances are generally not titled. In such a case, if inventory is to be used as security, the lender must trust the borrower and use a *general inventory lien* or a *trust receipt* system to obtain a secured position. These are legal instruments in which the lender maintains a security interest in the inventory, but the inventory is in the possession of the borrower. In a general lien (also known as a blanket lien), the lender gets a security interest in all the borrower's inventory, but keeps no record of particular inventory items. For example, in the case of the appliance retailer, the lender would have a security interest in the appliances but would not know at any particular time the exact composition of the security, since appliances are continually sold and restocked. By contrast, in the trust receipts system, specific untitled items serve as collateral. The items that are security for the loan are identified (perhaps by their serial numbers), and the lender keeps records giving the exact composition of the inventory at any time. When an item is sold, the borrower must offer additional collateral or must repay that portion of the loan. The trust receipt system is often used by automobile dealers in states where cars are untitled. However, under either system, the security is out of the lender's control and the firm will be able to borrow less and/or borrow at higher interest rates than in situations where the lender has more surety that the collateral will be available in the event of default.

Like financing using receivables as collateral, the use of inventory as security results in lower interest rates but has some offsetting costs. There are additional paperwork costs entailed in all types of inventory borrowings. If warehousing is used, there may be fees to warehousing and collateral-monitoring firms. These fees may have fixed and/or variable components and may be based on the size of the loan or the amount of inventory. The advantage to the borrowing firm of using inventory financing will depend on the magnitude of these additional costs compared to the reduced interest expense and increased availability that this borrowing system provides.

It is useful to summarize the mechanisms for obtaining short-term financing. Some important characteristics of the nine commonly used sources of short-term debt are presented in Table 11-1. One vital point to draw from the discussion and from this table is that *the types and costs of the various possible sources of short-term financing available to the firm will depend critically on other characteristics of that firm.* The firm's choice of capital structure and aggregate liquidity, the types of products and services (domestic and imported) that it purchases, its labor and tax payment situation, and the types of current assets that it holds will all bear on the types and costs of the short-term financing that will be available to it.

Table 11-1. *Characteristics of Sources of Short-Term Financing.*

Source of Financing	*Who May Use*	*Interest and Other Costs*	*Maturity*
Commercial Paper	Large firms and smaller firms with bank guarantee.	Interest cost plus cost of reserve bank credit; sum of two is usually below prime.	Up to 270 days; most common is 30 days.
Bankers' Acceptances	Firms importing goods.	Interest cost plus fees to bank; sum is often less than prime.	Usually 30 to 180 days; 90 days most common.
Accounts Payable	Any purchaser of goods or services.	1. For delay from discount date to due date: loss of discount.	1. Depends on terms; 30 days most common.
		2. For stretching beyond due date: higher borrowing costs, loss of bargaining power with supplier.	2. Until supplier sues.
Accruals	Firms who may defer labor; taxes, etc.	Depends on penalty cost of delay.	Depends on specific accrual.
Unsecured Credit Line	Firms with strong financial position from lender's view.	Interest cost, which depends on financial position of firm; Strong firms pay at prime. There may also be commitment fees.	Can be drawn down or paid off at any time.
Unsecured Short-Term Notes and Term Loans.	Firms with strong financial position from lender's view.	Interest cost, which depends on financial position of firm. Interest on notes may be discounted or paid at maturity.	90 days common for notes; varies for term loans.
Secured Borrowings Using Marketable Securities.	Firms holding marketable securities.	Interest at repo rate.	Reverse repos are typically very short maturities.
Secured Borrowings Using Accounts Receivable.	Firms with liquid and substantial accounts receivable.	1. Pledging: Interest expense lower than for unsecured borrowings; also large paperwork costs.	1. Loans due when invoices are paid.
		2. Factoring: Interest expense plus factor's fee averaging 1 percent of invoice (for discount factoring).	2. Firm sells assets; payment can be received immediately.
Secured Borrowings Using Inventory.	Firms with liquid and substantial inventory.	Interest similar to pledging accounts receivable; also monitoring, warehousing, and certification fees, depending on specifics of borrowing.	Loans are made when inventory is acquired and are due when inventory is used.

CALCULATING THE COST OF A SOURCE OF SHORT-TERM FINANCING

The first step in structuring the firm's liabilities is to generate a list of the types of short-term debt that are available to the firm. If this listing shows that the minimum levels of the firm's accounts payable and accruals are such that no additional financing is needed and aggregate liquidity targets are satisfied, then the process need go no further; these two sources of financing will comprise the firm's short-term debt package. However, the minimum levels of these liabilities do not provide sufficient short-term financing for most firms. In such cases, it is often useful to calculate measures of the maximum amount of financing and the cost of the alternative sources of short-term debt. We call measures of these characteristics the *net availability* and the *compounded effective annual interest rate*.

Calculating Net Availability To obtain the net availability from each source, the maximum amount of *net cash provided* by that source is calculated. This calculation is not as simple as it seems. The first thing to remember is that *cash financing* is what the firm requires. Thus, it is the *amount of cash that the firm receives* or the *amount of the delayed cash outflow* that comprises the relevant net availability.

Two problems often occur in determining this net availability from a potential source of financing. The first of these is *up-front expenses* that may make the amount of cash financing different from the face value of the debt. To see this, assume that one option in a firm's short-term financing package is a 180-day discounted note with a $1,000 principal amount. The interest for the 180-day period will be 5 percent. Such a note *will not provide $1,000 in financing*. Since the interest is discounted, the $1,000 note will net the firm only $950.00 in cash (equal to $1,000 minus interest of 0.05(1000)). Similar up-front expenses occur for several other types of current debts, including skipping the discount on accounts payable. Assume that the firm has the option of skipping the discount on invoices with a face value of $50,000 that have terms of 2 percent 10 days, net 90 days. If the firm pays in 10 days, the cash outflow will be $49,000; if it skips the discount, *only this amount of cash outflow is delayed*. The maximum financing from this source is $49,000, not $50,000. Any time that interest or other expenses are paid when financing is undertaken, and not at maturity, the net availability will be less than the face value of the liability.

A second problem in calculating the net availability from a liability occurs when *the financing from the liability changes over time*. There are several types of short-term financing with this characteristic, including short maturity term loans and accruals. For example, if the firm takes out a 180-day term loan with monthly amortization payments, the financing will not be the principal amount of the term loan. Since the principal decreases over time (in a nonlinear fashion), the average financing will be some lesser amount.

Table 11-2. *Average Financing From Example Term Loan.*

Month	Beginning Principal	Interest Payment	Principal Payment	Ending Principal
1	$10,000.00	$100.00	$1,625.48	$8,374.52
2	$ 8,374.52	$ 83.75	$1,641.74	$6,732.78
3	$ 6,732.78	$ 67.33	$1,658.16	$5,074.62
4	$ 5,074.62	$ 50.75	$1,674.74	$3,399.88
5	$ 3,399.88	$ 34.00	$1,691.48	$1,708.40
6	$ 1,708.40	$ 17.08	$1,708.40	0.00
Average	$ 5,881.70			

For example, assume that the principal amount on such a loan was $10,000, the interest is 1 percent per month, and equal monthly amortization payments are required. An analysis of the net availability from such a loan is given in Table 11-2. The monthly payment is $1,725.48.[12] Assuming that the payments on the loans are made at the end of the month, the beginning principal amounts constitute the financing for the month. For example, the financing provided by the loan for the second month is $8,374. 52. The average financing over the term of the loan is $5,881.70.

Let us illustrate changing availability over time with another example. Assume that a firm has a quarterly property tax liability with a face value of $100,000. It may choose to pay this liability on a monthly basis or to make the total payment at the end of the quarter. An analysis of the financing provided appears in Table 11-3. If the firm elects to pay at the end of each month, no month-end accrual occurs. However, if the firm chooses to pay at the end of the quarter, the accrued balance builds up over time, then is reduced to zero just before the end of the quarter. The delayed payments of $33,333

Table 11-3. *Financing from Example Tax Deferral.*

Month	Outflow for Monthly Payment	Month-End Accrual	Outflow for Quarterly Payment	Month-End Accrual	Month-End Financing Provided
1	$33,333	0	0	$33,333	$33,333
2	$33,333	0	0	$66,667	$66,667
3	$33,333	0	$100,000	0	0

[12]The present-value interest factor for a six-period annuity at 1 percent per period is 5.7955. The per-period amortization payment is then $10,000/5.7955 = $1,725.48.

for the first and second months provide month-end financing for the next month. That is, the strategy of delaying payments from a monthly to a quarterly basis provides $33,333 in financing during the second month and $66,667 in financing during the third month.

These two types of difficulties must be kept in mind in calculating the maximum amount of financing (the net availability) that is provided by each potential source of current debt. However, as long as the analyst focuses on the *net cash yielded* at various times from a source of financing, errors will be avoided.

Calculating the Compounded Effective Annual Interest Rate Once the firm knows how much financing a source will yield, a second natural question is the cost of this financing. We call this the compounded effective annual interest rate or *compounded EAI* of the funding source. The compounded EAI is calculated the same way for any source of funding: it is the yearly *compounded internal rate of return for the cash flows from the funding source.* To compute this cost statistic, the analyst obtains the cash flows for the funding source and their timing, calculates the internal rate of return (IRR), and compounds this IRR to a yearly basis. This gives a comparative cost statistic for the various available sources of funding which is based on net cash flows and is properly adjusted for the different maturities of the various funding sources. For purposes of this discussion, we will center on before-tax cash flows in calculating this cost measure.[13] To illustrate this procedure, let us do a few examples.

First, let us calculate the compounded EAI for the discounted note example previously presented. In return for the payment of $1,000.00 in 180 days, the firm can receive $950.00 in cash immediately. The IRR formula for this transaction is:

$$0 = 950.00 - 1{,}000.00/(1 + r) \qquad (11\text{-}1)$$

where r is the IRR for the 180-day period. Solving this yields an r of 0.0526.[14]

[13]When all the expenses associated with the various sources of short-term debt have the same tax status and all tax bills are paid at the time of the expenses, ignoring taxes does not influence the relative costs of various sources. For discussion of the effects of taxes on the cost of financing with accounts payable where this does not hold, see I. Brick and W. Fung, "The Effect of Taxes on the Trade Credit Decision," *Financial Management* (Summer 1984), pp. 24–30. When expenses and tax bills are not concurrent, the IRR method presented in this chapter can be used to calculate after-tax EAIs by applying this method to after-tax (rather than before-tax) cash flows.

[14]The IRR method is employed in this chapter because it will give the effective rate for any set of cash flows, either the simple ones in this example or the more complex ones to be presented later. However, there is a shortcut method that will give the uncompounded rate *only for situations where there are exactly two cash flows.* In this shortcut method, the uncompounded EAI is calculated by dividing the difference in the cash flows by the net availability. Using this shortcut, the uncompounded EAI for this example would be calculated as $(1{,}000.00 - 950.00)/950.00 = 0.0526$.

The formula for compounding a rate is:

$$r_{comp} = (1 + r)^t - 1 \tag{11-2}$$

where r_{comp} is the compounded rate and t is the number of compounding periods. For a 360-day year, the 180-day note would be reborrowed twice, so the compounded rate is:

$$\begin{aligned} r_{comp} &= (1 + 0.0526)^2 - 1 \\ &= 0.1080 = 10.80 \text{ percent} \end{aligned} \tag{11-3}$$

This 10.80 percent is a yearly rate that can be used in comparing this source of short-term funds with other potential sources.

Another example presented previously concerned skipping the discount in payment to a trade supplier. The terms of sale were 2 percent 10 days, net 90 days, and the face value of invoices was $50,000. The IRR of this financing is computed as:

$$0 = 49{,}000 - 50{,}000/(1 + r) \tag{11-4}$$

The positive value of the $49,000 amount occurs because this cash outflow is avoided by skipping the discount, and therefore is a *net cash inflow*. Solving for r yields a rate of 2.04 percent for the 80-day difference in timing between the cash flows. On a yearly compounded basis, the rate is:

$$\begin{aligned} r_{comp} &= (1 + 0.0204)^{360/80} - 1 \\ &= 0.0951 = 9.51 \text{ percent} \end{aligned} \tag{11-5}$$

Let us now apply these principles to calculate the compounded EAI for a more complicated problem.[15] A firm is selling $1 million per month on terms of 2 percent 10 days, net 60 days. Historically, the firm has collected 20 percent of its receivables on the discount date; an additional 74 percent of sales are collected on the sixtieth day. Five percent of sales will be disputed on product quality grounds and will not be collected until 120 days from the date of sale. The remaining 1 percent are bad debts and are never collected. Credit department costs are 1.2 percent of sales and are paid 30 days after sales occur. A factor has made an offer of discount factoring. In this offer, the firm will receive the face value of invoices, less a 2.5 percent factor's fee, 1.75 percent interest, discount expense, and a 5 percent product quality holdback; the cash will go to the seller immediately after sales are made. In this factoring arrangement, the factor absorbs any bad debts. The product quality

[15]This problem is adapted from E. Farragher, "Factoring Accounts Receivable," p. 41.

holdback will be settled on the 120th day, and the borrower will receive the remaining five percent at that time. What is the effective cost of this factoring?

The necessary analysis is presented in a spreadsheet format in Table 11-4. The basic data in cells B1 through B12 is used to compute the cash flows that appear in rows 17 through 21. The cash flows without factoring appear in column B of these rows while those with discount factoring appear in column C. The total net cash flow without factoring is $20,500 greater than that with factoring, but the cash flows from factoring occur earlier in time. The cash flow at day 120 happens to be the same in either case and thus has no bearing on the analysis. Since the last difference in the cash flows occurs at day 60, the present-value interest factors in column E have been computed for a 60-day period using the 60-day rate in cell E12. The rate of 2.7462 percent for this 60-day period produces a net present-value of zero in the differential cash flows (which appear in column D). This rate was found by iterating the contents of cell E12 until a zero NPV in cell F23 resulted. The yearly compounded rate is 17.65 percent, which is computed in cell E25 using equation (11-2).

Table 11-4. Cost Analysis of Example Discount Factoring.

	A	B	C	D	E	F
1	Sales	1000000				
2	Discount	.02				
3	% Taking Disc.	20%				
4	Disc. Exp.	4000				
5						
6	Factor Fee	.025 of sales				
7	Factor Exp.	25000 for sales of 1,000,000				
8	Interest Rate	.0175 of sales				
9	Interest Exp.	17500 for sales of 1,000,000				
10						
11	Bad Debt Rate	.01 of sales				
12	Credit Department Costs	.012 of sales		60-day Disc. Rate	.027462	
13						
14	Day	Cash Flow,	Cash Flow,	Diff. in		Cont.
15		No Factoring	Disc. Factoring	Cash Flows	PVIF	to NPV
16						
17	0	0	903500	−903500	1.00	−903500
18	10	196000	0	196000	.995495	195117
19	30	−12000	0	−12000	.986545	−11839
20	60	740000	0	740000	.973272	720221
21	120	50000	50000	0	.947258	0
22						
23	Total NCF	974000	953500		NPV	0
24						
25				Compounded Disc. Rate	.176507	

The computation of the net availabilities and compounded EAIs for each of the firm's potential sources of short-term financing may (under certain circumstances) be used to formulate a financing plan for the firm.[16] Such a procedure for formulating a structure of short-term liabilities is described in the following section.

THE SEQUENTIAL METHOD FOR FORMULATING A STRUCTURE OF CURRENT DEBT

In the prior section, we presented methods of assessing two important characteristics of each possible source of current debt for the firm. These were the net availability (which measures the maximum cash financing from the source) and the compounded EAI (which measures the costliness of a source). Under some limited conditions, these two parameters alone may be used to obtain an optimum structure for the firm's current liability package. To be used in this fashion, the net availability and compounded EAI for a source must *completely* capture the relative desirability of that source. For this complete capturing to occur, there must be no interactions among the EAIs and availabilities of the various sources. All sources must be divisible (utilizable in part) without affecting their EAIs. All sources must provide funding for one planning period only, or must be refundable at no cost. Finally, the firm must not be concerned with the differential effects of the various sources on aggregate liquidity.[17]

If these conditions are satisfied, the procedure for generating a minimum-cost plan for the structure of current liabilities is straightforward, and consists of the following steps:

1. List all the potential sources of short-term financing for the firm, starting from the lowest EAI and proceeding to the highest.
2. Starting with the source having the lowest EAI, proceed to utilize

[16]The internal rate of return has been used in this chapter without discussion of the problems in the use of this statistic to compare different sets of cash flows. Included among the problems are those related to rediscount rate and the possibility of multiple-root solutions in the calculation of the IRR. For discussion of these features of the internal rate of return, see T. Copeland and J. F. Weston, *Financial Theory and Corporate Policy*, Second Edition (Reading, Mass.: Addison-Wesley, 1983), pp. 29–36.

[17]If the firm is concerned with differences in liquidity, the net availability and the compounded EAI will not completely capture the desirability of any source of funding to the firm, since the various sources of funding will differ in their effects on aggregate liquidity. For the sequential method to be applicable, the firm must measure aggregate liquidity in some way that is not sensitive to differences in liquidity among different sources of current debt. For example, this would occur if the firm sets aggregate liquidity targets via the current or quick ratio.

sequentially more expensive sources until the firm's financing needs are fulfilled.

We call this method the *sequential method* because sources are chosen sequentially based on their costliness, from the cheapest to the most expensive. An illustrative example of this procedure is useful. Assume that a firm needs short-term financing totaling $1.5 million. Five sources of financing are available. Source A has an EAI of 9.32 percent and a net availability of $750,000. Source B has an EAI of 8.47 percent and a net availability of $340,000. Source C has an EAI of 21.81 percent and a net availability of $650,000. Source D has an EAI of 10.72 percent and a net availability of $134,000. Source E has an EAI of 8.05 percent and a net availability of $450,000. There is no interaction among the EAIs or availabilities for these sources (any source may be adopted without affecting the cost or availability of any other source). All the sources are completely divisible; the first dollar of financing from a source has the same EAI as all other dollars of financing from that source. All the sources are refundable at no cost, and the firm is unconcerned about differences in liquidity among the sources. What is the minimum-cost financing package?

The necessary analysis, performed according to the sequential method, is presented in Table 11-5. Data on the potential short-term financing sources are entered in columns A through C, starting with the lowest-cost source and proceeding to the highest-cost source.[18] Columns D through F determine the financing plan. The total financing requirement is entered as data in cell D4. Cells E4 through E8 contain "if statements." If the net availability (in column C) is less than the required financing (in column D), the net availability is displayed; otherwise, the required financing is displayed (for example, cell E4 contains "@IF(C4<D4,C4,D4)"). Column F contains the remaining financing after the use of the source on that line; cell F4 contains "D4-F4". For source E, the starting requirement is $1,500,000. The availability is $450,000 from this source, which is less than the required financing, so cell E4 returns the availability. After utilizing this source, $1.05 million in required financing remains, which appears in cell F4. This amount is also the starting required financing for the next source, so cell D5 contains "F4"; remaining cells in this column contain parallel entries.

The optimum financing plan appears in column E, and utilizes $450,000 in financing from source E, $340,000 in financing from source B, and $710,000 from source A. Financing from sources D and C is not utilized. The weighted-average EAI for the plan is calculated in columns G and H, and appears in cell H10. The EAI for this plan is 8.75 percent, and represents the yearly cost of the minimum-cost financing package from these sources of short-term financing.

[18]Alternatively, if the spreadsheet has a sorting function, the sources could be entered in any order and then sorted based on their compounded EAIs.

Table 11-5. Execution of Sequential Method for Example Problem.

	A	B	C	D	E	F	G	H
1		Compounded	Net	Starting	Usage from	Remaining	Percent	Contribution to
2	Source	EAI	Availability	Requirement	Source	Requirement	of Total	Weighted EAI
3								
4	E	8.05	450000	1500000	450000	1050000	.30	2.42
5	B	8.47	340000	1050000	340000	710000	.23	1.92
6	A	9.32	750000	710000	710000	0	.47	4.41
7	D	10.72	134000	0	0	0	0.00	0.00
8	C	21.81	660000	0	0	0	0.00	0.00
9							1.00	EAI for Plan 8.75
10								

SUMMARY

This chapter introduces the management of individual short-term liabilities. The goal in this management is to develop a strategy which, at a minimum cost, provides the desired funds and satisfies the firm's target level of aggregate liquidity. Nine commonly used sources of short-term funding were discussed: commercial paper, bankers' acceptances, accounts payable, accruals, unsecured credit lines, unsecured term loans and notes, and secured borrowings with marketable securities, receivables, or inventory as security. The availability and costliness of these sources varies substantially among firms, and depends on the firm's financial strength, operating methods, and other characteristics.

In addressing the structuring of current debt, the firm should first investigate all the possible sources of short-term debt that are available to it. There will be minimum levels of accounts payable and accruals which it is generally uneconomical to eliminate from the firm's structure of current debt. For amounts beyond this, if there are no interactions among the various possible sources of short-term funding, if all sources are divisible without affecting their costliness, if all sources are refundable, and if the firm's policy regarding aggregate liquidity is such that it is not concerned about differences in liquidity among the sources, analysis can proceed using the sequential method. In this method, the firm calculates the maximum funding from each source (its net availability) and the costliness of each source (its compounded effective annual interest rate). The firm then funds using the least-costly sources first and proceeding to more costly sources. This yields the optimum financing plan.

