EVALUATING FOREIGN PROJECTS--
AN ADJUSTED PRESENT VALUE APPROACH*

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WP 1062-79  April 1979

*See Footnotes
Forthcoming in Lessard, ed.,
Frontiers of International Financial Management,
Warren, Gorham and Lamont
I. INTRODUCTION

In evaluating foreign projects, firms are forced to distinguish between project and parent cash flows, and the traditional capital budgeting rules that implicitly separate investment and financing decisions often break down. Firms must deal with a variety of issues seldom encountered in a domestic setting. These include exchange rate changes that may or may not reflect differences in rates of inflation, credit controls and restrictions on exchange transactions, and a more extensive use of financial subsidies including concessionary credit and guarantees, incomplete capital markets, and different tax systems. In addition, differences in economic and political conditions mean that the basic business risks of foreign projects will seldom be the same as those in the domestic setting.

This paper shows how the more general adjusted present value (APV) approach, which explicitly recognizes the interactions between investment and financing effects, can be employed to evaluate foreign projects. It has two advantages over the more traditional approach: 1) it is more explicit and transparent and hence is more likely to call to management's attention certain key differences between foreign and domestic projects and 2) it can accommodate a wider variety of investment-financing interactions in ways that are more consistent with current capital market theory. Whether or not it is practical for direct use in the majority of foreign capital budgeting decisions, therefore, it provides a superior basis for developing simple rules that can be applied for recurring investment decisions. For large, complex projects with numerous project-specific financing arrangements, it appears to be the simplest appropriate approach.

The paper is organized in five sections. Section II, compares
and contrasts the APV approach to the traditional weighted average cost of capital method. Part III presents a general APV formula for foreign projects and shows how it can take into account most special situations that arise. Part IV discusses the appropriate discount rates to be used in APV evaluations of foreign projects. Part V presents the overall conclusions and briefly discusses the level within the organization at which generalized APV calculations are most appropriate.

II. **THE ADJUSTED PRESENT VALUE APPROACH**

As a result of the "cost of capital revolution" of the 1960s, the dominant approach to project evaluation is to discount expected after-tax project cash flows by a weighted average cost of capital,

\[ \text{NPV} = \sum_{t=0}^{T} \frac{\overline{CF_t}}{(1+\rho^*)^t} \]  

(1)

where NPV is net present value, \( \overline{CF_t} \) is the expected total after tax project cash flow in period \( t \), and \( \rho^* \) is the weighted average cost of capital. \( \rho^* \), in turn is usually defined as:

\[ \rho^* = (1 - \lambda)\rho^E + \lambda \tau (1 - \tau) \]  

(2)

where \( \lambda \) is the weight of debt in the total capital structure, \( \rho \) is the pre-tax interest rate on debt, \( \tau \) is the corporate tax rate, and \( \rho^E \) is the required rate of return on equity.

The advantage of the traditional approach is its simplicity. It imbeds in a single discount rate all financing considerations, thus enabling planners to focus on the projects's investment characteristics. However, different discount rates are required for projects that differ from a firm's typical project in terms of either business risk or contribution to debt capacity.
and equation (2) provides little guidance since $\rho^E$ will be changed by an unspecified amount. Both conditions are the rule rather than the exception for foreign projects. Further, when the financing complications of foreign projects are introduced, the weighted average approach becomes complex and cumbersome, removing its major advantage. In fact, when financing sources for foreign projects include limited amounts of restricted funds or project-specific concessionary credit, there will be different weighted average costs for projects that differ only in scale.

With capital structures that vary over time -- which is typical of projects financed independently of the parent to minimize taxes, take advantage of project-specific financing subsidies, or accommodate joint venture partners -- a different weighted average will be required in different years of the project's life.

Differences in project debt capacity can be incorporated in an alternative weighted average formula developed by Modigliani and Miller [1963]:

$$\rho^* = \rho[1 - \tau(1-\lambda)]$$

(3)

where $\rho$ is the "all equity" required rate of return reflecting the project's business risk. Further, it can be generalized to situations where business risk differs as well. The project required rate of return, $\rho^*_j$, is given by:

$$\rho^*_j = [i + \beta_j (\rho_m - r)] [1 - \tau(1-\lambda)]$$

(4)

where $\beta_j$ is the project's beta coefficient (adjusted to remove the effect of leverage) and $(\rho_m - r)$ is the risk premium on the market portfolio.

