

The International Control Conundrum with Exchange Risk: An EVA Framework

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Principal-agent problems between corporate parent and subsidiary operations are frequently exacerbated in international settings by exchange rate fluctuations between the foreign subsidiary's local currency and the parent multinational corporation's reference currency. We develop a conceptual solution

to this international control conundrum using Economic Value Added as the sole performance numéraire. Our framework facilitates assessment of foreign subsidiary performance in emerging-market countries in the presence of unexpected, exchange-related shocks.

INTRODUCTION

This paper develops a framework for planning and assessing the shareholder value-creating strategies of multinational corporation ("MNC") subsidiary units operating under fluctuating exchange rates. Designing effective management control systems for domestic firms is fraught with problems of information asymmetry and goal incongruence between corporate parent and subsidiary units. In an international setting

the problems are further complicated by exchange rate fluctuations between the foreign subsidiary's local currency and the parent firm's reference currency. To be reliable, management control systems for MNCs must somehow incorporate a multiplicity of complicating factors tied to the local environments in which they operate such as exchange rate fluctuations, differential rates of inflation, segmented capital markets and foreign exchange controls.

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The importance of MNC budgetary and control systems contrasts with an absence of recent research on this subject in the international management literature. As Miller (1998) notes, early scholarly work focused on development of accounting control mechanisms to deal with smoothing the impacts of foreign exchange movements on accounting profits, and facilitating the consolidation of financial statements (Lessard and Lorange, 1977). More recent research has seen a shift in emphasis from narrow focus on accounting and control issues to more eclectic interest in the role of supporting MNC executive compensation schemes (O'Donnell, 1999), administrative structures (Hedlund, 1986), behavioral orientations (Kobrin, 1994) and cognitive mindsets (Murtha et al., 1998) on MNC control and performance assessment guidelines.

While important, this research shift led to less emphasis on budgetary processes and practices necessary to operationalize MNC control over subsidiaries in volatile environments. Yet, recent research in international economics (Knetter, 1994) and international business (Clark et al., 1999) suggests a renewed interest in the impact of substantial inflation and exchange rate fluctuation on subsidiary performance when competing firms have discretion to pass through in product pricing some but not all of the fluctuation's impact. Both scholars (e.g., Oxelheim and Wihlborg, 1997) and practitioners (e.g., Ehrbar, 1999) are also seeking appropriate budgetary and control modes to align subsidiary manager actions to shareholder value creation. Re-emerging interests in foreign subsidiary strategy and performance in volatile local markets challenge international business scholars to revisit budgetary and control processes that might other-

wise skew MNC performance assessment.

We respond to this challenge first by reviewing the literature on MNC budgeting and control and EVA-based performance assessment. Second, we sketch out the basic tenets of a currency space mapping paradigm building on the key concepts of exchange rate and inflation pass-through as a basis for environmentalizing MNC budgeting and control systems. Third, we develop a contingent budgeting and control model based on EVA as the sole performance numéraire. The resulting model filters out key skewing factors in the foreign subsidiary's local market and suggests optimal subsidiary management responses to unforeseen exchange-related shocks. We then discuss the resulting model's implications, limitations and possible future refinements.

THE INTERNATIONAL CONTROL CONUNDRUM

A fundamental question in international business is how managers effectively control and coordinate MNC operations. Both domestic corporations and MNCs face problems of goal incongruence and information asymmetry among their individual business units, which may be characterized as the agents of their corporate parent, the principal. As Roth and O'Donnell (1996) and others (e.g., Nohria and Ghoshal, 1994) have noted previously, the problem of goal incongruence assumes that the corporate principal and its individual business-unit agents are self-interested, utility maximizers, but with different risk preferences and, therefore, different organizational strategies and performance goals. For example, corporate-wide goals emphasizing high returns on sales or investment may be inconsistent with the

goals of individual business units operating in new product markets which may seek to maximize sales revenue. If substantial, such differences may induce inconsistent product pricing, capital investment and personnel compensation schemes, to the detriment of corporate-wide performance. Reduction of the agency problem typically comes from the corporate parent, either by incurring monitoring costs to see that business units follow less preferable corporate policies, or by incurring design costs to set up incentives making it more preferable for business units to follow corporate policies (Jensen and Meckling, 1976).

In this context, previous research on MNC financial control systems indicates that surprisingly simplistic approaches are still in use. Oxelheim and Wihlborg (1997), for example, deplore the application of performance and control measures in many MNCs that assume they operate in a "closed" market setting more appropriate to a firm with only domestically-located subsidiaries. In this setting, performance relative to operating budget provides an easy-to-understand measure for controlling and evaluating subsidiaries. Simply put, budgetary variance analysis is based on the comparison between actual performance, whether it be sales, operating expenses or accounting income recorded *ex post*, with a corresponding budgeted amount forecast *ex ante* at the outset of the MNC's budgetary cycle. In an international setting, differences between actual and budgeted amounts tend to be explained in terms of price and or volume variance. The variance is then traced to changes in factors deemed either exogenous or endogenous to foreign subsidiary management, which is held respon-

sible for budgetary variance resulting from endogenous factors.