Unfortunately, the conditions under which the sequential approach will yield the optimal plan are quite restrictive. In the next chapter, we present a more complicated mathematical methodology (the integer programming approach) that produces the minimum-cost financial structure in these and a wide variety of other situations.

Problems

11-1. A firm is considering foregoing the discount on payments to a particular supplier. The firm purchases $200,000 per year from this supplier; purchases are distributed evenly throughout the year. The supplier offers terms of 1.5 percent 15 days, net 60 days, and the firm currently pays in 15 days and takes the discount. Calculate the compounded yearly effective annual interest rate and the maximum available borrowing from foregoing the discount to this supplier. Use a 360-day year.

11-2. A firm is considering several sources of funding as part of its

current liability structure. One possible source of funds is changing its payment policy regarding insurance premiums. Currently, the firm makes two premium payments per quarter (one on the 45th day and one on the 90th day). These payments are in the amount of $49,500 each, and reflect a discount from the insurance company for such a payment policy. The alternative strategy would be to pay $100,000 at the end of 90 days. Use a 360-day year.

a. Calculate the compounded yearly effective annual interest rate of the alternative strategy.

b. Calculate the average additional availability of funds over the quarter from the alternative strategy.

11-3. A firm needs $800,000 in financing during January and $1.5 million during February. The following sources of funding are available:

Source	*Yearly Compounded EAI*	*Maximum Availability, January*	*Maximum Availability, February*
Bank Borrowing	12.0%	$500,000	$500,000
Skip Discount, Supplier A	9.0%	$250,000	$350,000
Skip Discount, Supplier B	30.0%	$600,000	$800,000
Delay Payments on Accruals	25.0%	$150,000	$250,000

There are no interactions among the sources. Sources may be utilized in part without affecting their EAIs, and all sources have equal effect on the firm's aggregate liquidity. All sources have a one-month maturity. Formulate a financing plan for each month and compute the weighted-average EAI of the financing for each month.

Selected Readings

Brick, I., and W. Fung, "The Effect of Taxes on the Trade Credit Decision," *Financial Management* (Summer 1984), pp. 24–30.

Brown, K., and B. Summers, eds., *Instruments of the Money Market*, Fifth Edition (Richmond: Federal Reserve Bank of Richmond, 1981), Chapters 9 and 10.

Farragher, E., "Factoring Accounts Receivable," *Journal of Cash Management* (March/April 1986).

Gallinger, G., and P. Healey, *Liquidity Analysis and Management* (Reading, Mass.: Addison-Wesley, 1987), Chapters 16 and 17.

case

Charles' Clamps Corporation—Structuring Short-Term Liabilities: Sequential Method

Charles' Clamps Corporation was a family-owned firm headquartered in western Pennsylvania. The firm produced clamps of various types, including those for automotive and home repair applications. Clamps were manufactured mainly from sheet metal; thus the basic production processes were stamping and related metal-forming work, though some painting and some fabrication of other materials was required. The founder's name was Charles Jackson (hence the corporate name). The firm had grown over time and was now run by Mr. Jackson's sons, James and John. Financial statements for the firm as of the fiscal year ending on December 31, 1984 are presented in Exhibit 1.

Upon reviewing the firm's performance for 1984, the Jacksons were concerned with the amount of interest and other debt-related expense that the firm had incurred. The firm had paid $204,000 in debt-related expense in 1984, to service their long-term and short-term debt. The total principal on short-term debt and long-term debt (except for minimum levels of accounts payable and accruals) had averaged about $1.6 million, giving an effective financing rate of about 12.75 percent. This overall rate was slightly above the prime rate for 1984, which had averaged 12.04 percent. However, the firm's long-term debt consisted principally of mortgages on the firm's various properties and term loans secured by equipment. Some of these mortgages had been taken out years ago and carried below-market rates as low as 7.5 percent; the average rate on the firm's long-term debt was 9.3 percent. Since principal on long-term debt had averaged about 68 percent of total interest-bearing debt, the Jacksons had calculated that the average effective rate on the firm's short-term borrowings was about 20 percent, or about 8 percent above the average prime rate. This seemed quite high to them since they considered their firm's financial position to be strong. Therefore, the family decided to reexamine their firm's short-term financing strategy in detail.

Initial efforts centered on the estimation of next year's short-term financing needs. While the firm's sales were fairly stable from year to year, these sales exhibited some seasonality within each year. The Jacksons projected the firm's sales and asset patterns for 1985 based on this seasonality. In the first, third, and fourth quarters, additional short-term financing would be required. These projections are presented in Exhibit 2.

In making these projections, they had assumed for preliminary analysis purposes that

Exhibit 1

Charles' Clamps Corporation
Financial Statements
(rounded thousands of dollars)

Statement of Income and Retained Earnings
Fiscal Year Ending 12/31/84

Sales	$10,246
Cost of Materials	7,768
Interest and Other Financing Expenses	204
Gross Margin on Sales	2,274
Selling, Labor and Administrative Expenses	1,618
Earnings Before Taxes	656
Taxes (Federal and State Income)	342
Earnings After Taxes	314
Common Dividends	150
Changes in Retained Earnings	$ 164

Balance Sheet
12/31/84

Cash	$ 458
Marketable Securities	0
Accounts Receivable	1,404
Inventories	1,564
Other Current Assets	102
Total Current Assets	3,528
Gross Fixed Assets	3,346
Less: Accumulated Depreciation	1,886
Net Fixed Assets	1,460
Other Assets	336
Total Assets	$ 5,324
Accounts Payable (Materials)	$ 810
Notes Payable	540
Accruals	434
Current Portion—Long-Term Debt	176
Total Current Liabilities	1,960
Long-Term Debt	802
Common Stock and Paid-In Capital	100
Retained Earnings	2,462
Total Common Equity	2,562
Total Liabilities and Equity	$ 5,324

Exhibit 2

Charles' Clamps Corporation
Projected Quarterly Financial Statements
(rounded thousands of dollars)

Statement of Income and Retained Earnings

Quarter Ending	*3/31/85*	*6/30/85*	*9/31/85*	*12/31/85*
Sales	$3,120	$2,152	$2,582	$2,905
Cost of Materials	2,365	1,632	1,958	2,202
Interest and Other Financing Expenses	62	42	51	58
Gross Margin on Sales	693	478	573	645
Selling, Labor and Administrative Expenses	493	340	408	459
Earnings Before Taxes	200	138	165	186
Taxes (Federal and State Income)	104	72	86	97
Earnings After Taxes	96	66	79	89
Common Dividends	40	40	40	40
Changes in Retained Earnings	$ 56	$ 26	$ 39	$ 49

Balance Sheet

Quarter Ending	*3/31/85*	*6/30/85*	*9/31/85*	*12/31/85*
Cash	$ 558	$ 384	$ 461	$ 519
Marketable Securities	0	40	0	0
Accounts Receivable	1,710	1,180	1,415	1,592
Inventories	1,905	1,314	1,577	1,774
Other Current Assets	124	86	103	116
Total Current Assets	4,297	3,004	3,556	4,001

Gross Fixed Assets	3,346	3,346	3,646	3,646
Less: Accumulated Depreciation	1,970	2,053	2,144	2,236
Net Fixed Assets	1,376	1,293	1,502	1,410
Other Assets	409	282	339	381
Total Assets	$6,082	$4,579	$5,397	$5,792
Accounts Payable (Materials)	$ 987	$ 681	$ 816	$ 919
Approximate Required Short-Term Financing	1,015	0	442	686
Accruals	528	364	438	492
Current Portion—Long-Term Debt	176	176	198	198
Total Current Liabilities	2,706	1,221	1,894	2,295
Long-Term Debt	758	714	820	765
Common Stock and Paid-In Capital	100	100	100	100
Retained Earnings	2,518	2,544	2,583	2,632
Total Common Equity	2,618	2,644	2,683	2,732
Total Liabilities and Equity	$6,082	$4,579	$5,397	$5,792
Current Ratio (Ignores Current LTD)	1.70	2.87	2.10	1.91
Average Current Ratio				2.14

interest and other financing expenses would be the same percent of sales that it had been in 1985 and that the management policies they had followed in prior years would be continued. With regard to current liabilities, these policies were:

1. *Accounts Payable*—Invoices with terms of sale that allowed a cash discount were paid on the discount date and the discount taken. Invoices with terms of sale without discounts were paid on the net date. The Jacksons had felt that violating the terms of sale would harm relationships with suppliers. The firm's prompt payment policy made it a valued customer, and together with other factors allowed Charles' Clamps to secure the most advantageous delivery schedules and prices.

2. *Notes Payable*—The firm had in the past financed short-term swings in required funds by borrowing from their bank via discounted, unsecured short-term notes. In combination with the firm's other short-term and long-term debt, this approach resulted in an aggregate liquidity position (as measured by the current ratio) which the Jacksons considered satisfactory, though this position varied with financing needs. The bank had set the rates on these notes as prime plus 6.5 percent. The notes matured in 90 days.

3. *Accruals*—Included in this financing source were accrued wages, taxes, and numerous other miscellaneous items. The amounts of financing were widely distributed within accrual subclassifications, but one of the largest subclasses was accrued wages.

4. *Current Portion of Long-Term Debt*—This account was determined by the covenants of the firm's long-term debt agreements. For 1985, the firm had planned to purchase some equipment during the third quarter, and also planned to take out an amortized term loan to partially finance these purchases. Therefore, projections showed an increase in gross fixed assets, long-term debt, and current long-term debt during this quarter. The firm intended to refund all long-term debt as it came due.

The Jacksons also felt that, except for wages payable, the amounts of the other accrual subclasses were either too small to provide any substantial amount of additional financing or could provide such financing only at inordinate cost. They decided, as part of their efforts to control interest expense on short-term borrowings, to investigate the increased use of accounts payable and accrued wages as sources of short-term financing as well as the continued use of note financing from their bank. To assess the viability and cost of delaying of payment to accounts payable as a potential financing source, the Jacksons first developed a list of the terms of sale given them by suppliers and the proportions of accounts payable outstanding with each of these terms of sale. This list is presented as Exhibit 3. They decided to consider the strategy of delaying the payment of discount invoices from the discount date to the due date. They did not anticipate that this strategy would harm their relationships with suppliers, since they would still be honoring the suppliers' stated terms of sale.

Wage expense for production employees was 50 percent of Selling, Labor, and Administration Expense. The current twice-a-month pay schedule had been negotiated along with other pay and benefit features in the firm's labor contract. One short-term financing option would be to negotiate for a monthly payment cycle when the contract was reviewed. However, the members of the union considered even the current schedule to be a hardship and had pushed for a weekly pay cycle. Given the workers' preferences, they felt that going to the monthly cycle would

Exhibit 3

Charles' Clamps Corporation
Proportions of Accounts Payable for Various Terms of Sale

Terms	*Percent of Payables Balance*
Net Terms (Averaging Net 60 Days)	56
2% 10, Net 30	22
1% 10, Net 30	8
3% 10, Net 60	6
2% 10, Net 90	2
Miscellaneous Other Terms	6

require that they pay the workers 2 percent more than if the current pay schedule was continued.

In assessing their short-term banking relationships, the Jacksons had a long and rather arduous conversation with Carl Grant, their bank's commercial lending officer. Mr. Grant was surprised to find the Jacksons taking a serious look at their short-term financing situation, as the majority of their concern had previously centered on the cost of the firm's long-term debt. He agreed that the firm's overall financial position was quite strong and that the interest rate on the firm's note financing was quite high. However, he explained that since the firm had secured the long-term portion of its borrowing with fixed assets (a common requirement among smaller firms), in his view these substantial fixed assets could not be considered in an analysis of their short-term borrowings. Nonetheless, he agreed to grant future note borrowings at 5 percent above prime with the interest discounted. Borrowings would be limited to a maximum principal balance of $1.25 million.

Chapter -12

The Integer-Programming Approach to Structuring Current Dept

In the prior chapter, we described the commonly used sources of the firm's short-term debt and presented the sequential method for obtaining a minimum-cost structure of this debt. The main objective in this chapter is the presentation of another method for structuring current debt—the *integer-programming method*—which will produce an optimum structure under a wider variety of conditions than will the sequential method, but is more complicated mathematically. We will also illustrate the use of the integer-programming method to develop an optimum hedge for the uncertainties inherent in a firm's cash flows, where this hedge uses reserve borrowing capacity of current debt. A review of some survey evidence on practice in the management of current debt is also included in this chapter.

PROBLEMS WITH THE SEQUENTIAL APPROACH

While the sequential method of structuring current liabilities is simple to understand and to use, it is applicable only under some very limited conditions. Included among these conditions are: (1) the costs and available funding from each source of short-term debt must be independent of all other sources, (2) the cost of a source must not vary with the amount of funds obtained from that source, (3) all sources must be of one-period maturity or most be costlessly refundable, and (4) the firm must not be concerned with differences among sources in liquidity. Unfortunately, one or more of these four conditions are violated in the situations faced by many firms. In this section, we discuss some sources of these violations and the effect of these violations on the problem of determining an optimal structure for current debt.

Interdependencies Among Funding Sources If the cost or availability of financing from one source varies with the use of another source, the cost

and availability figures employed in the sequential method do not fully capture the relative desirability of funding from the various sources. In assessing their list of possible sources of short-term financing, many firms will find instances of such interdependencies.

A major source of interdependencies occurs between secured and unsecured borrowings. Recall that lenders will lend more funds or will lend funds at lower rates when borrowing is secured because, in liquidation, they have a priority claim on the revenues from the sale of a valuable asset. However, there is another side to the secured financing story. The pledging of assets as collateral to *secured* lenders increases the recovery to them but lowers the expected recovery to *unsecured* lenders. Every dollar that goes to a secured lender in liquidation is one less dollar that can be recovered by unsecured lenders. With respect to the credit-granting decision of an *unsecured* lender, pledging an asset to a *secured* lender is the same as removing that asset from the creditor's balance sheet. The more liquid and valuable is the asset (and therefore the better collateral it provides to secured lenders), the worse is the effect on unsecured lenders. Consequently, the use of assets as security to *reduce* the cost or *increase* the available borrowing from one lender may *increase* the cost or *reduce* the availability from other lenders.

Such interactions are a violation of the assumptions of the sequential method. When they occur, the *calculated* costs and availabilities misrepresent the *true* costs and availabilities because the interactions among the various sources are not taken into account. Under these circumstances, the sequential method may not produce the minimum-cost financing strategy.

Variation in Cost with Amount Borrowed When the cost per dollar borrowed from a source varies with the amount of funding from that source, any one-number measure of this per-dollar cost (including the compounded EAI) misrepresents the relative desirability of that source. Several potential sources of short-term financing have this characteristic.[1] Such variations in EAI will happen, for example, if there is some fixed cost associated with borrowing from a particular source, where this fixed cost is independent of the amount borrowed. Such a fixed cost will bear more heavily on per-dollar financing if borrowings are small than it will if borrowings are large.

To illustrate the fluctuation of EAI with amount borrowed, an example is in order. Assume that the firm has arranged with its bank to borrow on an unsecured line of credit. The maximum principal is $5 million, the expected interest rate is 10 percent per year (paid monthly), and all interest is paid at maturity. However, to maintain the availability of this credit line, the firm must pay a monthly fee of 0.25 percent of the average unborrowed balance. This commitment fee effectively imposes a fixed charge on the credit line; the minimum cost that the firm can pay is $12,500 per year (equal to 0.0025

[1]For an illustration of variation in per-dollar financing cost, see C. T. Conover, "The Case of the Costly Credit Agreement," *Financial Executive*, Vol. 39, No. 9 (September 1971), pp. 40–48.

times $5 million), regardless of how little it borrows. The result is that the compounded EAI of the credit line varies with the amount borrowed; this variation is portrayed in Table 12-1. If the firm's borrowings average only $500,000, the compounded EAI will be 12.96 percent; if the firm borrows to the maximum, the EAI will be 10.47 percent. As this example illustrates, when the EAI varies with the amount borrowed, a single measure will not properly represent the cost of that potential source of funding.

Multiperiod Maturities Many of the sources of funding facing firms have maturities that do not match the firm's planning horizon. For example, if the firm is planning its current liability structure for the next month and it issues nonrefundable 90-day notes, these notes will provide funding in that month, *and also in the two following months*. Multiperiod sources of funding may be highly desirable during one part of the time during which they are outstanding, but a good deal less valuable in other parts because of the availability of cheaper sources at other times. The optimum structure in one period will then depend on the structure chosen in another period. Because it assumes that each source of funds has a maturity of one planning period (or is refundable at no cost), the sequential method cannot address these interperiod effects.

Differences in Liquidity In the sequential method, sources of short-term funding are assessed based on cost and availability, without regard to their liquidity. Yet the firm may be concerned about differences in liquidity among current liabilities and their consequent effect on the aggregate liquidity of the firm. Under the sequential method, there is no guarantee that the minimum-cost structure of current liabilities will yield the desired level of aggregate liquidity.

Table 12-1. *Variation in Effective Cost with Amount Borrowed.*

Average Principal Amount	*Monthly Commitment Fee*	*Monthly Interest Expense*	*Monthly EAI (percent)*	*Yearly EAI (percent)*
$ 0	$1,042	$ 0	Infinity	Infinity
$ 500,000	$ 937	$ 4,167	1.02	12.96
$1,000,000	$ 833	$ 8,333	.92	11.57
$1,500,000	$ 729	$12,500	.88	11.11
$2,000,000	$ 625	$16,667	.86	10.88
$2,500,000	$ 521	$20,833	.85	10.75
$3,000,000	$ 417	$25,000	.85	10.65
$3,500,000	$ 312	$29,167	.84	10.59
$4,000,000	$ 208	$33,333	.84	10.54
$4,500,000	$ 104	$37,500	.84	10.50
$5,000,000	$ 0	$41,667	.83	10.47

When any of these assumptions about the nature of the firm's potential current liabilities are violated, the sequential method is unreliable; it may or may not yield an optimum structure, depending on the characteristics of the potential sources of funding. Under some circumstances, the violations of the assumptions underlying the sequential method are not serious, and a little insight and analysis will allow the sequential method to be used anyway. For example, suppose that the only violation of these assumptions is that two of the possible sources of short-term borrowing are mutually exclusive (and thus their availabilities are independent). If the more expensive of these sources is eliminated, the sequential method can be properly applied to the remaining sources to yield an optimum package.

However, there are many other situations that involve simply too many violations of the assumptions of the sequential method for insight and analysis to yield an optimum result. When this occurs, the firm needs to utilize a technique that can capture the complex interdependencies, costs, and constraints involved in the current liability structure problem. The integer-programming approach can accomplish this task. It is described in the following sections.

INTEGER PROGRAMMING AND THE STRUCTURING OF CURRENT LIABILITIES

The problem of deciding on a package of current liabilities can be viewed as one of minimization of costs, with this minimization constrained by the various characteristics of the situation. The costs to be minimized are the cash outflows for interest, fees, and so forth, associated with the firm's short-term financing plan. The constraints concern the maximum amount that can be borrowed, the need for funds, the firm's level of aggregate liquidity, and other circumstances. When viewed in this way, it is clear that the generic approach to the problem must be that of *mathematical programming*, which is used in Chapter 2 of this text to address the lockbox location problem. Since several of the variables in the typical current liability structuring problem can assume only integer values, *integer programming* is the type of mathematical programming usually required.[2] In this section, we will describe the solution procedure for the current liability structure problem under the assumption that the future cash flows (and consequently the future financing needs) of

[2]Major references in the use of mathematical-programming techniques to structure current liabilities include A. Robickek, D. Tiechrow, and J. Jones, "Optimal Short-Term Financing Decision," *Management Science*, Vol. 12, No. 1 (September 1965), pp. 1–36; G. Pogue and R. Bussard, "A Linear Programming Model for Short-Term Financial Planning Under Uncertainty," *Sloan Management Review*, Vol. 13 (1972), pp. 69–98; and J. Kallberg, R. White, and W. Ziemba, "Short-Term Financial Planning Under Uncertainty," *Management Science*, Vol. 28, No. 6 (June 1982), pp. 670–82.

the firm are certain. That is, in this section we ignore the uncertainty inherent in these flows. In the following section, the effects of uncertainty in these flows are discussed.