As noted by Myers [1974], however, formulas (2) and (4) are exactly correct only if the cash flows are perpetual and $\lambda$ is constant over time. In many cases where projects are financed from a common corporate pool the errors are not serious. However, if the financial structures of specific foreign projects differ from those of the parent firm or vary
over the project lives because of the availability of concessionary finance, tax considerations, or its efforts to reduce political or currency risks, even the generalized formula (4) is likely to be misleading.

To deal with the problem, Myers [1974] suggests a return to the basic Modigliani – Miller equation underlying (3). Rather than implicitly incorporating financial factors in $\rho^*$, the approach values them explicitly in an adjusted present value equation:

$$\text{APV} = \sum_{t=0}^{T} \frac{CF_t}{(1+\rho_j)^t} + \sum_{t=0}^{T} \frac{TS_t}{(1+r)^t}$$

(5)

where the first term is the present value of the total expected operating cash flows discounted by $\rho_j$, the "all equity" discount rate reflecting the project's business risk, and the second term is the present value of the tax shields arising from debt, discounted at the cost of debt $r$.

III. APPLYING APV TO FOREIGN PROJECTS

The APV approach, outlined in Section II implies a "divide and conquer" approach to capital budgeting. Financial contributions to a project's value are recognized separately and explicitly, the total present value is the sum of the present values of the basic project cash flows and the various financing effects can be generalized readily to incorporate the special situation encountered in evaluating foreign projects. For example, a general equation capable of capturing the effects of financial subsidies as well as the impact of interaffiliate transactions on taxes due and on funds that can be remitted is the following:
Adjusted Present Value \[ \text{APV} \] (6)

= Capital Outlay \[ -I \] (6a)

+ Remittable After-Tax Operating Cash Flows \[ \sum_{t=1}^{T} \frac{\text{CF}_t (1-\tau)}{(1+\rho_1)^t} \] (6b)

+ Depreciation Tax Shields \[ \sum_{t=1}^{T} \frac{\text{DEP}_t (\tau)}{(1+\rho_2)^t} \] (6c)

+ Tax Shields Due to Normal Borrowing \[ \sum_{t=1}^{T} \frac{\text{INT}_t (\tau)}{(1+\rho_3)^t} \] (6d)

+ Financial Subsidies or Penalties \[ \sum_{t=1}^{T} \frac{\Delta \text{INT}_t}{(1+\rho_4)^t} \] (6e)

+ Tax Reduction or Deferral via Interaffiliate Transfers \[ \sum_{t=1}^{T} \frac{\text{TR}_t}{(1+\rho_5)^t} \] (6f)

+ Additional Remittances via Interaffiliate Transfers \[ \sum_{t=1}^{T} \frac{\text{REM}_t}{(1+\rho_6)^t} \] (6g)
Each of the terms is discussed in greater detail below. The treatment of foreign exchange as well as the choice of discount rates is discussed in Part IV. For present purposes, assume that all cash flows are stated in dollars and that the discount rates reflect this fact.

Operating Cash Flow (6b): In the domestic case, there is little difficulty in defining after tax operating cash flows. They are the total project cash flows less U.S. taxes. Whether they are reinvested in the project or not makes no difference, since all flows are deemed available to the corporate cash pool. With foreign projects, there are two major issues in defining operating cash flows: (1) whether to use project cash flows or only those flows remitted to the parent, and (2) what taxes to assume, since these will be a function of financing and remittance decisions. The first distinction arises because of foreign exchange restrictions and ceilings on profit remittances; the second because of the interactions of various national tax systems.

Clearly, the only cash flows of value to the parent are those available for remittance in one form or another but not necessarily those actually remitted. Furthermore, after-tax flows must take into account the incremental taxes to the entire corporation. However, the specific choice of ways to deal with the two issues is a question of managerial art—the solution should be straightforward, easy to apply, and likely to bring to management's attention the most critical issues.

There are two basic approaches. One is to begin with the most favorable set of assumptions regarding taxation and remittability and, in later terms of the APV equation, subtract the present values of reductions due to specific restrictions or international tax interactions. The other is to start with conservative assumptions regarding remittability and taxation, later adding the present value of gains resulting from various mechanisms for circum-
venting restrictions or deferring taxes. I prefer the second alternative for the pragmatic reason that if a project is attractive under conservative assumptions there is no need to proceed with the far more complex set of calculations regarding tax and remittance adjustments which require consideration of the total corporate cash flow and tax situation.