Basics of the Constrained Structuring Problem Let us assume that the treasurer of a firm has projected the firm's future financing needs over the next several planning periods and has made a list of the possible sources of short-term financing over these periods. If none of the sources of short-term financing has a multiperiod maturity, the treasurer need plan only for the next period, and should be concerned with the minimization of costs only for that period.[3] However, if there are candidate sources of financing with multiperiod maturities, a multiperiod plan is required, and the value of financing charges over the entire period must be considered. The various aspects of the situation will generally impose the following types of constraints on the financing plan to be devised:

1. *Available Funds Constraints*—For each period covered by the plan, the cash generated by the sources of short-term borrowing must be sufficient to address the firm's short-term financing requirements.
2. *Limits of Borrowing Constraints*—In general, the maximum amounts of borrowing from each possible source of short-term funding will be constrained; principal amounts cannot be less than zero or exceed this maximum.
3. *Aggregate Liquidity Constraints*—During each period, the firm's short-term financing plan must satisfy the firm's aggregate liquidity targets.
4. *Constraints to Model Stepwise Costs*—If there are sources of borrowing that entail fixed costs, there can be no borrowing from these sources without these stepwise costs being incurred.
5. *Interaction Constraints*—These model the relationships among sources and over time. For example, the use of one source may preclude the use of another.
6. *Ending Condition Constraints*—While the horizon of the treasurer's plan is limited, the firm will continue beyond this period. Because of this, the firm may want to impose constraints on its condition at the end of the planning period.
7. *Miscellaneous Other Constraints*—These limit values of some variables to integers, and so forth.

To approach this problem, the treasurer may use integer programming. In formulating the problem in an integer-programming format, the task is to

[3]For simplicity, in this chapter we ignore the effect of the cost of financing on future financing requirements.

develop mathematical expressions for the objective function (which contains the costs of financing) and the various types of constraints faced by the firm. The precise mathematical formulations will vary from situation to situation, based on the types of current liability financing available to the firm. At this point, it is useful to demonstrate the required procedures by means of an example problem.

An Example Problem A firm is trying to structure its current liabilities package to achieve minimum cost. It has determined that over the next three months it will need short-term cash financing in the total amounts of $10 million, $4 million, and $8 million respectively. Four sources of financing are available:

1. *Notes with a Maturity of 90 Days*—The interest cost of these notes will be 11 percent per year, paid on a discounted basis. Only one borrowing can be made. Notes may be paid only at maturity. The maximum principal is $6 million. There can be no borrowings on this basis if secured borrowings are used.
2. *Secured Borrowings*—If this borrowing source is used, no borrowings can be made on unsecured notes. The borrowing will be secured by the firm's accounts receivable. Interest will be paid at maturity at a rate of 9.5 percent per year. Borrowings are on a monthly basis. Availability is based on the size of the firm's receivables portfolio; maximum borrowings for the three months are $4 million, $2 million, and $3 million respectively.
3. *Commercial Paper*—Maturity here will be 30 days. Rates are expected to be 10 percent per year in all three months. Interest is on a discount basis. The firm's maximum borrowings are $8 million. To be able to borrow using commercial paper, the firm will first have to pay a $10,000 fee to its bank to obtain a bank guarantee of this paper.
4. *Skipping the Discount on Payables*—The cost will be 1.25 percent per month on a discount basis. The availability depends on the amounts owed to suppliers; for the three months in question, the available financing will be $2.5 million, $3.5 million, and $4.5 million respectively.

The firm controls for aggregate liquidity based on the Comprehensive Liquidity Index. The target level of this index is 1.80; any value above this is acceptable. Current assets have an X value of $21.6 million in the first month, $15 million in the second month, and $20 million in the third month; and the minimum levels of accounts payable and accruals contribute $3 million to the value of Y. The firm is not concerned with its ending condition.

The objective function for this problem reflects the goal of minimizing

the sum of the costs of financing over the three-month period.[4] Let P_{ij} be the principal amount raised from source i in period j. Let an i value of A indicate the note borrowing source, B the secured borrowings with accounts receivable as security, C the commercial paper, and D skipping the discount on payables. Let A be the first month, B the second, and C the third. Thus, P_{BC} is the principal amount borrowed on a secured basis in the third month. Let the X_{ij} variables be zero-one integer variables denoting whether source i is used in period j; if there is no j designation on an X_{ij} variable, the variable is X_i and indicates whether source i is used in *any* of the planning periods. The objective function is then:

$$\text{Min} \sum_{\text{all } i} \sum_{\text{all } j} r_{ij} P_{ij} + \text{Other Costs of Financing} \qquad (12\text{-}1)$$

Where r_{ij} is the cost which is proportional to the amount financed from source i in period j. For most sources of financing, r_{ij} will be the interest rate for source i in period j, although r_{ij} can include any other costs that vary directly with the principal borrowed. In our problem, the only costs proportional to the principal amounts are interest expenses. The monthly interest rates are 0.91667 percent for the note borrowing (11 percent per year divided by 12 months), 0.79167 percent for the secured borrowings, 0.83332 percent for the commercial paper, and 1.25 percent for the payables. There is also a $10,000 fixed charge if commercial paper is used; let X_C be a zero-one variable indicating this use. The objective function based on these coefficients along with the important constraint equations for this example problem appear in Table 12-2. Let us review this formulation in detail.

The types of constraint equations necessary for this example problem appear in Table 12-2 in the same order in which these types were previously discussed. The available funds constraints appear in rows 2 through 4. There is one constraint equation for each planning period. Financing expense is on a discounted basis for the notes, commercial paper, and payables sources (sources A, C, and D), so their contributions to the needed cash financing are less than their principal values. For example, the coefficient of the principal amount variable for note financing is 0.9725, reflecting the discounting of three months' interest (since the notes mature in 90 days). The limits of borrowing (maximum principal) constraints appear in rows 5 through 16; there is one equation for each source in each period.

The aggregate liquidity constraints based on the firm's Comprehensive Liquidity Index (one constraint per period) appear in rows 17 through 19. In these three equations, the coefficients of the principal amount variables rep-

[4]A slightly more accurate portrayal would minimize the present value of the future financing costs. To do this, the coefficients of future costs in the objective function would include present-value factors representing relative timing of these future flows. For simplicity, we do not include these in the example problem.

Table 12-2. Partial LINDO Formulation for Example Problem.

```
MIN      10 XC + .0091667 PAA + .0079167 PBA + .0083333 PCA + .0125 PDA
       + .0091667 PAB + .0079167 PBB + .0083333 PCB + .0091667 PAC
       + .0079167 PBC + .0083333 PCC + .0125 PDB + .0125 PDC
SUBJECT TO
         2)   .9725 PAA + PBA + .9917 PCA + .9875 PDA >=  10000
         3)   .9725 PAB + PBB + .9917 PCB + .9875 PDB >=  4000
         4)   .9725 PAC + PBC + .9917 PCC + .9875 PDC >=  8000
         5)   PAA <=  6000
         6)   PAB <=  6000
         7)   PAC <=  6000
         8)   PBA <=  4000
         9)   PBB <=  2000
        10)   PBC <=  3000
        11)   PCA <=  8000
        12)   PCB <=  8000
        13)   PCC <=  8000
        14)   PDA <=  2500
        15)   PDB <=  3500
        16)   PDC <=  4000
        17)   .75 PAA + .9167 PBA + .9167 PCA + .9167 PDA <=  9000
        18)   .75 PAB + .9167 PBB + .9167 PCB + .9167 PDB <=  5333
        19)   .75 PAC + .9167 PBC + .9167 PCC + .9167 PDC <=  8111
        20) - 8000 XC + PCA <=  0
        21) - 8000 XC + PCB <=  0
        22) - 8000 XC + PCC <=  0
        23)   PAA - PAB =  0
        24)   PAB - PAC =  0
        25) - 6000 XA + PAA <=  0
        26) - 4000 XBA + PBA <=  0
        27) - 2000 XBB + PBB <=  0
        28) - 3000 XBC + PBC <=  0
        29)   XA + XBA <=  1
        30)   XA + XBB <=  1
        31)   XA + XBC <=  1
        32)   PAA >=  0
        33)   PAB >=  0
        34)   PAC >=  0
        35)   PBA >=  0
        36)   PBB >=  0
        37)   PBC >=  0
        38)   PCA >=  0
        39)   PCB >=  0
        40)   PCC >=  0
        41)   PDA >=  0
        42)   PDB >=  0
        43)   PDC >=  0
```

resent their contributions to the Y figure used in the Comprehensive Liquidity Index. The maturity of the secured borrowings, commercial paper, and payables is one month, so they turn over 12 times per year; their coefficients are therefore 0.9167 (equal to 1 minus 1/12). Similarly, the coefficient of the principal amount borrowed on notes is 0.75 because this source of financing matures four times per year.

The stepwise cost associated with the use of the commercial paper is modeled in rows 20 through 22. The X_C variable is constrained to zero or 1.0, and unless it is 1.0, no borrowings can take place from commercial paper in any of the three planning periods.

There are two interactions in this example problem. First, the principal borrowed under the note borrowings in the initial period will continue over the three months of the plan, and cannot be reduced or increased over time. Rows 23 and 24 insure this by requiring that the three principal amounts under the note borrowings (source A) be equal. The second interaction occurs between the unsecured note borrowings and the secured borrowings against receivables (source B). Row 25 requires that X_A be 1.0 if there are any note borrowings. Rows 26 through 28 make the same requirement based on X_{Bj} variables for periods A, B, and C. These four 0,1 integer variables are then used in rows 29 through 31 to insure that only one of these two possible sources can be used over the planning horizon. In these equations, the sum of X_A and an X_{Bj} variable are constrained to be less than 1.0. Since these X variables are zero-one integers, if one of them is 1.0, the other cannot be 1.0 (though both can be zero). If X_A is 1.0, all the X_{Bj} variables must be zero; if one of the X_{Bj} variables is 1.0, X_A must be zero.

The remaining rows constrain the principal amounts of the various borrowings to be greater than zero. Not shown here (in the interests of brevity) are the miscellaneous constraints necessary to confine the X_{ij} variables to zero or 1.0.

The solution to this formulation is presented in Table 12-3; some analysis of this solution is presented in Table 12-4. The financing cost is $201,210. In each of the periods, the 90-day notes and the commercial paper provide the necessary cash. The resulting Comprehensive Liquidity Indices are 1.81, 2.35, and 1.98 respectively.

This solution yields some interesting insights regarding the structure of this particular problem. These can be assessed by inspecting Tables 12-3 and 12-4. One interesting aspect concerns the nonuse of secured financing, which is the source of funding carrying the lowest interest rate. This lack of use is due to the constraint on the firm's level of aggregate liquidity. In the first period, the firm *must* use note financing in order to achieve its minimum desired Comprehensive Liquidity Index. Because of the coefficients of the principal amount variables in rows 17 through 19 of the formulation and because of the interactions among the sources, only the use of notes as part

Table 12-3. LINDO Solution for Example Problem.

OBJECTIVE FUNCTION VALUE
201.208000

1) VARIABLE	VALUE	REDUCED COST
XA	1.000000	.000000
XC	1.000000	10.000000
XBA	.000000	−14.219780
XBB	.000000	−.972750
XBC	.000000	−1.459035
PAA	2124.833000	.000000
PBA	.000000	.000000
PCA	8000.000000	.000000
PDA	.000000	.001172
PAB	2124.833000	.000000
PBB	.000000	.000000
PCB	1949.783000	.000000
PAC	2124.833000	.000000
PBC	.000000	.000000
PCC	5983.261000	.000000
PDB	.000000	.004202
PDC	.000000	.004202

of the financing package will achieve the necessary liquidity in this period (since the notes have a lower contribution to the Comprehensive Liquidity Index than do the other sources of financing). Since note financing must be used, secured borrowings may not be used.

Another interesting aspect of this solution concerns the use of the commercial paper. Since there is a fixed fee associated with this source of funding, its cost per dollar financed is very high if it is used in small amounts. However, the integer programming solution uses this source in sufficient amount that its overall cost is less than that of alternative accounts payable financing (which is the other remaining potential source of funding, since note borrowings have been used and secured borrowings are precluded).

The integer programming method is a straightforward approach to the current liability-structuring problem. As illustrated in the prior example, it yields optimal solutions when there are various constraints and interactions in raising the necessary funds. However, this methodology may also be used to simultaneously develop (1) a plan for short-term borrowing, and (2) a hedging strategy against the cash stockout risk that is caused by uncertainties in the firm's cash flows. Recall from prior chapters that one approach to hedging this risk is to keep a target level of aggregate liquidity (as discussed in Chapter 10). Another is to maintain a safety stock of liquid assets and/or

Table 12-4. Analysis of IP Solution.

	Principal Amounts Month				*Financing Amounts* Month		
Source	*A*	*B*	*C*	*Source*	*A*	*B*	*C*
A	$2,125	$2,125	$2,125	A	$ 2,067	$2,067	$2,067
B	0	0	0	B	0	0	0
C	$8,000	$1,950	$5,983	C	$ 7,934	$1,934	$5,934
D	0	0	0	D	0	0	0
					$10,000	$4,000	$8,000

	Financing Costs Month				*Contributions to CLI* Month		
Source	*A*	*B*	*C*	*Source*	*A*	*B*	*C*
A	$19.48	$19.48	$19.48	A	$ 1,594	$ 1,594	$ 1,594
B	0	0	0	B	0	0	0
C	$76.67	$16.25	$49.86	C	$ 7,333	$ 1,787	$ 5,485
D	0	0	0	D	0	0	0
	$96.15	$35.73	$69.34		$ 8,927	$ 3,381	$ 7,078
	Three-Month Total		201.21	Other *Y*	$ 3,000	$ 3,000	$ 3,000
				Total *Y*	$11,927	$ 6,381	$10,078
				X	$21,600	$15,000	$20,000
				CLI	1.81	2.35	1.98

short-term borrowing capacity (as discussed in Chapter 3).[5] The integer-programming approach to the current liability structure problem can also be used to plan this short-term borrowing capacity hedge. This use of integer programming in conjunction with hedging cash flow uncertainty is discussed in the next section.

INTEGER PROGRAMMING AND THE HEDGING OF CASH STOCKOUTS

For most firms, the expected cash flows used to determine the firm's financing requirements in various periods are not certain. Because of deviations from expectations in the levels of sales, collection patterns, and so forth,

[5]In Chapter 3, we generally limited our discussion of the use of reserve borrowing capacity in the hedging of cash shortages to the availability of additional borrowings on bank credit lines. We limited discussion to this particular source of funding in the interests of simplicity. However, the availability of reserve borrowing capacity from *any* source of short-term funding (accounts payable, commercial paper, accruals, etc.) can provide such a hedge, as is recognized in the following section.

the expected amounts of required financing and surplus funds are actually the means of the probability distributions. However, the firm's potential sources of short-term borrowing provide a method of hedging this cash flow risk. If the firm structures its sources of short-term borrowing so as to allow for *the availability of additional borrowing capacity* to address potential shortfalls, it can obtain a short-term financing strategy that includes a hedge against cash stockouts.

To see this, let us assume that the firm has, based on the costs of running out of cash, set an acceptable probability of such an event for each planning period. This probability, combined with data on the probability distributions of borrowing amounts in various future periods (obtained via a simulation analysis of the firm's cash budget), gives the total dollar amount of the necessary hedge. The firm's current asset structure can provide part of this hedge; the remainder can be provided by structuring current liabilities so as to have the necessary amount of reserve borrowing capacity available in each period. However, it is important to note that this reservation of borrowing capacity *may change the optimal strategy for financing expected deficits*. Further, because adding an additional set of constraints (those that require reserve borrowing capacity in each planning period) may change the mix of liabilities used in financing, *expected financing costs may be increased*. That is, depending on the costs of potential current liabilities and their availabilities, *this hedging strategy may not be costless*.

An Example Problem Let us modify the prior example problem to reflect uncertainty and to use available borrowing capacity as a partial hedge against cash stockouts. In addition to the data provided previously, assume that the firm has conducted a simulation of its cash budget and determined that the standard deviations of the expected levels of borrowings over the next three months are \$3 million, \$4 million, and \$5 million, respectively. The levels of borrowings are normally distributed and uncorrelated over time. The firm has decided that it is willing to undergo a probability of cash stockout of 5 percent in each month. If the firm has extra cash (because it has borrowed more on the 90-day note arrangement than it needs for financing, and the note balance cannot be reduced) this cash will be invested at 3 percent per year less than the interest rate on the notes. This investment will be in securities of very short maturity. The firm plans to keep \$1 million in other cash or near-cash instruments as part of current assets during each of the three months. Besides this cash reserve, the firm would like to formulate an additional hedge based on short-term borrowing capacity to deal with cash shortage risks.

To address this problem, we need to formulate the firm's short-term financing strategy in such a way that it allows for the required hedging availability in each period. Recognize first that each possible source of short-term debt can entail the funding of expected principal borrowings in each period

Table 12-5. Partial LINDO Formulation for Example Problem with Hedging.

```
MIN       10 XC + .0091667 PAA + .0079167 PBA + .0083333 PCA + .0125 PDA
        + .0091667 PAB + .0079167 PBB + .0083333 PCB + .0091667 PAC
        + .0079167 PBC + .0083333 PCC + .0125 PDB + .0125 PDC + .0025 HAA
        + .0025 HAB + .0025 HAC
SUBJECT TO
          2)   .9725 PAA + PBA + .9917 PCA + .9875 PDA >=   10000
          3)   .9725 PAB + PBB + .9917 PCB + .9875 PDB >=   4000
          4)   .9725 PAC + PBC + .9917 PCC + .9875 PDC >=   8000
          5)   PAA + HAA <=   6000
          6)   PAB + HAB <=   6000
          7)   PAC + HAC <=   6000
          8)   PBA + HBA <=   4000
          9)   PBB + HBB <=   2000
         10)   PBC + HBC <=   3000
         11).  PCA + HCA <=   8000
         12)   PCB + HCB <=   8000
         13)   PCC + HCC <=   8000
         14)   PDA + HDA <=   2500
         15)   PDB + HDB <=   3500
         16)   PDC + HDC <=   4000
         17)   .75 PAA + .9167 PBA + .9167 PCA + .9167 PDA + .2097 HAA <=   9000
         18)   .75 PAB + .9167 PBB + .9167 PCB + .9167 PDB + .2097 HAB <=   5333
         19)   .75 PAC + .9167 PBC + .9167 PCC + .9167 PDC + .2097 HAC <=   8111
         20) - 8000 XC + PCA + HCA <=   0
         21) - 8000 XC + PCB + HCB <=   0
         22) - 8000 XC + PCC + HCC <=   0
         23)   PAA - PAB =   0
         24)   PAB - PAC =   0
         25) - 6000 XA + PAA + HAA <=   0
         26) - 4000 XBA + PBA + HBA <=   0
         27) - 2000 XBB + PBB + HBB <=   0
         28) - 3000 XBC + PBC + HBC <=   0
         29)   XA + XBA <=   1
         30)   XA + XBB <=   1
         31)   XA + XBC <=   1
         32)   PAA >=   0
         33)   PAB >=   0
         34)   PAC >=   0
         35)   PBA >=   0
         36)   PBB >=   0
         37)   PBC >=   0
         38)   PCA >=   0
         39)   PCB >=   0
         40)   PCC >=   0
         41)   PDA >=   0
         42)   PDB >=   0
```

```
43)  PDC >=  0
44)  .9725 HAA + HBA + .9917 HCA + .9875 HDA =  3935
45)  .9725 HAB + HBB + .9917 HCB + .9875 HDB =  5580
46)  .9725 HAC + HBC + .9917 HCC + .9875 HDC =  7225
47)  HAA - HAB =  0
48)  HAB - HAC =  0
49)  HAA >=  0
50)  HAB >=  0
51)  HAC >=  0
52)  HBA >=  0
53)  HBB >=  0
54)  HBC >=  0
55)  HCA >=  0
56)  HCB >=  0
57)  HCC >=  0
58)  HDA >=  0
59)  HDB >=  0
60)  HDC >=  0
```

(P_{ij}), a hedging availability in that period, or both of these. Designate the principal amount of the hedging availability from source i in period j as H_{ij}. An integer program incorporating the modifications necessary to include this hedging strategy for the example problem is presented as Table 12-5.[6] Let us review the modifications that have been made to the original, unhedged program on a line-by-line basis.

In our example, for the sources of short-term financing involving secured borrowings, commercial paper, and skipping the discount on payables (sources B, C, and D), there are no costs directly associated with keeping reserve borrowing capacity. Therefore, no cost terms for the hedging availabilities from these sources appear in the objective function. However, to have cash available from the 90-day notes (source A), the firm must borrow this cash and invest it in short-term securities, since the principal amount owing on the notes cannot be changed over the three-month period. Consequently, the loss of these investments (interest expense minus investment income) must appear in the objective function. This is represented by the H_{AA}, H_{AB}, and H_{AC} terms that have been added to this function. The cost of these hedges is 3 percent per year (0.25 percent per month).

The availability constraints for the expected amounts of necessary funding (rows 2 through 4) are not affected by the inclusion of hedging strategy within the problem. However, the limits of borrowing constraints (rows 5 through 16) must now reflect the potential reservation of a portion of available

[6]As before, in the interests of space we do not present the constraint equations that limit the X_{ij} variables to zero or 1.0.

borrowing for hedging purposes. This is done by adding the hedging principal variable to the lefthand side of each of these constraint equations. For example, in row 5, the total principal available for borrowing *and* hedging from source A in period A is \$6 million; if borrowings from this source in this period are \$4 million, the maximum hedge from this source is \$2 million.

The modified aggregate liquidity constraints are presented in rows 17 through 19. The use of reserve availability from the secured borrowings, commercial paper, or delayed payment to suppliers does not entail a change in the firm's expected level of assets and liabilities, and therefore does not affect these constraints.[7] However, the use of notes as a hedging vehicle requires that more funds be borrowed on these notes and that these funds be temporarily invested; this changes the firm's aggregate liquidity position. Take period A as an example. For each dollar of principal borrowed on notes, the firm receives \$0.9725 in cash which is then invested in short-term securities. This increases X in the Comprehensive Liquidity Index by \$0.9725; the new X is \$21.6 million plus $0.9725H_{AA}$. For each dollar of principal borrowed on notes, Y in the Comprehensive Liquidity Index will increase by \$0.75 (since the maturity of the notes is 90 days). Let Y_p be the contribution to Y from the firm's other short-term borrowings. The new Y is then Y_p plus \$3 million plus $0.75H_{AA}$, since the contribution to Y from the unavoidable payables and accruals is \$3 million. Since the desired ratio of X to Y is 1.80, the appropriate constraint equation is:

$$21.6 + 0.9725\ H_{AA} \geq 1.80(Y_p + 3 + 0.75H_{AA}) \qquad (12\text{-}2)$$

Which simplifies to:

$$9 \geq Y_p + 0.2097H_{AA} \qquad (12\text{-}3)$$

Therefore, the necessary modification to reflect the hedge from the notes is to add $0.2097H_{AA}$ to the left-hand side of row 17. The same coefficient of H_{Aj} occurs for the other two aggregate liquidity constraint equations in rows 18 and 19.

Rows 20 through 22 utilize a stepwise variable (X_C) that must be 1.0 if the commercial paper (source C) is used as part of the firm's financing package. This variable appears in the objective function to trigger the required guarantee fee from the firm's bank. If the firm plans to use commercial paper as a financing vehicle *or as a hedge*, this fee must be paid; consequently, the hedging variables must appear in these constraint equations. Similar hedging principal variables for the notes payable (source A) and the secured financing (source B) must also appear in rows 25 and 26 through 28, where X_{ij} variables

[7]We assume that these constraints are not enforced if the firm, because of an unexpected cash shortage, is forced to deplete cash reserves or to borrow additional funds.

are used to signal the use of these sources; if these sources are used for borrowing or hedging, their X_{ij} usage variables must be 1.0.

The remainder of the original integer-programming formulation (through row 43) is as it appears in the unhedged program. Rows 44 through 60 are additional constraints resulting from the use of borrowing sources as hedging vehicles. Rows 44 through 46 give the total amounts of the necessary hedges. For example, row 44 specifies the hedge needed in period A. The dollar amount of the hedge (the righthand side of this equation) is determined as follows. Recall that the standard deviation of the necessary borrowing in period A is \$3 million, the probability distribution of this borrowing is normal, and that the firm wants to be 95 percent sure of having sufficient funds. The Z-score for 95 percent is 1.645, so the firm must have a total hedging reserve of \$4.935 million (equal to 1.645 times \$3 million). The firm's current asset position provides \$1 million of this reserve; the remaining \$3.935 must come from current liabilities. The total reserve hedging capacity must then be \$3.935 million. Similar calculations give the figures on the righthand sides of the equations in rows 45 and 46. The coefficients of the H_{ij} variables on the lefthand side of these equations are the ratios of the cash raised from these sources to the amounts of principal borrowed and are the same as those in rows 2 through 4. The remaining rows impose constraints that the hedging from the 90-day notes be the same in all periods (rows 47 and 48) and that the principal amounts of the hedges be greater than zero (rows 49 through 60).

A LINDO solution to this formulation is presented in Table 12-6. In this table, the amounts specified as hedges for the sources that are not costly unless used (sources B, C, and D) are arbitrary; costs for these hedges do not appear in the objective function.

Analysis of the LINDO solution is presented in Table 12-7. There are several differences between this hedged solution and the solution where there is no hedging. While the same sources of borrowing appear (notes, source A, and commercial paper, source C), the amount of borrowing on the note arrangement has increased from \$2.125 million to \$3.633 million over the unhedged solution. This greater use of note financing reduces the amount of necessary commercial paper financing; along with the financing available from delaying payments to suppliers, this creates the necessary \$3.935 million in reserve borrowing capacity for hedging purposes in the first period.[8] When borrowing is structured in this way, the firm will have the minimum required reserved borrowing capacity in period A and surplus reserve borrowing capacity in periods B and C.

The requirements of this hedging strategy increase the expected borrowing cost from \$201,210 to \$205,710. This increase in expected cost of \$4,500 is the cost of this hedging strategy. This additional cost should be

[8]The availability of a secured borrowing arrangement contributes nothing to hedging, since secured borrowings cannot be used in combination with the note borrowings.

Table 12-6. A LINDO Solution for Example Problem with Hedging.

	OBJECTIVE FUNCTION VALUE	
1)	205.707300	
VARIABLE	VALUE	REDUCED COST
XA	1.000000	.000000
XC	1.000000	10.000000
XBA	.000000	−14.219780
XBB	.000000	−.972750
XBC	.000000	−1.459035
PAA	3632.545000	.000000
PBA	.000000	.000000
PCA	6521.478000	.000000
PDA	.000000	.004202
PAB	3632.545000	.000000
PBB	.000000	.000000
PCB	471.261000	.000000
PAC	3632.545000	.000000
PBC	.000000	.000000
PCC	4504.739000	.000000
PDB	.000000	.004202
PDC	.000000	.004202
HAA	.000000	.004516
HAB	.000000	.000000
HAC	.000000	.000000
HBA	.000000	.000486
HCA	1478.522000	.000000
HDA	2500.000000	.000000
HBB	.000000	.000486
HCB	5626.702000	.000000
HDB	.000000	.000000
HBC	.000000	.000486
HCC	3495.261000	.000000
HDC	3806.329000	.000000

compared to the cost of other possible strategies, and the cheapest method of hedging cash flow uncertainty over the planning horizon should be used.

INTEGER PROGRAMMING AND CURRENT LIABILITIES IN PERSPECTIVE

The integer-programming structuring approach to current debt has many positive features. Properly used, it provides the minimum-cost constrained solution to any structuring problem whose relationships among variables are linear. It addresses multiperiod planning situations and can incor-

Table 12-7. *Analysis of Solution with Hedging.*

Maximum Principal Borrowings

Source	Month A	Month B	Month C
A	$6,000	$6,000	$6,000
B	$4,000	$4,000	$4,000
C	$8,000	$8,000	$8,000
D	$2,500	$3,500	$4,000

Principal Amounts

Source	Month A	Month B	Month C
A	$3,633	$3,633	$3,633
B	0	0	0
C	$6,521	$ 471	$4,505
D	0	0	0

Financing Amounts

Source	Month A	Month B	Month C
A	$ 3,533	$3,533	$3,533
B	0	0	0
C	$ 6,467	$ 467	$4,467
D	0	0	0
	$10,000	$4,000	$8,000

Financing Costs

Source	Month A	Month B	Month C
A	$33.30	$33.30	$33.30
B	0	0	0
C	$64.35	$ 3.93	$37.54
D	0	0	0
	$97.64	$37.23	$70.84
		Three-Month	$205.71

Contributions to CLI

Source	Month A	Month B	Month C
A	$ 2,724	$ 2,724	$ 2,724
B	0	0	0
C	$ 5,978	$ 432	$ 4,129
D	0	0	0
	$ 8,703	$ 3,156	$ 6,854
Other *Y*	$ 3,000	$ 3,000	$ 3,000
Total *Y*	$11,703	$ 6,156	$ 9,854
X	$21,600	$15,000	$20,000
CLI	1.85	2.44	2.03

Princ. Avail. for Hedging

Source	Month A	Month B	Month C
A	0	0	0
B	0	0	0
C	$1,479	$ 7,529	$3,495
D	$2,500	$ 3,500	$4,000

Fin. Amts. Avail. for Hedge

Source	Month A	Month B	Month C
A	0	0	0
B	0	0	0
C	$1,466	$ 7,466	$3,466
D	$2,469	$ 3,456	$3,950
	$3,935	$10,923	$7,416
Req. Hedge	$3,935	$ 5,580	$7,225

porate hedging strategies. It is relatively cheap to compute; except for very complex problems, large amounts of computer time are rarely used.

However, this approach to the problem is not without its difficulties. These difficulties relate to the programming effort necessary to implement the integer-programming methodology in this context. This necessary programming effort is in contrast to the application of integer programming to the lockbox location problem, which was discussed in Chapter 2. When the firm wants to use integer programming to address the lockbox location problem, the firm does not have to develop mathematical expressions for the objective function and the constraint equations. Since all firms' lockbox location problems have approximately the same structure, integer-programming formats have been developed to address this structure and are commercially available (often through the firm's bank). In using these formats, the firm needs only provide specific data sets (check origins, possible lockbox locations, and so forth), and the prewritten program finds the optimum combination of lockbox location and customer assignment. In such a case, no need for actual programming arises, unless the firm's lockbox location problem contains very special features.

The use of a prewritten integer-programming format is in contrast to the methodologies that a firm must employ in using integer programming for determining a structure of current debt. For most firms, *this* application of integer programming usually contains a sufficient number of unique features so that the firm must write its own objective function and set of constraint equations to model availabilities, costs, and interactions among its possible sources of financing. *The programming process of obtaining proper expressions for these functions is not trivial, and any errors made in the process may lead to costly mistakes.* For most firms, while its proper use will lead to an optimal structure of current debt, using integer programming in this application requires substantially more effort than does the application of this technology to the lockbox location problem.

The Management of Current Liabilities in Practice There is not a great deal of information available on the methods by which firms structure their current liability package. However, some very interesting survey results have been reported regarding firms' policies in the use of some *individual* sources of short-term funding. In this section, we present information on the firms' practices in the use of *accounts payable* and of *factoring* in funding their short-term liability needs.

In 1981, Hill, Sartoris, and Ferguson conducted a survey of the accounts payable managers of 1,479 firms of various sizes in various industries; 180 responses were received.[9] A major thrust of this survey was obtaining infor-

[9]The full results of this survey are reported in N. Hill, W. Sartoris, and D. Ferguson, "Corporate Credit and Payables Policies: A Survey of Size and Industry Effects," presented at the Financial Management Association's 1983 Annual Meeting, and available from Hill at Brigham Young University.

mation on firms' decisions regarding two methods of obtaining financing from accounts payable: skipping the discount and stretching accounts payable. Let us first discuss their results regarding the use of skipping the discount as a financing strategy. The survey revealed that the vast majority of firms generally take the discount. In deciding whether to take the discount, the primary criterion of most firms is the amount of the discount. This makes good financial sense, since the amount of the discount (along with the delay period from the discount date to the due date) determines the cost of skipping as a source of financing. The plurality of payables managers continue to use the postmark on the envelope as the appropriate date in determining whether their remittances are eligible for the discount.[10] Some accounts payable managers believed that the portion of payables offering discounts had decreased over time, but the majority of these managers felt that this proportion had stayed about the same.

The other financing strategy in connection with accounts payable is the stretching of payables beyond the due date. Hill, Sartoris, and Ferguson's survey revealed three important factors that are considered by firms in deciding whether to use this strategy: the value of using the funds (that is, the cost of the funds relative to other funding sources), the effects on relationships with suppliers, and the impact on the firm's credit rating. The relative significance of these three factors varied among large and small firms. For small firms, the value of the funds was the most important factor, followed by the impact on the firm's credit rating, and finally by the effect on relationships with suppliers. For large firms, relationships with suppliers are most important, followed by the value of the funds, and the effect on credit rating. While each of these three factors is related to the cost of stretching, the differences between large and small firms are interesting. The primary importance of supplier relations to larger firms versus its lesser importance for smaller firms may be an indicator of differences in the character of bargaining with suppliers. Large firms may be able to bargain effectively (so supplier relations are important), but small firms may have to take or leave whatever conditions of sale the supplier is willing to offer (in which case supplier relations would be of lesser importance).

Farragher surveyed 33 firms with an interest in factoring to determine patterns in the use of this financing method; 21 responses were received.[11] The types of firms with heavy and growing involvement in factoring continue to be those that have traditionally used this type of financing. These firms are manufacturers of textiles and clothing. However, there is also growing

[10]Interestingly, a parallel survey of credit managers (who are responsible for collections on these checks) indicated that the date when the check is received at the lockbox, and not the postmark date, was their preferred date for assessing discount eligibility. See Hill, Sartoris, and Ferguson, "Corporate Credit and Payables Policies," p. 11.

[11]See E. Farragher, "Factoring Accounts Receivable," *Journal of Cash Management* (March/April 1986), pp. 38–42.

involvement among firms manufacturing furniture and firms wholesaling toys and sporting goods. Firms see the most important services provided by factoring as (1) the credit analysis of customers, (2) the control of bad debt losses, (3) cash advances for sales, and (4) control of collection effort and expense. While, in this ranking, services that factors provide relating to credit management are at the top of the list, Farragher found that 55 percent of factoring volume is on a discount basis, while only 36 percent is maturity factoring. Together, these results suggest that *both* the factor's expertise in credit management functions *and* the financing that this process provides are important to firms in deciding whether to use factoring.

SUMMARY

In this chapter, the integer-programming approach to the problem of developing a minimum-cost structure for current liabilities was presented. This mathematical-programming approach to the current liabilities structuring problem is an improvement over the sequential method since it can incorporate interdependencies among funding sources, variations in the costs of borrowing for particular sources, multiperiod maturities, and other commonly occurring effects.

The disadvantage of this more robust approach is the programming effort necessary for its implementation. The various operating and industry characteristics of different firms result in substantially divergent opportunities for current liability financing. These divergent sources of potential funding make the precise form of the integer-programming problem vary substantially from firm to firm. Therefore, unlike cases where the firm uses integer programming to locate its lockboxes (a problem that is similar from firm to firm, and for which commercial software is available), the use of this technique for structuring current liabilities requires that the firm must develop its own mathematical expressions for the objective function and the constraint equations. The objective function will contain the costs of the various sources of funds in the various planning periods. Constraint equations may include those requiring that the funding raised be sufficient to meet the firm's needs, those limiting the funds available from each source, and those concerning the target level of the firm's aggregate liquidity. Additional constraints may be necessary to model stepwise costs, interactions among sources of funding (including mutually exclusive sources), the desired ending financial condition of the firm, and the need for available borrowing capacity as a hedge against cash flow uncertainty. Example problems were presented illustrating the integer-programming approach with and without the use of extra borrowing capacity to hedge this uncertainty.

The chapter also reviewed some survey results regarding the use of accounts payable and of factoring as part of the firm's current liability package.

In the use of accounts payable, most firms decide whether to skip the discount based on the amount of the discount; the amounts of discounts are such that most firms pay in sufficient time to take advantage of this discount. The plurality of payables managers believe they can take the discount if their firm's check is postmarked by the discount date. In deciding whether to stretch payables beyond the due date, firms consider the cost of the funds, the effects of this stretching on relationships with the supplier, and the impact of stretching on the firm's credit rating. The relative importance of these three factors varies among large and small firms.

The use of factoring continues to be dominated by firms in textile and clothing manufacturing. Most firms who use factoring discount their invoices, and thus obtain immediate cash from the factor. However, the nonfinancing services that the factor provides in making credit-granting decisions, in controlling bad debt loss, and in making collections are also important to firms who factor their receivables.

Once the firm has determined a structure for its current liabilities (given its previously determined structure of current assets), it has completed the main tasks of working capital management. However, firms that participate in international trade, investment, and financing face special problems in making decisions on short-term debt and assets. These special problems will affect their strategies regarding these items. The management of working capital in an international environment is the topic of the next chapter.

Problems

12-1. A firm is considering the use of a field warehousing arrangement as part of its financing strategy. The arrangement would require a $10,000-per-year fee for the maintenance of the warehouse, regardless of the amount borrowed. This fee would be paid at the beginning of the year. A collateral certification and monitoring fee of 2 percent of the amount borrowed would be required, also paid at the beginning of the year. Interest would be at a rate of 11 percent per year, paid at maturity. Assuming that the duration of all loans is one year, calculate the effective annual interest rates of this arrangement for principal borrowings of $100,000, $200,000, $300,000, $400,000, and $500,000.

12-2. A firm is trying to structure its current liabilities for the next two quarters using the integer-programming method. There are only two possible sources of financing:

a. Discounted notes with a maturity of 180 days (source A). The stated interest rate on these notes is 10 percent per year. Maximum principal borrowings are $5 million. Excess borrowings are not invested. The notes are not refundable.

b. Credit-line borrowings with the firm's bank (source B). For these borrowings there is a fixed application fee of $1,000, payable immediately. The firm must pay this fee if it intends to borrow in either quarter. Interest will be paid at maturity at a rate of 11 percent per year. Maximum principal borrowings are $4 million.

The firm requires net financing of $3 million in the upcoming quarter (quarter A) and $6 million in the following quarter (quarter B). For purposes of this problem, assume that the firm does not use the availability of either of these sources of funds to hedge uncertainties in its cash forecast.

Let: XB = a zero-one integer variable indicating whether the firm will borrow on the bank credit line.
PAA = the amount of principal borrowings from source A in quarter A.
PAB = the amount of principal borrowings from source A in quarter B.
PBA = the amount of principal borrowings from source B in quarter A.
PBB = the amount of principal borrowings from source B in quarter B.

Write the objective function and the constraint equations for this situation. Assume that the sources are independent. Ignore any effects of the choice of financing on aggregate liquidity and any restrictions on ending conditions.

12-3. The firm described in Problem 2 has decided to incorporate the hedging of cash flow uncertainties via reserve borrowing capacity as part of its structuring strategy for current debt. The firm has performed a simulation analysis on its cash forecast and determined that the standard deviation of needed borrowings is $1.5 million in the first quarter and $3.5 million in the second quarter. The levels of borrowing are normally distributed and serially uncorrelated. The firm has decided that it is willing to undergo a probability of cash stockout of 10 percent in each quarter. Excess borrowing capacity will provide the only hedge against cash flow uncertainty. Using these facts and the data presented in Problem 2, write the objective function and necessary constraint equations for this situation.

Let: HAA = the principal amount of excess borrowing hedge from source A in quarter A.

HAB = the principal amount of excess borrowing hedge from source A in quarter B.

HBA = the principal amount of excess borrowing hedge from source B in quarter A.

HBB = the principal amount of excess borrowing hedge from source B in quarter B.

Selected Readings

Farragher, E., "Factoring Accounts Receivable," *Journal of Cash Management* (March/April 1986), pp. 38–42.

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case

Transformers, Inc.[1] *Structuring Short-Term Liabilities: Integer-Programming Method*

Transformers, Incorporated, was a manufacturer of transformers, generators, and similar electrical devices. Founded in the early 1950s, the company had substantial success until the early 1970s, when a series of problems beset the firm. The recession of 1970–71 had severely reduced sales. From 1969 to 1970, the firm's sales declined by 33 percent (see Exhibit 1 for the company's financial statements for the fiscal years ending 12/31/69 through 12/31/72). Sales remained at these lower levels during fiscal 1971, then recovered in 1972. However, the losses during 1970 and 1971 had put a severe strain on the firm's financial position. In part to finance these losses, the firm had borrowed heavily from their bank during this period, both on a short-term and on a long-term basis. Short-term borrowings were made via an unsecured line of credit, while long-term borrowings were secured by the firm's fixed assets. However, in early 1973 additional short-term borrowing had come to a halt when the bank had indicated that it would not be receptive to requests by Transformers, Inc., for more short-term unsecured financing.

Besides these difficulties, Transformers, Inc. was also having problems with its trade suppliers. Because of suppliers' pricing and delivery policies, many of the raw materials used by the firm had to be ordered in increasingly larger quantities. Some domestic suppliers had offered substantial price reductions for ordering in larger quantities (quantity discounts), making ordering in small lots uneconomical, and some overseas suppliers had required that the firm take large quantities of materials because they did not maintain warehouse facilities in the United States. Because of its past losses and heavy investment in inventories, Transformers had stretched payments far beyond suppliers' terms of sale. In early 1973, there was a very real possibility that some of these suppliers would refuse to make further shipments, resulting in severe production problems for the firm. Some sort of financial restructuring was obviously needed.

In a discussion of the problems Transformers was having, a credit manager of one of these supplier firms suggested to Roger Trexler (Transformers' treasurer) that the firm consider a secured, short-term financing arrangement. Though Mr. Trexler was not familiar with this type of borrowing, he was determined to investigate any potential source

[1]This case has been adapted from Frederick C. Scherr, *Cases in Finance* (New York: Macmillan, 1984), pp. 132–37.

of new financing. Mr. Trexler contacted Transformers' bank lending officer and found him receptive to the possibility of secured short-term borrowing. The banker also proposed that such a financing system could be used to replace some of the firm's unsecured short-term borrowings with a lower interest arrangement. However, the banker said that under current lending policies a general security agreement (a blanket lien) would not be sufficient. An independent company would have to be retained to monitor the collateral and perform certification services for the bank. This sounded expensive to Mr. Trexler, but he made an appointment to discuss the matter with the agent of the company that usually performed collateral certification monitoring and certification services for Transformers' bank. At the meeting, the agent presented details of two borrowing plans to Mr. Trexler: certified accounts receivable and field warehousing of inventory.