The conservative approach includes in the first term only those cash flows available for remittance through normal channels, for example amortization of investment and repatriation of earnings -- but not those that can be obtained only through transfer pricing or other mechanisms for circumventing restrictions. The tax rate applied to these flows is either the parent rate or the foreign rate, whichever tax system imposes the largest tax liability. This implicitly assumes that all operating cash flows are remitted immediately to the United States and that the parent has no excess foreign tax credits. Any additional value derived by circumventing restrictions on cash remittances, deferring U.S. taxes, or offsetting excess foreign tax credits can be incorporated in additional terms. Since depreciation tax shields are captured in a separate term, after-tax cash flows are simply pre-tax flows multiplied by one minus the relevant tax rate.

A further and perhaps more serious issue in the computation of operating cash flows is the difficulty of measuring the true incremental cash flows of a project in an interdependent multinational system. For example, the establishment of a manufacturing plant in a country previously served by exports will result in an erosion of profits elsewhere in the system, but may also create new profit opportunities for other parts of the system that provide intermediate or complementary products. This difficulty is exacerbated by departures from arm's length transfer pricing among units, some of which undoubtedly result from conscious manipulation of tax and exchange control systems but most of which result from the near impossibility
of allocating the joint costs and benefits associated with "soft" factors of production such as technology and managerial expertise used by more than one unit of the corporation. Clearly, an attempt should be made to measure incremental cash flows to the total system. Further, in keeping with conservative tax and remittance assumptions, inter affiliate flows should be valued as closely to an arm's length value as possible. 5/

Depreciation Tax Shields (6c): For reasons which will be stated more fully in Part IV, it is useful to separate depreciation tax shields (and other accounting allocations over time) from operating flows. As noted above, this simplifies the computation of after-tax operating flows.

Interest Tax Shields (6d): For a variety of reasons, including the availability of concessionary credit, the existence of tax or exchange considerations that favor remittances in the form of interest payments, and the desire to hedge currency or political risks, foreign projects are often financed with a different and typically higher proportion of debt than the corporation as a whole. Further, the debt issued to finance the project often exceeds the increment to overall debt capacity provided by the project. Thus, approaches that directly utilize the project capital structure in computing a weighted average cost of capital are likely to overstate the worth of the project, but a weighted average based on the total firm's capitalization also is likely to be misleading. In the APV equation, in contrast, the second term captures the tax shields associated with a project's incremental contribution to corporate debt capacity. The costs or benefits of "overborrowing" at the project level for reasons of currency risk, concessionary credit, or remittance restrictions are treated explicitly in later terms.
Financial Subsidies or Penalties (6e): The value of subsidies in the form of concessionary credit or penalties resulting from local financing requirements can be computed by comparing the present value of the total pre-tax payments on the debt, including interest and principal, at the rate that would apply if the same debt were issued to competitive capital markets with the face value of the debt. For example, if a project is eligible for a concessionary loan at 6 percent instead of a market rate of, say, 9 percent, (6e) would be the difference between the present value of the total pre-tax payments on the 6 percent debt discounted at 9 percent and the face value of the debt. 6/

The Use of Pre-tax or Restricted Funds: Firms often have access to funds from existing operations whose use is restricted by exchange controls or because special tax advantages will be forfeited or additional U.S. taxes imposed if the funds are remitted rather than reinvested. The APV framework lends itself readily to incorporating the incremental value of a project resulting from its ability to employ such funds. Since the operating cash flow term already captures project cash flows that will be available for remittance, taxed as if they are remitted, the use of restricted funds simply reduces the investment outlays (6a) by the difference between their face value and the present value of these funds if remitted via the best alternative mechanism. 7/

Ability to Reduce or Defer Taxes (6f): The base case operating cash flows, term (6b), incorporate conservative assumptions regarding the taxation of project cash flows—that they will be taxed at the U.S. rate or the local rate in the foreign country, whichever results in the greater tax liability. In many cases an MNC can reduce taxes from this level by combining profits from countries with relatively low and high taxes, by shifting expenses and revenues among its affiliates, or simply by reinvesting profits in low tax countries and deferring the additional U.S. taxes. In principle, the present
value of these tax changes can be readily incorporated in an APV term, although computing them may require a complex corporate tax model. However, reversing the analysis to calculate a "breakeven" value for (6f) may show that a readily attainable degree of tax reduction is all that is required. Thus the full analysis can be avoided.