Under the certified accounts receivable system, the collateral monitoring and certification services company would examine the Transformers' receivables to see if these were adequate collateral. Usually receivables more than 90 days old or those due from customers of uncertain credit quality were not considered to be adequate collateral for borrowings. If all or part of the receivables were approved as collateral, the bank would prepare a security agreement, have it signed by Transformers, and have it filed as prescribed by law. Payments by customers against the receivables used as security would be made to a special bank account. As existing receivables were paid and new ones generated, the collateral monitoring and certification services company would verify receivables balances and prepare reports of receivables eligible as collateral. The bank would loan Transformers up to 75 percent of the certified and monitored balance. In return for its services, the collateral monitoring and certification services firm would be paid a yearly fee of 2.5 percent of the average amount of the loan. The receivables loan would carry an interest rate of 4 percent over prime (rather than the current rate of 7 percent over prime charged for the firm's unsecured borrowings). Because of the high quality of Transformers' receivables, Mr. Trexler believed that all the firm's receivables would be adequate collateral for borrowing under the certified receivables system.

Under the field warehousing arrangement, the collateral monitoring and certification services company would physically inspect and verify the quality of Transformers' inventory as collateral. Only inventory with significant resale value was considered to be adequate collateral for borrowing. For Transformers, only raw materials inventory would meet this qualification. A security agreement would be executed and filed on the inventory, and the collateral monitoring and certification services firm would lease (for a nominal fee) a portion of the storage area at Transformers' facilities. This area would be used to store the inventory that was collateral for borrowings. Access would be restricted (by means of a locked gate), and the collateral monitoring and certification services firm would arrange for the bonding of personnel who would control materials flow to and from the restricted area. The certification firm would also prepare periodic reports to the bank on the amount of collateral in the storage area. The bank would loan Transformers up to 60 percent of the collateral value. The yearly field warehousing fee to the collateral monitoring and certification services firm would be $15,000 per year plus 1.5 percent of the average amount of the loan. The entire $15,000 fee would have to be paid if the field warehousing arrangement was used at any time during the year. Bank interest charges would be the same as for the receivables borrowing system.

To assess the available financing from these two arrangements, Mr. Trexler esti-

Exhibit 1

Transformers, Inc.
Income Statements and Balance Sheets, Ordered by the Accountant's Method

Fiscal Year Ending	*12/31/72*	*12/31/71*	*12/31/70*	*12/31/69*
Sales	$3,170,860	$2,090,918	$2,176,716	$3,259,708
Cost of Goods Sold				
Direct Labor	448,664	377,065	474,524	538,760
Direct Materials	1,652,972	1,445,416	1,604,344	1,885,659
Other	259,752	272,324	180,772	269,380
Gross Margin on Sales	809,472	(3,887)	(82,924)	565,909
Selling and Administrative Expenses	542,359	436,342	520,404	464,363
Interest Expense	138,005	108,882	38,924	12,300
Income from Operations	129,108	(549,111)	(642,252)	89,246
Other Income	53,083	0	53,066	0
Earnings Before Taxes	182,191	(549,111)	(589,186)	89,246
Taxes	59,287	(141,035)	(306,196)	48,902
Earnings After Taxes	122,904	(408,076)	(282,990)	40,344
Dividends	0	0	0	0
Changes in Retained Earnings	$122,904	($408,076)	($282,990)	$40,344

Cash	$17,975	$5,297	$76,753	$103,545
Accounts Receivable	494,484	509,829	451,615	472,008
Inventory	1,613,364	882,457	916,312	741,951
Other Current Assets	184,869	183,308	391,148	344,995
Total Current Assets	2,310,692	1,580,891	1,835,828	1,662,499
Net Property, Plant, and Equipment	1,874,369	1,909,177	1,708,438	1,199,262
Misc. Other Assets	562,571	510,851	376,253	223,229
Total Assets	$4,747,632	$4,000,919	$3,920,519	$3,084,990
Accounts Payable	$734,941	$771,894	$669,945	$214,807
Due to Bank, Short-Term	812,274	375,882	130,289	12,139
Total Current Liabilities	1,547,215	1,147,776	800,234	226,946
Due to Bank, Long-Term	646,201	797,106	642,783	169,122
Deferred Income Taxes	0	0	135,190	76,370
Common Stock	46,547	39,041	36,605	36,350
Paid-In Capital	1,841,909	1,474,140	1,354,775	1,342,280
Retained Earnings	665,760	542,856	950,932	1,233,922
Total Owners' Equity	$2,554,216	$2,056,037	$2,342,312	$2,612,552
Total Liabilities and Equity	$4,747,632	$4,000,919	$3,920,519	$3,084,990

Exhibit 2

Transformers, Inc.
Average Quarterly Figures for Several Items

Quarter	First	Second	Third	Fourth
Accounts Receivable	$ 611,128	$ 545,650	$ 480,172	$ 545,650
Raw Materials Inventory	$1,635,518	$1,460,284	$1,285,050	$1,460,284
Needed Short-Term Financing	$1,833,364	$1,532,531	$1,236,199	$1,462,031

mated the average receivables, inventory, and financing needs for Transformers for each quarter of the upcoming year. These figures are presented in Exhibit 2. The needed financings in this exhibit are net of minimum levels of accounts payable and accruals and all anticipated long-term financing. Mr. Trexler had already computed the firm's projected current ratios (Transformers' preferred measure of aggregate liquidity) under the assumption that this needed financing was raised via short-term debt and found the levels of this ratio to be in line with the company's target levels of aggregate liquidity. The needed financing amounts incorporated a reduction in the firm's accounts payable to levels sufficient to insure the continued flow of goods from suppliers.

With all this information in hand, Mr. Trexler scheduled another meeting with the firm's banker. They agreed that the introduction of lending with receivables and inventory as security would provide increased availability and lower interest rates, but would dilute the bank's unsecured position. Because of this, the bank would continue with its current levels of unsecured lending only if the firm did not borrow with receivables and inventory as security. If Transformers decided to borrow on this basis, the maximum available amount of unsecured financing would be reduced at the rate of $0.30 for every dollar of principal borrowings that were outstanding on these short-term secured loans. However, whether or not the firm decided to employ secured lending, the maximum principal on the unsecured balance was limited to the $812,274 amount outstanding as of December 31, 1972.

On inquiring into other possible sources of funding, Mr. Trexler also found the banker receptive to the possibility of short-term note borrowings. The long-term loans made by the bank to Transformers were secured by the firm's property, plant, and equipment. As of late 1972, the book value of this equipment was about $1.8 million, while the total principal on the loans was only about $.65 million. There was thus some free collateral value available from these assets. The banker agreed to approve borrowings on 180-day notes, secured by these assets, for amounts up to $250,000. Interest would be at 13 percent and would be paid on a discounted basis. If the firm elected to use this funding source, the first group of notes would be issued immediately and would be due in mid-1973; new notes would be issued when the first group was retired. No prepayment of the notes was allowed. Borrowing via these notes would not affect the terms or availability of borrowing on the firm's unsecured credit line or of borrowing with receivables or inventory as collateral.

Chapter -13

Working Capital Management in International Settings

Since the 1960s, a major trend has been the internationalization of business. This trend is driven directly by shareholder wealth maximization. It is in the interests of shareholders that managers seek out profitable markets, less expensive sources of materials and labor, and less restrictive regulatory environments, regardless of the location of these conditions. By finding and using these advantageous circumstances on a worldwide basis, managers can maximize the value of the firm.

There are many institutional and cultural differences among countries that influence the firm's business practices. Differences in economic conditions, language, legal systems, regulatory climates, and cultural heritage require careful consideration and attention. However, the basic principle of financial decision making holds: the firm should maximize the risk-adjusted net present value of cash flows. In this chapter, we provide an introduction to the management of short-term assets and liabilities in international settings based on this principle.

The application of this principle requires estimates of the expected cash flows and their risk. The differences among countries in taxes, legal systems, and so forth will affect the expected levels of cash flows from working capital investments and sources of financing. There are also substantial differences in the risk of the cash flows from international transactions as compared to the risk of cash flows from transactions within the firm's host country. The sources of these risk differences, and the methods available to deal with these differences, will be a major topic of discussion in this chapter.

WHY HAVE INTERNATIONAL WORKING CAPITAL?

The firm may use several different methods to take advantage of superior business conditions in another country: *trade* (importing and exporting of goods and services to and from the other country), *investment* (establishing

an affiliate to produce goods or services within the other country), and *financing* (raising funds in the other country). These three strategies are alternative ways of utilizing the nonhost country's relative advantage, and to a great extent they are substitutes. For example, suppose that another country has a lower interest rate on loans than does the firm's host country (for whatever reason). Businesses within the other country will have lower costs of capital, and can provide goods at cheaper prices. To exploit this advantage, a firm needing such goods could either: (1) import them from businesses operating in that country, (2) set up an affiliate to manufacture in that country, financed with inexpensive local borrowings, or (3) borrow funds in that country to finance production in the firm's host country.

While all three strategies can achieve the same result, trade, investment, and financing have different effects on the firm's working capital position. *Importing* from another country may require that the firm deal in the currency in which the exporters' invoices are denominated. That is, importing may require the firm to practice the cash management of disbursements in multiple currencies. *Exporting* requires that the firm practice both cash and credit management on an international scale, since the firm will be selling to businesses in other countries and collecting from them. *Investment* in a producing, wholesaling, or retailing affiliate requires that the firm keep cash, receivables, and inventory assets that are denominated in and/or are located in the foreign country. *Financing* in nonhost capital markets requires the comparison of vehicles for the acquisition of short-term debt that combine different financing rates and different denominated currencies.

SOURCES OF RISK IN INTERNATIONAL FINANCIAL MANAGEMENT

While there are differential effects of trade, investment, and exporting strategies, it should be clear that *any* attempt to take advantage of an opportunity outside the firm's host country will generally require *some* international exposure in the firm's working capital accounts. With this exposure come the various risks inherent in different types of international transactions. The sources of this risk are discussed in this section. Following sections will discuss strategies available for hedging these risks. For discussion purposes, let us break the additional risks inherent in international cash flows into three types: *exchange risk*, *political risk*, and *economic risk*.

Exchange Risk Whether the firm is engaged in trade, investment, or financing, it is almost inevitable that the firm must exchange cash denominated in one currency for cash denominated in another. For example, the firm may want to transfer cash to an affiliate for the purchase of inventory in the affiliate's host country, and it may later want to repatriate cash from the sale of that inventory. These transactions may both require that currency of the

firm's host country and of the affiliate's host country be exchanged. Assume that the firm is located in the United States and the affiliate is located in West Germany. The currency used in West Germany is the deutsche mark (DM). If the firm wishes to purchase 10,000,000 DM worth of inventory in Germany for this affiliate and the exchange rate is 2.5 DM per dollar, it will have to exchange $4 million to obtain the necessary German currency. Later, once the inventory is sold, the firm will have to exchange the DMs received into dollars.

The *risk involved in currency exchange* transactions comes not in exchanging currencies to address *current* needs for cash, but concerns the risk inherent in *future* conversions. Since 1971, the value of U.S. currency has floated against many other major currencies; we are in a period of *floating exchange rates*. These exchange rates change rapidly in response to countries' economic policies and developments.[1] This exchange rate system adds volatility to estimates of future cash flows from foreign transactions. Returning to our inventory purchase example, the number of dollars needed for the *current* purchase of the inventory is certain, since the current exchange rate and the needed number of DMs are known. However, the *future* dollar cash flow from the sale is uncertain. Let us assume that the sale of the inventory by the firm's German affiliate is expected to net 11,000,000 DM in six months. If this revenue is to be repatriated to the parent firm for use in the United States, it must be converted back into dollars. The estimate of the future cash flow is uncertain due to the general nature of most business transactions, domestic and international; there is uncertainty with respect to the eventual number of units sold, the price of these units, and so forth. However, there is additional uncertainty in the amount of the future cash flow from this inventory investment *because of possible fluctuations over the six-month period in the DM/dollar exchange rate.* For example, suppose that the value of the DM rises relative to the dollar, so that at the end of six months there are 2.85 DMs required to obtain each dollar. The firm will then receive only about $3.86 million in return for the 11,000,000 DM from the inventory's sale. Because of this change in exchange rates, while the firm would make a profit on the transaction *as denominated in DM*, it would take a loss when the profits were repatriated into dollars.

Political Risks This source of variation from expectations is also known as *country risk* or *sovereignty risk*. It stems from the fact that any government

[1]The foreign exchange marketplace is a system of brokers and banks located in money centers throughout the world. For an excellent discussion of foreign exchange markets and the determination of exchange rates, see J. O. Grabbe, *International Financial Markets* (New York: Elsevier, 1986), pp. 57–76 and 151–220. For some views of corporate executives on the effects of foreign exchange fluctuations on their businesses, see G. Melloan, "Corporations Grow Weary of Dollar's Capers," *Wall Street Journal* (March 3, 1987), page 35.

may choose to change the conditions under which foreign and domestic firms operate within the governed country. The firm's expected cash flows may be estimated based on an anticipated set of these conditions, but the actual conditions in force at a future time may be quite different. For purposes of discussion, let us divide political risks into three types: the risk of *civil unrest*, the risk that *the rules of operation governing the firm's business within the country may be changed*, and the risk that *the firm may be unable to repatriate the expected amounts of cash to the host country*.

Of these risks, that of civil unrest (war, revolution, riot, and similar activities) receives most attention in the press because of its spectacular nature. When these conditions occur, normal business processes may be disrupted, and assets may be destroyed or cash flows from these assets may cease temporarily or permanently. These are disastrous results, and risk of civil disruption in many countries is substantial.

Once the firm has expended the effort and funds to establish a trading relationship within a foreign country, or has made an investment in that country, it is vulnerable to changes in the rules of operation within that country. This is a second type of political risk that comes with international dealings. These changes are made by governments for political reasons, and their likelihood varies with the political character of the foreign country. Changes in the rules of operation can take several forms. The following are common.

1. Cancellation of importing, exporting, or other operating permits and licenses or increases in the required fees to renew such permits and licenses
2. Expropriation or confiscation of assets without adequate compensation
3. Imposition of increased taxes or other fees
4. Imposition of new restrictions on collections, investments, and so forth

For example, suppose that the firm has established an affiliate to hold and sell inventory in a foreign country. However, while the firm has inventory within that country, the country's political leadership imposes a new tax on inventory held there, including existing inventory. This tax would reduce net expected revenues from the affiliate. The possibility of the imposition of such a tax is a risk that the firm takes in holding inventory in that particular country.

In addition to the risk of civil unrest and the risk of possible changes in the rules of operation, countries may also directly inhibit firms' transfers of funds from the foreign country to the firm's host country. The firm may want to repatriate funds, but the foreign government may block or delay this transfer in various ways. One mechanism is to *regulate the dividends that an affiliate can make to its parent firm*. A typical restriction that can accomplish

this regulates the affiliate's yearly dividends to a set percentage of its net worth.

Another mechanism that affects the cash flows from affiliates to parent firms is *exchange controls*. For their own political purposes, governments may regulate both the *exchange rate* at which outgoing cash is changed from their country's currency into other currencies and the *amount of exchange* that is allowed among currencies. With regard to exchange rates, the government may require an affiliate of a foreign-owned firm or a firm importing products into its country to exchange for local currency at a rate that gives a higher value to that currency than does the market rate. For example, suppose that the government of a country with currency denominated in pesos imposes a new mandated exchange rate of 50 pesos per dollar when the market rate is 25 pesos per dollar. Effectively, this action reduces the value of all cash leaving the country by 50 percent and is exactly equivalent to a tax on such cash flows.[2] The potential for such an action adds additional risk to investments in a country where such an action can be taken. Note that this risk of *politically imposed* changes in the rate of exchange is separate from the risk of *market-determined* changes in the rate of exchange.

A similar reduction in value occurs if a foreign government imposes new controls on the *maximum amount of exchange* among currencies. Such controls typically require that those wishing to exchange local currency for the currency of other countries do so only through a central exchange where the amount of exchange is regulated. The possibility that the firm will not be able to execute a planned exchange of an affiliate's currency into that of its host country adds risk to future cash flows. For example, suppose that a firm expects to receive monthly cash flows of $1 million from an affiliate in another country. The affiliate may have the local currency available to make these payments, but if the local government has imposed new currency controls such that the affiliate may obtain only $500,000 per month, regardless of the amount of local currency it wishes to exchange, only $500,000 may be paid to the parent firm.

Economic Risks In addition to exchange and political risks, international trade, investment, and financing also carry economic risks that vary from country to country. The volatility of a country's wage rates, material costs, interest rates, product demand, and other variables are related to the structure of its economy. The economies of some countries are based primarily on the production and export of one product (oil, for example). Fluctuations in the price of that particular commodity will affect such countries much more than those with more diversified economic bases.

While we have discussed them separately for convenience, it is important to realize that international exchange risk, political risk, and economic risk

[2]For a discussion of the effects of exchange rate regulation on the foreign country's economy, see Grabbe, *International Financial Markets*, pp. 70–74.

are not independent. Indeed, there is substantial overlap among them; political, economic, and exchange rate outcomes are quite intertwined. For example, suppose that for political reasons the government of a country imposes controls on the amount of local currency that may be exchanged for the currency of other nations. This *political* action may reduce the potential amount of cash repatriations, but the effect does not stop there. Industries within the country will have difficulty obtaining advantageous foreign goods since foreign suppliers will recognize the increased problems in being paid for such goods in their home currencies. This will reduce the efficiency of operation of these local industries. The reduced efficiency will have adverse effects on the level of local *economic* activity. Further, the reduced economic activity in the country may adversely affect the *exchange* value of its currency relative to that of other countries.

This chain of events need not start with a political action. Any change in any one of the political, economic, or exchange conditions will affect the other two. A change in economic conditions, for example, will certainly affect political circumstances within a country and the exchange rate of that country's currency with the currencies of other countries.

Assessing Risk in International Transactions To deal with the additional sources of risk that the firm faces in international dealings, the level of this risk must first be assessed. The available mechanisms for addressing and/or hedging this risk and the relative costs of these methods are then considered in developing a risk-management strategy. Information on exchange, political, and economic risks in international transactions is available from several sources.

Information on the relative volatility of currencies (and therefore their exchange risk) is presented in most textbooks on international finance and international economics. These analyses can be used to gain long-term historical perspectives. Historic conversion data is also available in *International Financing Statistics*. To assess more recent trends, the analyst may obtain data on the exchange rates of major currencies for immediate delivery (called *spot rates*) on a daily basis from the *Wall Street Journal.*

The political and economic risks in dealing with various countries are more difficult to assess. A number of organizations provide analyses of the political and economic climate in various countries on a commercial basis, and information of this type is sufficient if the firm's exposure is relatively small. However, if the firm is considering substantial investment or financing, an in-depth study of the potential host country's political and economic climate is required.[3]

[3]For an excellent discussion of the assessment of political and economic risks in international management, including a listing of the information sources on these risks, see two papers by E. G. Roberts: "The 'Debt Bomb' Shelter: How to Evaluate Foreign Credit Risk," *Cashflow* (October 1984), pp. 55–57 and "Evaluating Country Risk," Occasional Paper of the Credit Research Foundation, 1984.

EDGING EXCHANGE RISK IN INTERNATIONAL TRANSACTIONS

Once it assesses the sources of risk in a proposed international transaction, the firm most incorporate this risk in its decision process. The firm may perform this incorporation by (1) *hedging the risk* (where hedges are available) and including the cost of the hedge in its evaluation of the transaction, or (2) *pricing the risk* by increasing the risk-adjusted discount rate for future cash flows from the transaction. In this section, we discuss several techniques that may be used to hedge the exchange risk in international transactions.[4]

Denominating Transactions in Dollars The simplest method of hedging exchange risk is to require that all transactions be conducted in dollars (or whatever is the currency of the firm's host country). By doing this, the firm avoids involvement in currency exchange. This technique is most applicable when the firm is importing or exporting.

While a relatively simple strategy, requiring that invoices be paid in dollars presents other problems. First, by making this requirement, the firm is merely shifting the exchange risk to its trading partner; the exchange risk is not really eliminated. For example, suppose that a U.S. firm is exporting to a West German firm on terms of sale requiring payment in 90 days. The dollar value of the shipment is $250,000 and it currently takes 2.5 DMs to obtain one dollar; the U.S. firm requires payment in dollars. Thus, at the current exchange rate the German firm will require 625,000 DM to obtain the necessary dollars. But over the 90-day terms of sale the DM may fall in value relative to the dollar. If, when payment is due, there are 2.6 DMs required to obtain each dollar, the German firm will have to exchange 650,000 DM to obtain the necessary U.S. currency. From the German firm's standpoint, this decrease in the value of the mark relative to the dollar has resulted in an increase in the cost of the shipment.

One difficulty in denominating invoices in dollars relates this shift in risk to the price at which the sale is made. *The trading partner will not accept the risk of adverse currency movements without compensation.* To make a sale with payment denominated in dollars, the U.S. firm must offer a lower price than if the trading partner can pay in foreign currency. This lower price

[4]We assume that the firm has no internal hedging mechanisms available to it, and thus must rely on the external mechanisms described in this section. However, some firms will have hedging mechanisms available to them within the structure of the firm's operations. For example, when the firm holds cash in several countries, it is diversified; fluctuations that affect one currency adversely may affect another positively. In such circumstances, external hedging is of less concern, and netting (a procedure discussed later in the chapter) can be a useful hedging strategy. Inventory strategies may also be used as hedging mechanisms. For example, an affiliate could purchase, pay for, and hold larger amounts of inventory from the parent firm. By purchasing the inventory at current exchange rates rather than purchasing it as needed, transfers at uncertain future rates are avoided.

compensates the trading partner for the currency risk and is the cost of this hedge.

Another problem with denominating export invoices in dollars is that this tactic subjects the exporter to the political risk of controls on the amount of exchange. When the foreign firm wants to pay the invoice, it must obtain dollars to do so. If there are government controls on the amount of exchange, it may not be able to accomplish this currency transaction, and thus may not be able to pay the invoice when due. A related approach that avoids this is to invoice in the local currency, but to *index the amount of the invoice* to the exchange rate between the dollar and the local currency. If the value of the local currency falls, the amount of the invoice rises. However, like denominating in dollars, this indexing system requires the trading partner to bear the exchange risk.

Invest Surplus Cash in the Eurodollar Market International investment of surplus funds need not be made in the local currency of the country in which the investment is made; it can also be conducted in dollars. In this way exchange risk is avoided. The major marketplace for international dollar-denominated investment is the *Eurodollar market*, which was discussed briefly in Chapter 2. A more complete discussion is appropriate at this point because of the importance of the Eurodollar market in offshore investment of surplus funds.[5]

Eurodollars are dollar-denominated deposits located outside the United States. The "Euro" in "Eurodollar" originally referred to Europe as the place of residency of these dollar deposits, but there are now centers of Eurodollar commerce throughout the world. The Eurodollar market is a "wholesale" money market for large deposits and loans. These deposits and loans are mostly bank-to-bank transactions, but large commercial firms may participate if they have sufficient amounts to invest or are of sufficient creditworthiness to borrow. Many U.S. firms invest in the Eurodollar market, and firms such as Gulf Oil, Martin-Marietta, and Warner Communications have been active in borrowing there. One-week and six-month maturity instruments are the most common *investment* vehicles; both fixed-rate and floating-rate investments are available. However, *borrowing* is mostly on terms of longer than one year, so the Eurodollar market is not a popular source of short-term financing.

While investment in dollar-denominated securities avoids exchange rate risk, this is not the basic reason for the substantial popularity of the Eurodollar market; firms can achieve the same result by investing domestically. The Eurodollar market is primarily a vehicle for borrowing and lending in an

[5]For additional discussion of the Eurodollar market, see T. Cook and B. Summers, eds., *Instruments of the Money Market,* Fifth Edition (Richmond: Federal Reserve Bank of Richmond, 1981), pp. 123–33.

environment not subject to U.S. banking regulations. Eurobanks are not required to keep noninterest-bearing cash reserves beyond those necessary for their operations, they do not have to pay Federal Deposit Insurance Corporation insurance premiums, and they are not subject to any U.S. interest rate ceilings on deposits and loans.

By avoiding these requirements, which are quite costly to domestic banks, Eurobanks can achieve significant savings. In addition to these regulatory advantages, Eurobanks are often located in areas of low local taxes. Also, the specialization of Eurobanks in large-denomination transactions enables them to achieve lower overheads than domestic financial institutions. Together, the lower costs of regulation, taxation, and operation yield a very favorable result for large investors and borrowers alike; institutions dealing in Eurodollars are often able to both *pay higher interest on dollar deposits and make dollar loans at lower rates than domestic banks.*[6] That is, Eurdollar banks can profitably make transactions on far lower interest rate spreads than can domestic banks.[7]

However, investing in Eurodollar markets entails a bit more risk than does domestic investment. This additional risk stems from political and credit-related factors. From a political standpoint, there is risk that the government in the Eurobank's host country will restrict the movement of dollar-denominated funds out of the country and back to the investor; the government of the Philippines instituted such controls in 1983. Also, any disputes must be settled via the laws of the host country, and these laws may change before the maturity of the deposit.

For several reasons, there may also be additional credit risk in investing via may Eurobanks compared to investing via U.S. banks. First, Eurobanks are not covered by the U.S. government's deposit-insurance program. Second, many Eurobanks are "shell" subsidiaries of other, larger financial institutions. While their parent banking organizations are sound, the Eurobank itself may have a very small capitalization. These additional sources of risk have not deterred many U.S. firms from investing in the Eurodollar market. Instead, the major determinant of a firm's participation in this market is *size*. Required investment amounts are quite large; most Eurodollar deposits are for $500,000 or more.

[6]For a more complete discussion regarding why these differentials exist and persist, see D. S. Kidwell, M. W. Marr, and J. L. Trimble, "Domestic versus Eurodollar Bond Sale: A Persistent Borrowing Advantage," paper presented at the 1987 Financial Management Association meeting and available from Trimble at the University of Tennessee.

[7]Further, Eurodollar investments are advantageous in that the interest rate risk on borrowings and lendings in this market can be directly hedged via futures and options traded for this purpose; a cross-hedge is not necessary. See Grabbe, *International Financial Markets*, pp. 250–55.

Prebuy and Presell Foreign Currency in the Spot Market A third strategy for hedging exchange risk in a future foreign currency transaction is to immediately buy or sell the foreign currency in the spot market, then cover the transaction when the foreign currency is required. For example, suppose that a firm is importing goods, with the order denominated in Swiss francs (SF). Required payment in SF will be due in 120 days in the amount of SF 5,000,000. To cover this future cash need, the firm can immediately purchase 5,000,000 in Swiss francs.[8] If the exchange rate is SF 2.0 to the dollar, this currency will cost the firm $2.5 million. The Swiss francs will then be deposited in an account denominated in SF for the 120 days until payment is required. In this way, regardless of fluctuations in the exchange rate, the firm will have the required currency available at a fixed dollar cost.

While this strategy hedges the firm's cash needs, it is often expensive. For the 120-day delay from the initiation of the transaction until the money is due, the firm will have made an investment of $2.5 million (the initial cost of the francs). The return on this investment will be the interest on the invested francs. The interest on such short-term investments is generally less than the return on investments in the firm's operations; this difference in return is a penalty cost of this strategy. Another (and sometimes cheaper) way to hedge exchange risk is the *currency forward*, which is discussed in the following paragraphs.

Currency Forwards One type of contract used to purchase currency for future delivery is called the *forward purchase* of this currency. Forward purchases are negotiated between an international bank and the firm, and are tailored to the firm's specific currency needs. Forwards are not traded by firms on exchanges. Because these contracts cannot be traded, once the firm undertakes a forward exchange contract, it must honor this contract; there is no simple method of making an offsetting transaction or of reselling the contract to another firm. Because of this illiquidity, forwards are generally undertaken to meet specific and known currency needs and are held to maturity.

Representative forward and spot rates are quoted daily in *The Wall Street Journal*; the exchange rates in effect on June 30, 1987 are presented in Table 13-1. These rates are expressed as the number of U.S. dollars required to obtain one unit of the foreign currency. For example, the firm must pay $1.595 dollars for the *current* delivery of each British pound, but need pay only $1.5775 for each pound *to be delivered in 180 days*. Thus, if the firm needs 100,000 pounds to pay for an imported shipment in 180 days, two alternatives are to pay $159,500 on the spot market and invest the 100,000

[8]This importing example requires a future *outflow* denominated in a foreign currency. If the transaction instead involved a future *inflow*, the firm would short the currency (borrow it; presell it) in the spot market.

Table 13-1. Spot and Forward Rates for Various Currencies (June 30, 1987). U. S. Equivalent Dollars

Currency	Spot Rate	30-Day Forward Rate	90-Day Forward Rate	180-Day Forward Rate
Pound	1.595	1.5922	1.5864	1.5775
Yen	.006693	.006712	.006747	.0068
French franc	.1622	.1621	.1618	.1612
Swiss franc	.6508	.6527	.6561	.6618
Mark	.5393	.5407	.5435	.548
Dollars Required to Obtain 100,000 Units of Currency				
Pound	159,500	159,220	158,640	157,750
Yen	669.3	671.2	674.7	680
French franc	16,220	16,210	16,180	16,120
Swiss franc	65,080	65,270	65,610	66,180
Mark	53,930	54,070	54,350	54,800

pounds in an interest-earning pound-denominated account, or purchase a *180-day forward*, which will earn no interest. The optimal strategy in choosing among any forward alternatives thus depends on the interest rates available for dollar- and nondollar-denominated accounts and the available spot and forward exchange rates.[9]

Currency Futures Because the currency forward is a private rather than a traded contract, it is a rather inflexible means of hedging exchange risk. A more flexible approach is the use of *traded futures contracts* in the foreign currency. Like a forward, a currency future is a contract for the purchase of a particular amount of foreign currency at a particular future time. The prices in the future acquisition of currency via forwards and futures have historically been very similar. However, currency futures are different from forwards in three important ways. First, *currency futures are traded on exchanges* and processed through clearinghouses in the same way as are interest rate futures. Currency futures in major currencies, including pounds, yen, marks, Canadian dollars, and Swiss francs, are traded on the International Money Market. The major trading volume is in contracts maturing in March, June, September, and December; volume for contracts maturing in other months is not large enough to provide sufficient liquidity. Delivery of the currency takes place on the third Wednesday of the delivery month. The minimum contract size varies with the currency, as does the margin requirement.

[9]For discussion of the determinants of forward rates, see Grabbe, *International Financial Markets*, pp. 78–89.

Because of the existence of active trading in these currency futures, a firm hedging via this vehicle does not have to hold the contract until maturity. Instead, the firm may offset the contract at any time it deems advantageous by undertaking an opposing transaction (going short in a contract in which it is long, for example). The exchange's clearinghouse will then wipe out the offsetting transactions, and the firm's involvement is ended. Also, no time-consuming negotiations are necessary; the firm deals in standard contracts. In this way, the firm experiences higher liquidity and more rapid execution of currency hedges than by using forwards. Because of the ability to be liquidated before maturity, most futures contracts are reversed. Most forward contracts, on the other hand, are held to maturity.

However, because of the standardization necessary to achieve the economies of scale that make trading economically possible, *the variety of currencies, maturity dates, and amount of futures contracts is limited.* This is the second difference between currency futures and currency forwards. Negotiated *forwards* can be tailored to the firm's particular needs, but the firm is limited to what the *futures* market is trading. For this reason, when hedging in futures markets, it is rare that the hedge exactly matches the future currency transaction. The futures transaction may be different from the hedge in *date* (unless this date happens to be the third Wednesday of March, June, September, or December), *amount* (unless the transaction happens to be a multiple of the standard currency contract), or even *currency* (unless the required currency happens to be one of the traded currencies).

The inevitable mismatch of one or more of these characteristics introduces *basis risk* into hedging with currency futures, just as a parallel mismatch introduces this risk in hedging future financing or investment with interest rate futures. In currency futures, basis risk is the chance that the relationship between the *currency being hedged* (Mexican pesos for delivery in April, for example) and the *currency future being used as a hedge* (Swiss francs for delivery in June, for example), will change over time. If the relationship between the transaction being hedged (the *basis*) and the hedge itself changes, exchange risk will not be completely offset by opposing movements in valuation of the two items.[10]

The third difference between forwards and futures has to do with the patterns of cash flows from the two contracts. In the case of a forward contract, the firm generally will be required to put up only a small cash deposit before the maturity date of the contract (although the amount available for borrowing

[10]In hedging the movement of one currency with a contract in another, the amount of basis risk depends on the correlation in the movements of the two currencies. A table of correlation coefficients in price movements between major currencies on which futures and options are available and currencies on which such contracts are not available can be found in J. Madura and T. Veit, "Use of Currency Options in International Cash Management," *Journal of Cash Management* (January/February 1986), page 47.

on its credit line with the bank issuing the forward may also be reduced). The firm pays the balance at the maturity of the contract, and there are no cash flows between the initiation of the contract and its maturity. This is not true for futures contracts. *Futures contracts are usually bought on the margin and are marked to market each day.* In purchasing a future, the firm makes an initial deposit in its margin account, and will be either adding or withdrawing cash from its account based on daily fluctuations in the value of the futures contract. These intermediate cash flows do not occur for forward contracts.

Therefore, neither futures nor forwards dominate as exchange risk hedges. Futures are more liquid and more rapid to execute but introduce basis risk because of their limited variety in amount, maturity, and currency. Also, futures entail cash flows during the period when the contract is being held. If cash inflows are required, the firm will experience opportunity losses on this cash. Forwards do not require cash transactions during these intermediate periods.

Currency Options Another potential exchange risk hedge is the currency option. This contract gives the holder the right to buy (in the case of a call) or sell (in the case of a put) an interest in a specific amount of future currency for a specific amount of time. Option contracts for the acquisition of *currency on the spot market* and for the acquisition of *currency futures* are traded on exchanges. The maturity dates and amounts of these options are similar to those of traded currency futures contracts.

As with futures contracts, the clearinghouse affiliated with the exchange on which options are traded can offset opposing transactions, and the firm can thus liquidate its options position at any time. However, the cash flows related to options contracts are quite dissimilar to those of futures contracts. Options involve a fixed cost of purchase. If the option is not exercised, the firm loses only this fixed cost, and the cost of the options contract does not count toward the purchase or sale of the currency if the firm chooses to exercise the option. Also, there is no daily "marking to market" of margin with an option contract; the only cash flows are the initial fixed cost of the option and the cash flows related to its exercise or reversal.

While they are similar in many respects, one significant difference between some of the available options on foreign exchange and options on interest rate futures (discussed in Chapter 3) concerns the *exercise dates* allowed for the currency options. The options on interest rate futures are all *American-style* options; they can be exercised any time prior to maturity. American-style options are traded on currency in the spot market and on currency futures contracts. However, there are also *European-style* options traded on currency. European-style options can be exercised only on their maturity date and not before.

The use of options on interests in currency has some advantages to

firms. Since the option need not be exercised, it offers firms the opportunity to participate in fortuitous movements in exchange rates while being protected from disadvantageous movements. For example, the firm may purchase a call option on a foreign currency in anticipation of a future need for cash in that currency. If the price of that currency rises relative to the dollar, the firm will exercise the option and acquire the currency at the option's exercise price.[11] If the currency falls relative to the dollar, the firm will let the option expire and acquire the currency directly on the spot market.[12]

However, an options strategy also has some disadvantages relative to the use of forwards or futures. The initial cost of the option is paid whether the firm exercises the option or not and does not contribute to the cost of the currency acquired. Also, volumes (and consequently liquidity) in the market for currency options are a good deal less than those on the spot and futures markets for foreign exchange. This smaller volume is probably due in part to the newness of these markets; options on foreign exchange have been traded only since 1982.

In this section, we have briefly described six methods of hedging exchange risk in multicurrency transactions: denominating transactions in dollars, investing in Eurodollars rather than foreign currency, predealing in the nondollar currency, currency forwards, currency futures, and options on currency and currency futures. Each of these approaches has advantages and disadvantages; these and other characteristics are presented in Table 13-2. Other more exotic methods of hedging are also available. Included among these are futures-style options,[13] currency swaps,[14] and the use of futures to hedge exchange risk and interest rate risk simultaneously.[15]

Evaluation Hedges of Exchange Risk To evaluate the effects of these hedges on a particular transaction, the appropriate procedure is to incorporate the cash flows from the hedge within the firm's estimates of the cash flows from the transaction. The cash flows from alternative hedged and unhedged strategies are then discounted at appropriate risk-adjusted discount rates, and the strategy that will result in the highest net present value is chosen.

[11]Note that the same effect could be achieved by selling the option (which would have risen in price) and purchasing the exchange on the spot market.

[12]Good numerical examples in the use of currency options for exchange hedging can be found in Madura and Veit, "Use of Currency Options," pp. 44–46.

[13]For discussion of this instrument, see Grabbe, *International Financial Markets*, pp. 115–16.

[14]See David Watts, "The Structure and Mechanics of Interest Rate and Currency Swaps," in *Inside the Swap Market*, Second Edition (London: IFR Publishing, 1986), pp. 24–32.

[15]This strategy is described in H. Kaufold and M. Smirlock, "Managing Corporate and Interest Rate Exposure," *Financial Management* (Autumn 1986), pp. 64–72.

Let us proceed with an example problem in the pricing and hedging of exchange risk. It is June, 1987, and a firm is considering a transaction that would result in an immediate cash outflow of $50,000 and a cash inflow of 100,000 Swiss francs in six months. The amount (in SF) and timing of the future cash flow is certain, and for simplicity we will ignore any taxes and any transaction costs in currency conversion. The firm is considering three alternatives. First, the firm can go unhedged. However, the SF : dollar exchange rate is volatile, so a risk-adjusted discount rate is required. Based on the firm's cost of capital, assume that the appropriate monthly discount rate is 1.0 percent.

The second alternative is to short the currency in the spot market. That is, the firm would arrange to borrow SF 100,000 from its bank and to repay the loan once the future SF cash inflow is received. The current exchange rate is 0.6508 dollars per SF. In this arrangement, the firm will have to pay interest on the loan at the current rate for SF accounts, but can invest the proceeds of the loan in short-term, SF-denominated investments. Assume that the interest rate on the loan is 0.521 percent per month (paid in SF), and that the interest rate on short-term SF investments is 0.250 percent per month. The firm will formulate an additional hedge against the exchange risk on the future interest expense; this interest expense will then be certain and is appropriately discounted at the risk-free rate for dollar investments, which is 0.542 percent per month.

The final alternative is to engage in a forward exchange contract with the firm's bank. In this arrangement, the firm will short the forward (sell a forward contract) and cover the contract with the future cash inflow; the bank will hold the cash from the selling of the contract. Assume for simplicity that no initial cash will be required to obtain this contract. The current forward rate of 180-day SF forwards is 0.6618 SF per dollar.[16]

The required analysis, in a spreadsheet format, is provided in Table 13-3. The unhedged alternative appears in rows 7 through 14. In this option, there are two cash flows: the initial expense of $50,000 and the future expected inflow of $66,180. The amount of this expected inflow is calculated based on the 180-day forward rate, which is the market's expected exchange rate 180 days hence. At a discount rate of 1.0 percent per month, the present-value interest factor for six months is 0.94205 (cell I12), the contribution to the net present value from the future inflow is $62,345 (in cell I13, which contains "I11*I12"), and the total net present value is $12,345 (in cell I14, which contains "@sum(B13 . . . I13)").

[16]Note the relationship between interest rates and forward exchange rates in this example problem. Because the dollar interest rate is higher than the SF interest rate, the SF in the forward market is selling at a premium relative to the spot market (it takes more dollars to buy the future currency than the present currency). This relationship is assured by *interest rate parity*; see Grabbe, *International Financial Markets*, pp. 78–81.

Table 13-2. Summary of Six Methods of Hedging Exchange Risk.

Hedge	*Application*	*Where Traded*	*Currencies Traded*	*Contract Size*
1. Denominate in dollars.	Import and export.	Not traded.	—	—
2. Invest surplus cash in Euro-dollar market.	Investment.	Eurodollar centers throughout the world.	Dollars	Typically over $500,000.
3. Prebuy or presell foreign currency.	All.	Spot currency market is worldwide network of brokers and traders.	All.	Any.
4. Currency forward.	All.	Not traded by firms.	All.	Negotiated.
5. Currency futures.	All.	Intl. Money Market	Pound	25,000 pounds
		Intl. Money Market	Can. Dollar	$100,000 Can.
		Intl. Money Market	Yen	12.5 mil. Yen
		Intl. Money Market	Swiss Francs	125,000 SF
		Intl. Money Market	Marks	125,000 DM
6. Options				
a. American, on spot.	All.	Phil. & London Stk. Exc.	Pound	12,500 pounds
		Phil. & London Stk. Exc.	Can. Dollar	$50,000 Can.
		Phil. & London Stk. Exc.	Yen	6.25 mil. Yen
		Phil. & London Stk. Exc.	Swiss Francs	62,500 SF
		Phil. & London Stk. Exc.	Marks	62,500 DM
		Phil. & London Stk. Exc.	French Franc	125,000 FF
b. European, on spot.	All.	Chi. Board Options Exc.	Same as futures traded on Intl. Money Market.	
c. American, on futures.	All.	Chi. Mercantile Exchange	Same as futures traded on Intl. Money Market.	

Table 13-2. Continued.