**Ability to Circumvent Restrictions on Remittances (6g):** The base case operating flows, term (6b), include only those operating flows available for remittance. Thus, they will be less than project flows whenever there are binding remittance restrictions. In many cases, however, the restricted flows can be transferred out through inter-affiliate pricing, management fees, special export programs, or other mechanisms. The value of these remittances, typically less than the face value of the funds in question, can be incorporated in another APV term. Again, a major advantage of the "divide and conquer" approach is that it makes explicit the impact on project value of remittance restrictions and alternative ways around them. Even where the exact possibilities for transferring restricted funds are not known, a "breakeven" value for term (6g) can be computed, thus showing what proportion, in present value terms, of the restricted profits would have to be transferred to make the project marginally attractive.

IV. APPROPRIATE DISCOUNT RATES WITH THE APV APPROACH

Although with the APV approach discount rates no longer carry the burden of implicitly capturing all the effects of a project's financial structure on its value, they still must reflect the riskiness of each APV term as well as the implicit assumptions incorporated in the cash flows regarding inflation and exchange rate changes. We deal with the latter point first.
Inflation and Exchange Rate Changes

A general approach for evaluating foreign projects must be capable of dealing with projects in a large number of different countries with cash flows in various currencies. Furthermore, the method should be sufficiently general to deal with domestic projects as well. A brute force solution would be to generate a matrix of discount rates for nominal cash flows in each currency in each time period. Such an approach, however, is likely to be viewed by users as a black box and to lead them to overlook certain key interrelationships between inflation rates and changes in exchange rates that are relevant to the estimation as well as the valuation of project cash flows.

The basis for a simpler yet more transparent approach is provided by the set of equilibrium relationships between interest rates, rates of inflation, and changes in exchange rates that (tend to) hold in efficient markets—purchasing power parity, interest rate parity, and the domestic and international Fisher effects. Even when these relationships do not hold precisely, they serve to highlight the impact on cash flows of the interactions between inflation and exchange rates and provide insights regarding the valuation of these flows.

In order to trace the implications of these equilibrium relationships for the estimation and evaluation of cash flows, it is useful to separate the terms in (6) into two groups: (1) those cash flows (6b, 6g) which are not contractually denominated in money terms and whose level depends on, among other things, the interactions of inflation and exchange rate changes, and 2) nominal flows (6c, 6d, 6e, 6f) that are fixed...
contractually in a particular currency. A different treatment is appropriate for each of the two classes of flows.

**Non-Monetary Flows and Purchasing Power Parity:** Extensive theoretical and empirical research suggest that over time exchange rates adjust to reflect differences in the internal purchasing power of various currencies. If purchasing power parity (PPP) holds, exchange rate changes and relative rates of inflation offset each other, and the multi-currency setting is reduced to a single currency one. Specifically, with purchasing power parity the spot exchange rate for foreign currency (stated in terms of units of the base currency per unit of foreign currency) at time \( t \) is

\[
S_t = S_0 \frac{(1 + I)^t}{(1 + I^*)^t} \tag{7}
\]

where \( S_0 \) is the current spot rate, \( I \) the base currency inflation rate, and \( I^* \) the foreign currency inflation rate. Further, according to the Fisher effect, nominal interest rates incorporate a premium for anticipated inflation. Thus the present value of foreign operating cash flows can be expressed alternatively as

\[
V = \sum_{t=1}^{T} \frac{\overline{CF}_t (1+I^*)^t}{(1+\rho_{\text{real}})(1+I)^t} \frac{S_0 (1+I)^t}{(1+I^*)^t} \tag{8a}
\]

where \( \overline{CF}_t \) is the expected operating cash flow stated in constant foreign currency terms and \( \rho_{\text{real}} \) is the appropriate discount rate in real terms—the real interest rate plus a risk premium, or

\[
V = S_0 \sum_{t=1}^{T} \frac{\overline{CF}_t}{(1+\rho_{\text{real}})} \tag{8b}
\]
The real version, (8b), reduces the problem of estimating and valuing foreign cash flows to a simple multiplication by the current spot rate. It also highlights the fact that exchange rates and inflation have no effect on real cash flows when equilibrium tendencies hold.