Maturity	*Advantages*	*Disadvantages*
—	1. Eliminates exchange risk for domestic firm.	1. Shifts exchange risk to foreign trading partner. 2. For exports, subjects firm to political risk of exchange controls.
One-week and six-month maturities are the most common.	1. Interest rates on investments are higher than for domestic investments.	1. Required transaction sizes are large. 2. There is credit and political risk.
Delivery is in two days from order.	1. Entirely eliminates exchange rate risk. 2. Can be arranged for any amount or currency.	1. Requires substantial initial investment.
Negotiated.	1. Entirely eliminates exchange rate risk. 2. Can be arranged for any amount, maturity, or currency.	1. Inflexible and illiquid; cannot be retired before maturity.
Mar./June/Sept./Dec. Mar./June/Sept./Dec. Mar./June/Sept./Dec. Mar./June/Sept./Dec. Mar./June/Sept./Dec.	1. Contact can be liquidated at any time by offsetting transaction. 2. Easy and rapid to execute.	1. Limited currency, maturity, and amount leads to basis risk. 2. Contract marked to market every day; cash may be required for margin calls.
1, 2, 3, 6, 12 mo. 1, 2, 3, 6, 12 mo. 1, 2, 3, 6, 12 mo. 1, 2, 3, 6, 12 mo. 1, 2, 3, 6, 12 mo. 1, 2, 3, 6, 12 mo.	1. Can be executed or sold at any time before maturity. 2. Allows firm to participate in advantageous price movements while protecting on downside.	1. Limited currency, maturity, and amount leads to basis risk. 2. Requires fixed charge that does not reduce eventual cost of currency.
1, 2, 3, 6, 12 mo.	1. Can be sold at any time before maturity. 2. Allows firm to participate in advantageous price movements while protecting on downside.	1. Limited currency, maturity, and amount leads to basis risk. 2. Requires fixed charge that does not reduce eventual cost of currency. 3. Can be executed only at maturity.
	1. Can be executed or sold at any time before maturity. 2. Allows firm to participate in advantageous price movements while protecting on downside.	1. Limited currency, maturity, and amount leads to basis risk. 2. Requires fixed charge that does not reduce eventual cost of currency.

Table 13-3. Analysis of Example Exchange Rate Problem.

	A	B	C	D	E	F	G	H
1	Spot Rate	.6508	Dollars per SF					
2	180-Day Forward Rate	.6618	Dollars per SF					
3	SF required	100000						
4								
5	Month	0	1	2	3	4	5	6
6								
7	Alternative 1 — No Hedge							
8	Monthly Disc. Rate	.01						
9	Initial Expense	−50000						
10	Exp. Future Inflow							66180
11	Total Cash Flows	−50000	0	0	0	0	0	66180
12	PVIFs	1	.99010	.98030	.97059	.96098	.95147	.94205
13	Contribution to NPV	−50000	0	0	0	0	0	62345
14	Net Present Value							12345
15								
16	Alternative 2 — Short the Spot							
17	Monthly Disc. Rate	.00542						
18	Interest Rate on SF	.00521						
19	Int. Income on SF	.0025						
20	Exchange Rates	.6508	.65263	.65447	.65630	.65813	.65997	.66180
21	Net Int. Exp. in SF		271	271	271	271	271	271
22	Net Int. Exp. in $		−177	−177	−178	−178	−179	−179
23	Initial Expense	−50000						
24	Revenues from Loan	65080						
25	Total Cash Flows	15080	−177	−177	−178	−178	−179	−179
26	PVIFs	1	.99461	.98925	.98392	.97862	.97335	.96811
27	Contribution to NPV	15080	−176	−175	−175	−174	−174	−174
28	Net Present Value							14032
29								
30	Alternative 3 — Short the Forward							
31	Monthly Disc. Rate	.00542						
32	Initial Expense	−50000						
33	Future Inflow							66180
34	Total Cash Flows	−50000	0	0	0	0	0	66180
35	PVIFs	1	.99461	.98925	.98392	.97862	.97335	.96811
36	Contribution to NPV	−50000	0	0	0	0	0	64069
37	Net Present Value							14069

Calculations for the alternative of shorting the spot market (borrowing the currency and paying interest) appear in rows 17 through 28. Here, the firm shorts the SF 100,000 and covers this short when the SF is received, so there is no net cash inflow when the SF 100,000 is paid to the firm. However, there are future cash outflows for interest expense and inflows from the investment of the SF 100,000. This interest expense and interest income are based on the rates for these two transactions, which appear in cell B18 and B19. The difference in these rates times the borrowed principal of SF 100,000 gives the net SF outflows in cells C21 through H21 (for example, cell C21 contains "(B18 – B19)*B3"). Projected exchange rates in row 20 are used to calculate the future net interest expenses in dollars, which appear in row 22. The net cash flows in row 25 are discounted by multiplying them by the present-value interest factors in row 26. These present-value interest factors are calculated using the 0.542 percent per month dollar risk-free rate, which appears in cell B17. The net present value of $14,032 from this strategy appears in cell I28.

Analysis of the final strategy (selling a forward contract in SF) appears in rows 30 through 37. Analysis is very similar to the first alternative, except that the shorting of the future exchange rate results in a certain future cash flow, so a discount rate representing only the time value of money (and not risk) is used. The resulting net present value is $14,069. Since this is the highest net present value of the alternative strategies available to the firm, the optimum choice is to sell a forward contract for the 180-day delivery of 100,000 Swiss francs.

Hedging Nonexchange Risks in International Transactions

In the prior section, we discussed the various ways in which the firm can hedge the exchange risks inherent in international dealings. However, the firm also faces other sources of risk in these dealings. First, there are the *normal commercial risks* in any business transaction, domestic or international: the risk of default by customers, the uncertainty of sales and cost level, and so forth. Second, there are the *additional political and economic risks* that accompany international dealings: the risk of nationalization and confiscation, the risk of changing laws and exchange controls, the risks inherent in the structure of the foreign economy, and so forth. In this section, we discuss three strategies that will hedge one or more of these nonexchange risks (and sometimes hedge exchange risk at the same time). These three strategies are: (1) the local financing of investments, (2) the careful structuring of repatriations, and (3) the purchase of insurance on the firm's international investments.

Local Financing of Investments When the firm makes an investment in current assets, whether this investment is in cash, marketable securities, ac-

counts receivable, or inventory, this investment must be financed. By financing foreign investments via the capital markets and the currency of the locale where they reside, the firm can partially hedge both the political risk of expropriation and the exchange risk among currencies.[17] The risk of expropriation is hedged because the net amount of *domestic* investment by the firm is reduced. For example, suppose that a firm makes an inventory investment in a foreign country at a cost of $10 million. If the foreign government expropriates the investment without compensation and the investment has been financed in the firm's host country, the entire $10 million is lost; the foreign government has seized the assets, but the firm must still pay for the financing.

However, assume that the firm has raised $6 million of the required financing in the same foreign country. If the assets are seized, the firm can end its involvment in the country and refuse to repay this debt; its net exposure to possible expropriation is $4 million rather than $10 million. Further, the foreign government may be less likely to undertake such an expropriation since its country has less to gain. While the government can obtain the inventory via expropriation, those providing the financing will lose their investments.

This local financing strategy also provides a partial exchange rate hedge. If the value of the financing as well as of the foreign investment is denominated in the local currency, the effect of disadvantageous swings in exchange rates on asset value will be partially reduced by the parallel effect on financing. Taking our prior example, if the firm's $10 million investment was financed via the capital markets of its home country and the value of the home currency appreciated 10 percent relative to the value of the foreign currency, the investment would be worth only $9 million and the firm would take a $1 million opportunity loss. However, if this investment was partly financed with $6 million in foreign debt, the value of this debt would also fall to $5.4 million; and the firm's loss would be only $0.4 million.

Structuring of Repatriations Another risk faced by firms making foreign investments is that, after the investment is made, the foreign government will change the local laws in an attempt to stop dividend repatriations to the parent firm. To deal with this political risk, the firm may set up business arrangements between the parent and the foreign unit such that these repatriations are in a form other than dividend payments. For example, the firm may require the foreign unit to pay management fees or royalties to the parent. Another strategy is to manipulate the transfer pricing of materials and services

[17]The use of local investment to hedge these risks is discussed in E. F. Brigham and L. C. Gapenski, *Intermediate Financial Management* (Chicago: Dryden, 1984), p. 952 and in P. Drucker, "Insulating the Firm from Currency Exposure," *Wall Street Journal* (April 30, 1987), p. 28.

between the firm and the foreign units in such a way that the foreign unit must pay large amounts of cash to the parent.[18]

While these structuring strategies are useful, the firm should realize that they will not go unchallenged by the foreign government. By usurping that government's amended dividend transfer laws, the firm exposes itself to the risk of retaliatory action. In particular, by avoiding regulations intended to restrain repatriations, the firm may expose itself to the risk of expropriation.

Export and Investment Insurance Programs Several agencies offer insurance against political and other risks associated with international dealings. Two of these are the Foreign Credit Insurance Association (FCIA), a unit of the Export-Import Bank, and the Overseas Private Investment Corporation (OPIC). The FCIA offers policies against nonpayment by foreign debtors for political or commercial reasons. Political risks covered include civil disturbances and controls on the amount of available exchange. Commercial risks covered include both economic risks and the default risk of debtors. Policies to cover both commercial and political risk or political risk alone are available. Premiums, deductible loss amounts, and procedures vary among types of policies and among the countries covered by the policy. Policies can cover single-sale transactions or the firm's entire foreign operation. In addition to coverage of default by debtors in paying for exported shipments, coverage is available on inventory residing in a foreign country. Special programs are available for firms whose prior exporting experience has been limited, for service firms, and for firms engaged in foreign leasing. Exports with terms of sale of up to five years may be insured.

OPIC is an agency of the U.S. government, and is primarily concerned with facilitating investments in less-developed foreign countries (where these countries are generally friendly to the United States). Coverage is currently available for investments in many countries all over the world, including such diverse locations as Argentina, Cameroon, China, Fiji, Nepal, and Tonga. OPIC insures against political risks only. Three types of political risk may be covered: (1) restrictions on the amount of exchange, (2) expropriation and nationalization, and (3) violence and civil unrest. Separate premiums are paid to insure against each of these political actions. Coverage of investments is to a maximum of 90 percent of the invested amount. Only new investment (and not existing investment) may be insured. In addition to coverage of exports for a wide range of U.S. products and of working capital investments, coverage is available on loans, leases, and natural resource investments. However, all investments covered must assist in the social or economic development of the country in which the investment is made.

In considering whether to employ these insurance programs, the finan-

[18]For a good discussion of these repatriation strategies, see Brigham and Gapenski, *Intermediate Financial Management*, pp. 937–40.

cial analyst needs to estimate their effect on the level, timing, and risk of the expected cash flows from the international transaction. The net present values of the cash flows for the various insured and uninsured strategies should then be compared. For example, in an exporting situation, the net present value of an uninsured sale to a foreign credit applicant may be estimated using the methods outlined in Chapter 6. If the firm can obtain insurance (perhaps from FCIA or OPIC) a new pattern of expected cash flows and risk will result. The risk-adjusted net present value of the uninsured and insured sales are compared, and the strategy with the highest net present value is chosen.

MANAGEMENT OF INTERNATIONAL WORKING CAPITAL ACCOUNTS[19]

Up to this point, the majority of this chapter's discussion has been devoted to the additional political, economic, and exchange risks that occur for the firm in international dealings. These additional risks occur in many situations where the firm is managing international working capital accounts and transactions. For example, keeping an inventory of materials in a foreign country to support sales of an affiliate involves the risk of expropriation of the inventory, the risk of imposition of new taxes on the inventory, the risk that the inventory will not be sold because of local economic conditions, and the risk that the value of the local currency will change before revenues from the sale of the inventory are repatriated.

However, in addition to these *differences in risk* between domestic and international working capital transactions, there are also some differences in the *required techniques for the international management of individual working capital assets and liabilities.* The goal of the firm in the management of these assets and liabilities is still to maximize the wealth of shareholders by maximizing net present value. However, there are additional issues in the achievement of this goal in international settings that do not occur in domestic situations. We discuss some of these issues in this section.

Cash Management As in the management of domestic cash, the firm can maximize net present value by collecting cash as quickly as possible, disbursing it as slowly as possible, and investing temporary surpluses as profitably as possible. However, in the management of international cash, the cash asset is denominated in various currencies and located in various countries. In this context, one set of cash management issues arises in *managing flotation on international cash transfers.*

To understand the importance of the management of flotation of inter-

[19]An alternative treatment of the issues discussed in this section can be found in A. C. Shapiro, *International Corporate Finance: Survey and Synthesis* (Tampa, Florida: Financial Management Association, 1986), pp. 32–48.

national cash, consider the relatively simple case of an exporting firm collecting from a foreign importer of its goods. In exporting, the firm has several options in arranging for payment by the foreign customer. Two of these are: (1) the exporting firm may grant credit directly to the customer, or (2) the exporting firm may require that the customer's bank accept drafts for goods before they are delivered to the buyer.[20] In either case, the buyer will eventually wish to pay for the goods, either by paying the firm (in the first option) or paying the drafts (in the second option). Several delays occur between the buyer's instructions to its bank to start payment procedures and the seller's eventual receipt of the funds. Included among these are the delay at the importer's bank in executing these instructions, delay while the funds are moving from the foreign bank to the seller's U.S. bank, and delay between the time the U.S. bank receives the funds and the time they are credited to the seller's account. If the drafts option is used, the processing of these documents can add additional delay.

Together these delays commonly add *eight to ten business days* to the time between the foreign firm's payment and the domestic firm's receipt of this payment. During that time, the domestic firm cannot use the funds. Also, over this substantial time, exchange rates may change and adversely affect the number of dollars received; the funds cannot be exchanged into dollars until received at the seller's bank. It is easy to see that such delays pose a substantial cost to the exporter.

One of the tasks of the manager of international cash is to minimize these delays in the receipt of funds from foreign customers or affiliates.[21] Several tools are available for addressing this task. The ability of foreign and U.S. banks to handle import-export transactions, including document processing and cash transfers, varies substantially from bank to bank, so *proper bank selection* is a major tool for float reduction. The use of *noncheck transfer mechanisms* should be routinely considered.[22] Also, *careful preparation of drafts* and other documents according to the laws of the importing country can avoid substantial delays in cash transfer.

Another technique (called *netting*) can be used to reduce the number of transfers among a firm's own foreign and domestic units, and thus reduce

[20]The use of drafts backed by both the firm and its bank in payment results in the creation of bankers' acceptances, a financing and investment instrument discussed in prior chapters.

[21]For an excellent discussion of cash management in exporting, see E. Roberts, "Benefits of Export Cash Management Studies," *Journal of Cash Management* (September/October 1984), pp. 30–34.

[22]If the countries involved are members of the SWIFT transfer network, the out-of-pocket costs of such transfers are very small (less than $1.00); see V. Srinivasan and Y. Kim, "Payments Netting in International Cash Management: A Network Optimization Approach," *Journal of International Business Studies* (Summer 1986), pp. 1–20.

flotation. While there are several versions of this technique, the basic idea is to offset payments among the various units of the firm located in various countries. For example, suppose that the firm's subsidiary in country A needs to make a payment to the parent firm and that the parent firm needs to make a payment in the same amount to another subsidiary in country B. If the funds are transferred from the subsidiary in country A to the firm's headquarters, and the firm makes a separate transfer from headquarters to the subsidiary in country B, there will be float from two transfers. However, if the transactions are netted, the subsidiary in country A can send the funds to the subsidiary in country B, and only one transfer results. The problem of minimizing float and other transfer costs of funds between the firm's units over multiple periods, given legal and other constraints involved in this transfer, is amenable to sophisticated optimization techniques.[23]

A second set of issues in the management of international cash revolves around the *flotation management for a foreign unit* of the firm. Unfortunately, many of the standard techniques used to shorten float on the incoming domestic checks of U.S. firms are not applicable in other lands. For example, if a firm has made an investment in a foreign subsidiary, and this subsidiary sells and collects within its own country, it would seem that a straightforward application of lockbox location methodologies would minimize the mail float on the subsidiary's incoming checks. However, the financial cultures of many other countries are not oriented toward such lockbox systems, and some are in fact resistant to their application. Although, in the United States, banks have been the largest developers and sellers of these flotation management technologies, banks in other countries (particularly in Europe) have shown no interest in these techniques.[24] To reduce float on incoming checks of foreign affiliates, some firms have gone so far as to set up accounts at the banks of the affiliate's major customers. While such accounts are costly to maintain, they eliminate clearing float completely, since clearing now requires only internal debiting and crediting of the payor's and payee's accounts at the same bank. The advantage and cost of such innovative flotation management strategies will vary from country to country.

Accounts Receivable Management In the management of domestic accounts receivable, the financial manager's basic duties are to make and monitor decisions regarding terms of sale and credit granting. These duties are no different in international situations, but complications occur that are not

[23]Techniques for the analysis of this problem are presented in M. Anvari, "Efficient Scheduling of Cross-Border Cash Transfers," *Financial Management* (Summer 1986), pp. 40–49. A. Shapiro, "Payments Netting in International Cash Management," *Journal of International Business Studies* (Fall 1978), pp. 51–58, and Srinivasan and Kim, "Payments Netting."

[24]See J. Shoch, "Management of U.S. Cash Flows for a Foreign-Based Multinational," *Journal of Cash Management* (May/June 1984), page 44 for discussion.

part of the domestic scene. Several of these complications revolve around the different *levels of information* available regarding foreign markets and credit applicants.

Let us discuss terms-of-sale decisions first. In many countries, terms of sale (particularly for imported goods) are legislated, and there is no decision to be made regarding these terms: the firm complies with the required terms or it does not deal in that country. If the firm is not bound to legislated terms, the optimum terms can then be set for foreign markets just as in domestic markets; the appropriate analysis techniques are discussed in Chapter 5. However, these techniques require an estimate of *the future sales that will result from various terms policies.* Even in an industrialized country where product markets are well-developed, such estimates are quite uncertain. In countries with more fluid product markets, the uncertainty in such estimates is greater. Because of this uncertainty as to future sales volumes and the importance of these sales volumes in terms-of-sale decisions, the appropriate assessment and pricing of risk in these decisions is critical.

As with information on product markets, credit information on foreign customers is often inferior in quantity and quality to that available on domestic customers or is in a form that makes the assessment of default probabilities and recovery rates more uncertain.[25] While the availability of such information and its usefulness varies from country to country, the type of information gathered is similar to that of domestic applicants: histories of trade payments, financial statements, and so forth. There are several organizations, such as Dun and Bradstreet International and FCIB-NACM Corporation, that will assist the firm in obtaining this information. But the information received will often be less than that which the seller would prefer. In fact, international credit managers often use the acronym "LESS" to describe the information available on foreign debtors:

- ☐ *L*imited (not many sources of information)
- ☐ *E*xpensive
- ☐ *S*low (distance/language barrier)
- ☐ *S*uspect (incomplete/neutral information)

One alternative is to price this uncertainty of information by raising the discount rate used to estimate the value of the expected cash flows when credit information is sketchy.[26] Another response is to require that the purchaser use *documentary credit* procedures in order to make purchases. The

[25]For discussion of sources of credit information on foreign firms, see G. N. Cristie and A. E. Bracuti, *Credit Management* (Lake Success, N. Y.: Credit Research Foundation, 1981) pp. 644–49.

[26]See Chapter 6 for discussion of the risk introduced in credit-granting decisions as a result of uncertainty regarding estimates of customer-specific parameters.

draft/acceptance procedure that results in a bankers' acceptance is one of these and is one of the safest because the buyer's bank has also agreed to honor the draft, reducing the risk of default. Other documentary credits, such as *export drafts* (which are not guaranteed by a bank), involve a lower default probability than do sales on an open account basis but a higher default probability than do bankers' acceptances.[27]

Inventory Management There are several differences between the management of domestic inventory and the management of inventory in a multinational context. For one thing, any political risk of war and civil disturbance bears heavily on inventory. Unless the civil disturbance results in changed laws, trade creditors within a foreign country will still owe the same amounts to the firm when the disturbance is over. But inventory is a *physical good*; it can be burned or otherwise destroyed in such disturbances.

Another difference between domestic and international inventory management occurs if the firm has set up a local affiliate to sell the firm's exported output. In such cases, the lead times, safety stocks, and order sizes will not be the same as those that would be calculated in domestic inventory management. The mere physical distance between the firm's plant and the sales location raises the lead time from order to delivery and raises the transportation cost in obtaining materials. These differences must be addressed in formulating a strategy for international inventory management.

Short-Term Financing The financial culture and business climate of the foreign country will affect both the optimal level of short-term financing and the available sources of this financing. Firms may finance internationally by using such sources as accounts payable from foreign suppliers, accrued expenses of foreign operations, and so forth. However, the availability and cost of these sources of short-term debt varies substantially among countries based on laws, interest rate levels, local business customs, and so forth.

In choosing among the various sources of short-term financing available in other countries, it is *extremely* important that the firm keep in mind the effects of *different rates of inflation* on the advantage of borrowing in various currencies.[28] A loan from a foreign bank (payable in the bank's home currency) at a lower interest rate may seem a desirable source of financing, but a higher inflation rate in that country may make such borrowing less advantageous than a loan carrying a higher interest rate but denominated in the firm's home currency. To see this, let us assume that a firm has, among its alternative sources of short-term financing, two potential 90-day note ar-

[27]See Cristie and Bracuti, *Credit Management*, pp. 659–79 for a discussion of documentary credits.

[28]For discussion of this issue, see Brigham and Gapenski, *Intermediate Financial Management*, p. 929.

rangements. Interest and principal are payable at maturity in both cases. The first of these is from a domestic bank and requires that the firm pay 2 percent interest (over the 90 days) on a principal of $10 million. The second is from a foreign bank and requires the payment of SF 15,634,604 in 90 days based on a principal of SF 15,365,704 (an interest rate of 1.75 percent for the 90 days in SF). If the current spot exchange rate is $0.6508 per SF, this second arrangement also provides $10 million in financing (since 15,634,604 divided by 0.6508 equals $10 million).