Of course, PPP does not hold exactly, and interest rates do not provide precise guides to exchange rate changes. However, there is little evidence for major currencies subject to market forces that deviations from these key relationships are persistent or that they can be forecast. As a result, the simplified approach to cash flow estimation and valuation based on these equilibrium tendencies is quite robust.

It is much more likely that firms can forecast trends in relative prices of certain inputs and outputs since these hinge on micro-level changes in productivity, scarcity, or substitutability of the good or factor in question. Furthermore, given the evidence that PPP holds quite well over the long run, these relative price shifts are likely to result in larger impacts on project values than divergences from PPP. These relative price shifts can be incorporated readily by changing project cash flows in either (8a) or (8b), but (8b) has the advantage that it is less complex since it abstracts from offsetting inflation and exchange rate changes. Even for managed currencies where divergences between inflation differentials and exchange rate changes can be forecast, the equilibrium base case provides a useful point of departure. Divergences can be modeled explicitly by incorporating "non-parity" assumptions in (8a) or explicitly altering real foreign cash flows in (8b). In either case, it must be recognized that divergences from PPP will affect cash flows for most projects as well, since they will change the relative prices of goods and factors sold or purchased in different countries.
Nominal Flows: Contractual nominal cash flows including interest on debt and tax rebates based on historical cost depreciation can be discounted at a nominal rate appropriate to the currency in question and multiplied by the current spot rate. For major currencies, where interest rate parity and the Fisher effect tend to hold, market interest rates are appropriate. Where market interest rates do not reflect generally held inflation and exchange rate expectations as a result of credit controls or exchange restrictions, an offshore rate [if available] or an estimated rate must be used. If access to a particular financial market with repressed interest rates is contingent on investing in a particular project, this should be reflected in the APV equation by a financial subsidy term, (6e).

Although exchange rate changes reflected in market interest rates will have no impact on the present value of interest bearing monetary items, they will affect the value of interest tax shields that depend on the nominal interest rate. Furthermore, the value of depreciation tax shields and other historical cost allocations will depend on anticipated exchange rate changes. This is in contrast to operating cash flows, where exchange rates matter only to the extent that they diverge from PPP.
Risk Premia for Foreign Projects

Although the APV approach does not incorporate the effects of financial structure in the discount rate, the discount rate for each term must reflect both the rate of interest (real in the case of operating flows, nominal in the case of nominal flows) and a risk premium. According to current capital market theory, this risk premium should reflect only the systematic risk of the project. An interesting question, which is beyond the scope of this paper, is whether this systematic risk should be measured relative to the firm's home country market portfolio or relative to the world market portfolio. As shown by Lessard [1976], the systematic risk of foreign projects will differ somewhat from U.S. and world perspectives, but much more substantially for other single-country versus world perspectives.\(^13\)

In either case, for a U.S. firm, foreign projects will tend to have less systematic risk than domestic projects. In small, relatively isolated countries where prospects are not dependent on the world economy, projects will have relatively little systematic risk, even if their total risk is very large, and the appropriate discount rate will be (close to) the risk free rate.

The suggestion that cash flows from projects in politically unstable countries should be evaluated at a riskless rate will undoubtedly be met with derision by many practitioners. Many firms attach large risk premiums to such projects. However, the difference is often more semantic than real. A common approach to evaluating foreign projects is to discount most likely (modal) rather than expected (mean) cash flows at a risk-adjusted rate. For projects with a significant risk of expropriation or large losses due to changes in the economic structure of a country, the mean will be substantially lower than the mode. Thus the discount rate is being used to adjust cash flows as well as to discount them by a risk premium.

The more explicit approach that captures the effect of risks on expected cash flows as well as on their valuation is superior.\(^14\)

Appropriate discount rates for each category of the APV terms are discussed below.
Operating Cash Flows ($p_1$): Since these flows are not contractually fixed in any currency, but vary depending on the interactions of inflation and exchange rates as well as a host of other factors, I have argued that they should be stated in terms of units of constant purchasing power and discounted at the real rate of interest plus a risk premium reflecting their systematic risk. However, determining this systematic risk represents a major challenge. In many cases there will be no foreign uni-national firms in the same industry with sufficiently active shares to provide $\beta$ estimates. Furthermore, formal or informal approaches for estimating fundamental $\beta$'s are likely to be hampered by a lack of experience with similar projects and by U.S. firms' typically less complete understanding of foreign economies compared to their knowledge of the domestic setting.

An exception is the foreign project that serves world markets and has relatively small local operating costs, such as a capital intensive mining venture. Its systematic risk will be very similar to a project located in the United States producing similar products. The primary differences will be the tax treatment and the political risks it is subject to. The tax treatment is readily captured in the APV formula and, as noted above, the effect of political risks should be reflected in the expected cash flows but, on the assumption that these risks are largely unsystematic, should not add to the risk premium.15/
For projects producing for local markets, a complete approach would require modeling the sensitivity of project cash flows to the local economy and then tracing the linkages of the local economy with the world economy. A "quick and dirty" indication of the likely result can be obtained by computing the U.S. $s of the stock market indexes for various countries. These are reported in Table 1 for purposes of illustration. They suggest that the systematic risk from a U.S. perspective of projects of "normal" risk (as measured by the aggregate risk of all firms) in various foreign countries is less than that of the "normal" domestic project.

**Depreciation Tax Shields ($2$):** This is a nominal cash flow in either the parent currency (US$) or the foreign currency, depending on which country's tax rate results in the higher tax bill and hence is binding. If the foreign tax rate is lower than the U.S. tax rate, term (6a) will include the additional taxes levied by the United States and (6b), the incremental tax rebate, will be that provided by U.S. tax law. Technically, the depreciation tax shields are subject only to the risk that the firm cannot make use of them. This may be serious in certain cases, but in general if the firm cannot take the deductions directly it can carry them forward or backward in time or in the ultimate case, transfer them to another firm through mergers. Roughly speaking, then, $\rho_2$ will involve only a small risk premium and can be approximated by the interest rate on the firm's debt in the currency in question.

**Interest Tax Shields ($3$):** The risk associated with the interest tax shields is the risk that the firm will not be able to obtain them either because (1) it defaults on its debt, (2) it fails, or (3) it has no profits against which it can offset the deductions. (1) and (2) will be reflected in the firm's borrowing rate. Therefore, it should be a reasonable approximation.
### TABLE 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Annualized Standard Deviation of Returns#</th>
<th>Correlation with U.S. Market</th>
<th>Market Risk (beta) from U.S. Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>26.4%</td>
<td>.50</td>
<td>.71</td>
</tr>
<tr>
<td>Germany</td>
<td>20.4</td>
<td>.43</td>
<td>.47</td>
</tr>
<tr>
<td>Japan</td>
<td>20.1</td>
<td>.40</td>
<td>.43</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>21.9</td>
<td>.61</td>
<td>.72</td>
</tr>
<tr>
<td>Switzerland</td>
<td>22.7</td>
<td>.63</td>
<td>.77</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>41.0</td>
<td>.51</td>
<td>1.13</td>
</tr>
<tr>
<td>United States</td>
<td>18.5</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* All figures estimated from data for 1973-1977 period

# Measured in U.S. dollars

† The S&P 500 Stock Index is used to represent the U.S. market

Financial Subsidies or Premiums (p₄): Again, these are nominal flows which should be discounted at the nominal interest rate on the firm's debt in the currency in question.

Tax Reductions or Deferrals (p₅): These are nominal flows in U.S. dollars. They should be discounted at the firm's nominal interest rate.

Additional Remittances (p₆): The appropriate rate for these flows is hard to define. They are real flows, but the risks of being able to remit the funds are unlikely to be highly systematic. However, the amount available for remittance through these channels will depend directly on project operating cash flows. Therefore, the discount rate applied to operating flows, p₁, appears to be a reasonable choice.

V. SUMMARY AND CONCLUSIONS

The APV approach provides a generalized framework capable of incorporating most of the special financial considerations that arise in evaluating foreign projects. Its attractiveness vis-à-vis traditional approaches, which attempt to force all of these factors into a single term, rests only in part on its conceptual superiority. Much of its attraction lies in its transparency and simplicity of use in certain situations.