On the surface, it would seem that the SF loan is cheaper, since the interest rate is lower. However, the foreign bank's loan must be paid off in SF, and the eventual dollar/SF exchange rate will depend on the relative inflation in the two countries. Let us assume that this differential inflation will result in a rise in the Swiss franc of 0.5 percent relative to the dollar over the 90 days. The analysis appears in Table 13-4. In this case, the anticipated exchange rate at the time the note matures will be $0.654054 per SF (equal to 1.005 times 0.6508), and the firm will have to pay $10,225,875 (equal to 15,463,604 SF divided by $0.654054 per SF). This translates into an interest

Table 13-4. *Effect of Change in Exchange Rate on Interest Cost of Borrowing.*

Dollar Note

Dollar Amount of Financing	*Dollar Interest Rate*	*Dollar Payment in 90 days*	*Dollar Payment/ Dollar Financing*
$10,000,000	$0.02	$10,200,000	$1.02

SF Note

SF Amount of Financing	*SF Interest Rate*	*SF Payment due in 90 days*
15,365,704	.0175	15,634,604

Exchange Rate: Dollars/SF		
Current Rate 0.6508		Rate in 90 Days 0.654054
Dollar Amount of Financing		Dollar Payment in 90 days
$10,000,000		$10,225,875	1.0225875

rate of about 2.259 percent, which is higher than the interest rate on the dollar-denominated loan.

The point is, that in analyzing nondollar sources of financing, *anticipated changes in exchange rates must be included in the analysis.* Note that in this analysis we are discussing *anticipated* changes in exchange rates (which affect the *expected* levels of cash flows), not *unanticipated* ones (which affect the *risk* of these cash flows). The cash flows in Table 13-4 from the two financing vehicles are the expected flows based on anticipated inflation rates. *Anticipated changes* such as these *will be reflected in the forward and futures market prices* of currencies and are thus observable by the firm.

This concludes our discussion of some of the differences between the management of working capital in a domestic and in an international setting. The following section reviews surveys of practices used by managers in the management of international short-term assets and liabilities.

THE MANAGEMENT OF INTERNATIONAL WORKING CAPITAL IN PRACTICE

Two surveys of large numbers of firms, both conducted in 1983, provide some information on the practice of international working capital management. Collin and Frankle (CF) wanted to assess the international practices of U.S. firms; they surveyed the Fortune 1000.[29] Soenen and Aggarwal (SA) were concerned with contrasting practices among firms in various countries, and surveyed large industrial companies in the Netherlands, in the United Kingdom, and in Belgium.[30]

Of the additional sources of risk in international transactions, exchange risk and political risk (particularly risks of restriction on repatriation and of expropriations) are seen as important by the vast majority of U.S. firms (CF, p. 46). To hedge exchange risk, the majority of U.S. firms use forward exchange contracts; a smaller percentage use futures (CF, pp. 46–47). Forward exchange contracts are also very popular hedging vehicles for firms in the U.K., the Netherlands, and Belgium (SA, p. 64). The denomination of transactions in the currency of the home country is also used as an exchange hedge by a substantial fraction of firms in all three of these countries, but the use of traded market vehicles (such as futures) for hedging is popular only for firms in the U.K. (SA, p. 64). Of these three countries, there is less

[29]See J. M. Collins and A. Frankle, "International Cash Management Practices of Large U.S. Firms," *Journal of Cash Management* (July/August 1985), pp. 42–48. The response rate for this survey was 22 percent.

[30]Results are reported in L. Soenen and R. Aggarwal, "Corporate Foreign Exchange and Cash Management Practices," *Journal of Cash Management* (March/April 1987), pp. 62–64. The overall response rate for this survey was 30.5 percent.

hedging of foreign exchange risk by firms in Belgium than in the U.K. or the Netherlands (SA, pp. 63–64).

One method of hedging the risk of controls on dividend repatriation from a foreign affiliate is the careful structuring of the relationship between the companies so that part of the cash flow to the parent firm comes from nondividend sources. While dividends are still the most common form of repatriating cash, this mechanism is by no means dominant. Other mechanisms, which avoid dividends (and thus restrictions on dividend repatriation), are used by many firms. Popular mechanisms include interest payments and principal payments on capital borrowed from the parent, transfer pricing, royalty payments, and management fees (CF, p. 46).

The management of cash and marketable securities on an international basis poses special problems. Although the use of lockbox systems for domestic collections is common among large firms, only a small fraction of large firms use these systems in international dealings (CF, p. 44). In moving cash from one country to another, wire, cable, and mail transfers are used by over half of all firms; netting of payments among foreign units is also common (CF, p. 45). The decision on where and how to invest excess cash depends on the structure of the firm's international operations. Those U.S. firms whose international cash management operations are centralized at their corporate headquarters usually invest in dollar-denominated securities, while firms with decentralized operations usually invest in local, nondollar markets (CF, p. 44).

In domestic credit-granting situations, firms generally either grant credit on an open-account, unsecured, basis or require cash in advance. These two policies are also used in international dealings; many firms sell foreign buyers on open-account terms, and a few cash-in-advance sales are made (CF, page 47). However, letter-of-credit transactions (which are part of the document system that can generate bankers' acceptances) are the most popular credit-granting option in international trade. Other documentary credits (such as drafts) play a lesser role (CF, p. 47).

In addition to investments in short-term international assets, firms may also finance internationally. While several programs are available from domestic and foreign governments, most large U.S. firms obtain international financing from commercial banks in the United States and elsewhere. Only about one-fourth of large firms use United States and foreign government financing programs (CF, pp. 45–46).

MARY

Firms engage in international working capital transactions as part of the process of maximizing shareholder wealth. By trading, investing, or financing in another country, the firm can take advantage of superior conditions in

product, labor, or capital markets. However, dealing on an international basis changes both the risk and expected levels of cash flows as compared to parallel dealings done domestically.

Differences in risk between domestic and international transactions stems from currency, political, and economic differences among countries. Differences among currencies used in the denomination of transactions leads to exchange risk. Exchange risk is the uncertainty regarding the future rate of interchange between the currency in which the international transaction is denominated and the currency of the firm's host country. Political risk is of several types, and includes the possibility of civil unrest in the foreign country, changes in the rules under which the firm operates in the foreign country, and controls on the rate or amount of exchange between the foreign country's currency and the currency of the firm's host country. Economic risk stem from the variation in the nature of economic activity among countries.

When considering an international transaction, the risks inherent in that transaction must first be assessed. These risks will encompass the normal business risks in any domestic transaction, plus the additional risks that com from dealing internationally. Once the levels of these risks are assessed, they must be either hedged or priced in evaluating the proposed transaction. Several hedges are available to address the risks associated with international dealings. Exchange risk may be hedged by denominating the transaction in dollars, dealing in the Eurodollar market for investments rather than in non-dollar foreign markets, prebuying or preselling required foreign currency, and via currency forwards, futures, or options. Nonexchange risk may be hedged by financing foreign investments within the foreign country, managing relationships between the firm and its foreign affiliates so as to structure cash repatriations in nondividend forms, and insuring the firms' foreign investments. Alternate hedging and pricing strategies for foreign investments and financing are evaluated by their effects on the risk-adjusted net present value of the proposed transaction.

Besides differences in risk, international dealings also entail consideration of other differences, not involved in the management of domestic short-term assets and liabilities. Differences among countries in financial systems, and the cross-border nature of transactions, cause differences in the level and character of cash flows from domestic versus foreign undertakings. In cash management, new problems arise in the international scheduling of cash transfers and in managing flotation of foreign affiliates. Reduced levels of information on foreign markets and credit applicants are challenges in receivables management. In ordering inventory, international lead times and ordering costs are higher than in domestic situations. Finally, the evaluation of current liability financing in nondollar currencies requires the consideration of anticipated changes in exchange rates caused by international differences in inflation.

This chapter, the last in the text, introduces the reader to the management of internationalized working capital investment and financing. However,

whether the reader's future involvement with the management of current assets and current liabilities is on a domestic or/and an international basis, it is well to remember that working capital management is a rapidly changing field. New techniques, instruments, and securities for the management of short-term assets and liabilities appear rapidly and increasingly. In a dynamic field such as this, constant study and attention are required to keep one's knowledge current.

Problem

13-1. A firm is trying to decide on a strategy for dealing with the risk of the cash flows from an overseas trade credit applicant. The sale is denominated in wolfgangs, which is the currency of the country in which the sales is to be made. There is no risk of political action in the foreign country, and the terms of sale are 180 days. There is no chance that the debtor will default. The forward exchange rate for 180 days is 5 wolfgangs per dollar, and the invoice amount is 500,000 wolfgangs. One strategy to be evaluated is to make the sale and to purchase a forward currency contract. If this contract is purchased, an immediate deposit of 5 percent of the contract amount (in dollars) will be required; this will be refunded when the contract is executed. The cost of materials necessary for the sale is $75,000, payable immediately, and the discount rate is 1 percent per month. Calculate the net present value of the sale where exchange risk is hedged via the forward contract in wolfgangs. Use a 360-day year for calculation purposes.

Selected Readings

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case

Jupiter Machinery[1] *International Cash and Credit Management*

Jupiter Machinery was a medium-sized manufacturer of precision machinery; yearly sales were $100 million. The firm was based in the United States and did not advertise internationally. Consequently, the management of Jupiter Manufacturing was quite surprised to be approached by executives from Mechanico General regarding an order. Mechanico General, a firm located in the country of Isla Verde, manufactured parts for the automotive industry in that country. The executives of Mechanico had become familiar with Jupiter's products and service from visits to manufacturers of automotive parts in the United States. Based on this knowledge, they had decided to approach Jupiter regarding the purchase of new machinery.

After considerable discussion between the manufacturing staffs of Mechanico and Jupiter, a list of the required items was compiled. Some of the items were currently available from Jupiter's inventory while others would require manufacturing. It was determined that the order could be ready for shipment in 90 days.

Concurrent with these negotiations, the firm's credit manager, Pamela Vance, had been accumulating a file of credit information on Mechanico General. Ms. Vance was quite experienced with regard to domestic credit investigations and credit-granting decisions, but had no experience in international dealings. Since it was clear from the beginning that the order would be substantial, she decided to collect all possible information on Mechanico General. She first obtained credit reports on the firm from commercial reporting agencies. These indicated that Mechanico General was a large firm with substantial financial strength and a record of satisfactory payments to local suppliers. An inquiry to Mechanico's bank (made through Jupiter's bank) showed the firm to be well-known and respected and to have substantial bank balances. Talks with the international credit departments of other U.S. exporters to Mechanico indicated that sales were being made on an open-account and on a draft basis with terms of 180 days from date of shipment; some of these U.S. firms reported prompt payments, while others showed slowness of up to 30 days beyond terms.

[1]This case was developed with the help of Edward G. Roberts of Union Carbide Corporation.

While this was much less information than could be obtained on a domestic buyer, Ms. Vance recognized that these were all the data she was going to be able to obtain. Based on this limited information, Ms. Vance had estimated that the default probability for Mechanico was relatively low. Her numeric default probability estimate was 0.75 percent, and her estimate of the recovery rate in default was 20 percent. She also estimated that it would take 5 years to make any recovery if the firm defaulted on the debt. Because of the very limited available information, she recognized that these estimates were subject to considerable uncertainty.

Besides the normal commercial risk of default in selling to any applicant, Ms. Vance was also aware of the political risks in selling to a firm in a foreign country. At the time of the proposed sale, Isla Verde was a country with a relatively stable political condition, but there was always the chance that the country's government would respond to domestic political pressures by taking an action that would make the situation more difficult for firms exporting to the country. In particular, she was worried that the government of Isla Verde would institute a freeze on payments to foreign suppliers. If such a political action were undertaken while Jupiter had monies due from Mechanico, collection of the invoice would be substantially delayed. For modeling purposes, Ms. Vance estimated that between the time the shipment was made and the time payment was due, there would be a 5 percent chance that the government would take such an action, and that such an action would result in payments being delayed to foreign suppliers until the end of a two-year period. In addition to these commercial and political factors, there was also currency risk in the sale. The currency in use in Isla Verde was the peseta, and the spot exchange rate at the time of the analysis was 127.30 pesetas per U.S. dollar.

Because of the exchange risk in the proposed sale, it was agreed that Ms. Vance and the firms' cash manager (Jack Roddenberg) would participate in the negotiations between Jupiter's marketing staff and the purchasing agents for Mechanico. These negotiations would determine the price, terms, and currency of the sale. It was made clear rather early in the negotiations that requiring terms shorter than 180 days or requiring that Mechanico purchase on a documentary credit basis would result in the loss of the sale. If the sale were denominated in pesetas, it was agreed that the amount of the invoice would be 82,745,000 pesetas (equivalent to $618,423 at the 270-day forward exchange rate). If the invoice was denominated in dollars, the amount would be $600,000. Jupiter had one week to analyze these two alternatives and decide which of the two would be exercised. In any case, providing the machinery ordered (and replenishing Jupiter's inventory of machinery to desired levels after the order) would cost Jupiter $500,000. For modeling purposes, Ms. Vance assigned this outflow to the day on which the order was to be shipped.

During the one-week period, it was the task of Ms. Vance and Mr. Roddenberg to make hedging and credit-granting decisions regarding the proposed sale. To make such decisions, they had to consider the various risks and the possible hedges available for these risks. To hedge the political and commercial risk of the transaction, the firm could purchase insurance coverage. Since Jupiter did not expect to make any other foreign sales during the upcoming year, it was decided that a single-sale policy (rather than a policy covering multiple sales) was the most economical. The policy Jupiter was considering was a comprehensive one that would partially insure the firm against default by Mechanico for commercial or political reasons. The premium would be $10,000, payable immediately. Under this policy, if Mechanico did not pay for the shipment within 240 days from the date of

shipment (180-day terms of sale plus 60 days) for commercial reasons, Jupiter would file a claim for the amount of the invoice with the insurance company, which would pay 90 percent of the invoice value in an additional 60 days. The remaining 10 percent of value constituted Jupiter's deductible; any recoveries in default would go to the insurance company. If the invoice were not paid because of political action, the same timing would apply, but there would be no deductible amount; the insurance would pay for 100 percent of the loss. If both default and political action occurred, the claim would be paid at the commercial loss rate. If the invoice were denominated in dollars, the claim would be paid in dollars. If the invoice were denominated in pesetas, the amount of the payment for the insurance claim would be computed based on the exchange rate in effect at the time the payment was made.

The exchange risk in the sale could be hedged in several ways. One method was to denominate the sale in dollars, which would reduce the amount of the sale from $618,423 (at forward exchange rates) to $600,000. However, Ms. Vance and Mr. Roddenberg also considered hedging of the exchange risk by using currency forwards and futures. They knew that Jupiter would receive the cash in 270 days if Mechanico paid as expected and if no government action occurred: 90 days to assemble the order plus the 180-day terms of sale. Therefore they approached their bank regarding the possibility of selling a forward contract for the receipt of 82,745,000 pesetas in 270 days. The bank quoted a 270-day forward exchange rate of 133.80 pesetas per dollar, and gave Jupiter the option of either paying 5 percent of the current dollar value of the contract in advance or having its credit line reduced by the dollar amount of the contract. In no case were the revenues from the contract's sale available to the company until the contract was fulfilled. Given that Jupiter's current policy for the management of short-term debt called for substantial reserve credit lines to hedge against cash shortages, Ms. Vance and Mr. Roddenberg knew that the firm would utilize the first of these alternatives, and would present the 5 percent cash advance.

The third alternative for hedging currency risk was the use of futures. While futures on the Isla Verde peseta were not traded, Mr. Roddenberg knew that movements in the German deutsche mark and the peseta were highly (though not perfectly) correlated. In this strategy, futures contracts on deutsche marks with the maturity nearest that of the invoice would be sold and used as a proxy for a contract in the pesetas. The timing and size of the proposed sale was such that Mr. Roddenberg was able to get a close match on the amount and maturity of the contracts, but some basis risk remained because of the use of a proxy currency. Also, Jupiter would have to deposit $19,000 in a noninterest-bearing margin account that would be marked to market each day.

Ms. Vance and Mr. Roddenberg knew that the strategies of using futures and forwards hedged exchange risk on the future cash flow only if Mechanico paid on the 270th day. If Mechanico defaulted or if a government action delayed receipt of the monies from Mechanico, the contracts would be reversed at that time by a transaction in the spot market. That is, if the 82,745,000 pesetas were not received from Mechanico on the 270th day, Jupiter would have to cover the contracts by purchasing pesetas in the spot market. This would subject the firm to two other risks: the risk of currency fluctuations in the spot market when covering the short, and currency risk on other future cash flows, which would not be hedged.

To begin their quantitative analysis, Ms. Vance and Mr. Roddenberg first recognized that there were eight possible strategies: four

Exhibit 1

Jupiter Machinery
Listing of Eight Possible Hedging Strategies

Strategy	*Exchange Risk Hedge*	*Political and Commercial Risk Hedge*
A	None	None
B	Denominate in Dollars	None
C	Forward Contract	None
D	Futures Contracts	None
E	None	Insurance
F	Denominate in Dollars	Insurance
G	Forward Contract	Insurance
H	Futures Contracts	Insurance

possible currency hedges (no hedge, denominating in dollars, using a forward, and using futures) and two possible insurance strategies (insure or not insure). These strategies are summarized in Exhibit 1. With regard to the commercial default and political events, they saw that four outcomes were possible. Assuming that these processes were independent, they calculated the probabilities of occurrence of each outcome. The four outcomes and their probabilities are presented in Exhibit 2. They also recognized that, to evaluate the various strategies, they would need expected future exchange rates for the times of anticipated future events. The projected rates and event dates are presented in Exhibit 3.

Using these data, analysis proceeded as follows. First, the expected cash flows (in the appropriate currencies) were calculated for the various future events for each strategy and converted into dollars. An example of their analysis at this stage for strategy A is presented in Exhibit 4. Risk-adjusted discount rates were then applied to these estimates of expected future cash flows. These risk-adjusted rates were designed to allow for: (1)

Exhibit 2

Jupiter Machinery
Commercial and Political Outcomes with Probabilities

Outcome Number	*Commercial Outcome*	*Political Outcome*	*Probability*
1	No default	No action	0.9429
2	No default	Action	0.0496
3	Default	No action	0.0071
4	Default	Action	0.0004
			1.0000

Exhibit 3

Jupiter Manufacturing
Important Future Dates and Projected Exchange Rates

Time (Days)	*Time (Months)*	*Event (Types of Cash Flows)*	*Projected Exchange Rate, Pesetas per Dollar*
0	0	Insurance, deposit on forwards, initial margin on futures.	127.30
90	3	Initial outflow of $500,000.	129.50
270	9	Inflow from customer payment or reversal of futures or forwards.	133.80
390	13	Insurance payment if there has been default or political action.	136.70
720	24	Payment from customer if sale is uninsured and if there is political action but no default.	144.60
1800	60	Payment if customer defaults and if the sale is uninsured.	170.60

Exhibit 4

Jupiter Machinery
Cash Flows from Strategy A

Monthly Risk-Free Rate			.005				
Month		0	3	9	13	24	60
Proj. Pesetas:	$	127.3	129.5	133.8	136.7	144.6	170.6
			Dollar-Denominated Cash Flows				
Outcome							
	1		−500000				Prob.
	2		−500000				.9429
	3		−500000				.0496
	4		−500000				.0071
							.0004
			Peseta-Denominated Cash Flows				
	1			82745000			
	2					82745000	.9429
	3						.0496
	4					16549000	.0071
						16549000	.0004
			Expected Dollar Cash Flows				
		0	−500000	583111	0	28383	728
Hedges of Expected Cash Flows (0 = no hedge, 1 = hedge)							
Currency							
Proxy Hedge		0	0	0	0	0	0
Direct Hedge		0	1	0	0	0	0
Commercial		0	1	0	0	0	0
Political		0	1	0	0	0	0

the commercial risk from the variation in the cash flows due to default or nondefault of Mechanico and the uncertainty in the estimation of the parameters related to the default process, (2) currency risk for nonhedged and partially hedged nondollar flows, and (3) variation in cash flows due to political action and the uncertainty in Ms. Vance's estimate of the probability of this action.

The risk-adjusted rates used in the discounting process were developed based on the firm's cost of capital and the risk-free rate of interest and were compounded monthly. Jupiter's cost of capital was 0.600 percent per month, and the risk-free rate of interest was 0.500 percent per month. In evaluating a domestic credit applicant, the firm's cost of capital would be used as a discount rate for the expected future cash flows from the sale (such a domestic sale would not, of course, involve any exchange or political risk). However, Ms. Vance felt that an additional increment to this risk-adjusted rate was required because of the limited credit information available. It was decided to add an additional 0.100 percent per month to the cost of capital to represent this additional commercial uncertainty. Thus, the adjustment for commercial risk would be 0.200 percent above the risk-free rate rather than the 0.100 percent (equal to 0.600 minus 0.500) used for the evaluation of domestic credit applicants.