In practice, capital budgeting involves a great deal of trial and error with various "what if" questions. Furthermore, many uncertain outcomes are never reduced to specific cash flows but instead are dealt with by testing the sensitivity of cash flows to changes in a particular assumption and by
judging whether a particular variable is likely to exceed a "breakeven" value. The ability to separate the various terms greatly facilitates such analyses. In most cases, only the operating cash flow streams will need to be run under a variety of scenarios. Similarly, if there is uncertainty with respect to the appropriate discount rates, most of it will center on the risk premium for the operating cash flows, and thus sensitivity analysis can concentrate on these flows. The distinction between real and nominal flows allows a substantially simplified treatment of inflation and exchange rates, but it also serves to highlight the differential impact of these factors on the two types of flows.

While these considerations clearly favor the APV approach, they do not call for its use in all situations. Little will be lost in using a single discount rate that is roughly consistent with APV solutions for small, recurring projects with few or no financing interactions. However, even in this case the APV framework provides the ideal basis for computing these hurdle rates for decentralized use. Any strategic decision that involves financial complexities, though, should be evaluated in the more complete fashion outlined.
FOOTNOTES

*An earlier version of this paper was presented at the Spring 1978 meetings of the Eastern Finance Association. I am grateful to Gene Carter, Rich Cohn, Christine Hekman, Stewart Myers, Joel Ornstein, Jim Paddock, Kirit Vora, and Hadi Alwani, who discussed the paper at the EFA meetings, for their comments. All remaining errors and arbitrary choices, of course, are my responsibility.

1/ Eiteman and Stonehill [1979], Rodriguez and Carter [1979], and Shapiro [1978a] provide summaries of the factors distinguishing domestic and foreign projects. An early paper that raised most of these questions was Stonehill and Nathanson [1968].

2/ The APV approach is presented in Myers [1974]. Taggart [1977] provides an excellent comparison of APV with the traditional approach.

3/ See, for example, Shapiro [1978b].

4/ This is not necessarily the tax system with the highest tax rate, since rules regarding depreciation and deduction of expenses vary widely and the present value of tax shields denominated in a particular currency are affected by the rate of inflation and nominal interest rate for that currency.

5/ Vernon and Wells [1976] and Robbins and Stobaugh [1973] provide further illustration of the difficulty of measuring incremental cash flows at a system level.

6/ Pre-tax cash flows are used since it is assumed that the use of concessionary debt will require a matching reduction in other corporate borrowings. Thus the additional interest tax shields of the concessionary debt will be offset by reduced interest tax shields on corporate borrowings at market rates. The tax shields gained and lost will not match exactly if debt capacity is defined in terms of book values. Even if defined in terms of (net present value of) cash flows, the offset will be inexact since the proportion of the debt service flows that is interest will differ for the concessionary debt and borrowings at the market rate with the same present value. In most cases, however, the error is small. Myers, Dill and Bautista [1976] discuss exact measures of offsetting "equivalent loans."

7/ For a succinct definition of these relationships, see Giddy [1977] or Dornbusch [1979] and Frenkel [1976] for a more complete discussion of the underlying economic theory.

8/ For an excellent review of the theory and evidence regarding purchasing power parity, see Officer [1976].

9/ This formula can be altered readily to accommodate varying rates of inflation over time.
Footnotes (continued)

10/ It is common to generate project cash flow estimates by multiplying unit input and output figures by current prices and then "inflating" these cash flows by the anticipated general rate of inflation, essentially working from constant to current terms.

11/ (8b) is derived from (8a) by canceling the various inflation terms.

12/ Roll [1977] finds no evidence that deviations from purchasing power parity are persistent or can be forecast.

13/ The reason for this is that the U.S. market portfolio is an extremely large proportion of the world market portfolio and, as a result, highly correlated with it.

14/ Eiteman and Stonehill [1979] follow a third approach, "adjusting" cash flows until they are of equivalent risk to those of domestic projects and then discounting them by the domestic "cost of capital." This is similar to taking certainty equivalents of cash flows and discounting them by the riskless rate. While in many ways it is theoretically more appealing than to discount expected cash flows by a risk-adjusted rate, there are no operational yet reasonably precise ways to do this.

15/ If risks of nationalization, etc. are a function of the project's profitability, they should be treated as a call option held by the government on the project. This point is developed by Daenick [1977]. Lessard and Graham [1976] discuss the valuation of mining ventures in some detail.
REFERENCES


References (continued)