The International Control Conundrum with Foreign Exchange Risk

Unique to international control systems is the exchange rate variable used for translating local currency budgets into reference currency terms. In a seminal paper, Lessard and Lorange (1977) addressed the problem of which exchange rate to use in drafting *ex ante* budgets and in measuring *ex post* performance; they recommended that projected exchange rates be incorporated in both the budgeting and the performance tracking processes. Their approach allowed the foreign subsidiary to negotiate with its MNC parent an "internal forward rate" which best reflected its anticipation of exchange rate changes. Such exchange rates would foster goal congruence between MNC parent and foreign subsidiary as well as fairness for operating managers since they would receive neither blame nor credit for variance in performance attributed to unexpected fluctuations. Foreign subsidiary management was *de facto* shielded from unforeseen exchange rate changes while the MNC parent acted as a banker literally buying its foreign subsidiary's foreign-currency denominated budget at a pre-specified forward rate. Implicit in their model was a neutrality assumption about the subsidiary's own economic exposure to the inflation/devaluation cycle. Jacque and Lorange (1984) deal with such distortions in the case of hyperinflation: they develop a "variance smoothing model" which adjust the price variable exclusively in the operating budget with "shadow" sectorial prices and real exchange rates.

Under both approaches foreign subsidiary management was still held responsible for forecasting errors and was thus motivated to adjust managerial decisions to contingencies as they arose during the budget year. Lessard and Sharp (1984) develop a contingent budgeting method for the MNC, which featured multiple scenario development, review for possible surprise deviations in existing exchange rates, and implied adjustments to costs and operating cash flows related to such surprises. Multiple scenarios, however, may still miss the mark if actual operating conditions differ from discrete scenarios formulated *ex ante*; budgetary variance analysis founders when actual conditions “fall between the cracks” of these discrete scenarios. An improvement to this approach would be to establish an objective, continuous link between any surprises that may arise in actual operations and managerial response that optimizes the EVA-based performance.

EVA-Based Performance Numéraire

EVA measures the net operating results after taxes less a charge for the capital employed to generate these profits. Positive EVA indicates that value has

been created for the firm’s shareholders; negative EVA signifies value destruction (Stern, 1990). It is consistent with free cash flow measures commonly used in capital budgeting and performance measurement. Unlike similar conventional accounting measures of profit derived from an individual firm’s income statement EVA first takes into account the cost of *all* capital, that is not only the cost of debt capital (readily visible as interest expense in the income statement) but also the cost of equity capital. Second, EVA is not constrained by generally accepted accounting principles (“GAAP”) thereby allowing managers to capitalize R&D, marketing, training and related costs into the asset base committed to the profit-generating project.

In its most elementary formulation, EVA is calculated as in Figure 1. Capital charges equal the firm’s capital employed, multiplied by the weighted average cost of capital (“WACC”). The WACC equals the sum of the cost of each of the components of capital—both short- and long-term debt, and shareholders’ equity—weighted for their relative proportions in the firm’s target capital structure. Thus, in its unadjusted form, EVA is equivalent to net income minus the cost of debt and equity capital

**FIGURE 1
CALCULATING EVA**

Economic Value Added	=	Net Sales
	-	Operating Expenses Including Depreciation (Including Taxes But Excluding Interest Expense)
	=	Net Operating Profit After Depreciation
	-	Capital Charges For Both Debt and Equity Employed
	=	Economic Value Added

TABLE 1
EXAMPLES OF TYPICAL EVA ACCOUNTING ADJUSTMENTS

Common Areas Where GAAP-Based Accounting Is Adjusted	GAAP Treatment	Nature of Adjustment
Marketing and R&D Costs	Expense	Record As Asset And Amortize
Deferred Taxes	Record As Asset And/Or Liability	Reverse Recording of Asset And/Or Liability To Reflect Cash Basis Reporting
Purchased Goodwill	Record as Asset: Amortize Over Up To 40 Years	Reverse Amortization To Reflect Original Asset Amount
Operating Leases	Expense	Record Asset And Amortize; Record Liability And Related Interest
Bad Debts And Warranty Costs	Estimate Accrual	Reverse Accruals To Reflect Cash Basis Reporting
LIFO Inventory Costing	LIFO Permitted	Convert to FIFO
Construction In Progress	Record As Asset	Remove From Assets
Discontinued Operations	Include In Assets And Earnings	Remove From Assets And Earnings

(Biddle et al., 1998)

used to generate that income. The income (or loss) left represents the absolute value created (destroyed) for shareholders of the firm.

Some clarification of EVA accounting methodology provides additional insight on how this performance measure compares with others commonly used. First, EVA accounting capital is the sum of all of the firm's financing, apart from non-interest-bearing operating liabilities, such as accounts payable, accrued wages and accrued taxes. That is, invested capital equals the sum of shareholders' equity and all interest-bearing debt, both short-term and long-term maturities.

Second, EVA accounting commonly leads to certain adjustments to net operating profit after-tax ("NOPAT") and capital-cost components. EVA proponents have identified over 160 possible adjustments for managers to consider implementing. From a practical standpoint, however, only eight adjustments are commonly implemented when shifting from GAAP to EVA accounting approaches. Table 1 lists these adjustments. EVA proponents argue that these accounting adjustments reduce most of the distortions in managerial incentives introduced by GAAP accounting and align more closely performance mea-

surement with value creation. For example, the treatment of bad debts under EVA accounting reduces managerial incentives to distort operating performance through opportunistic accrual estimation. Other mechanisms such as EVA-based stock option plans, used in conjunction with EVA accounting also act to curb managerial gaming with performance measures. Together, these EVA accounting standards and supplementary incentives schemes play a part both in *ex ante* budgetary negotiations between senior and mid-level managers, and in the *ex post* review of their performance (O'Byrne, 1997).

CURRENCY SPACE MAPPING

Contingent budgeting based on an EVA-framework rests largely on management's ability to chart alternative scenarios, which adequately schematize future market conditions for the MNC's foreign subsidiaries. While alternative scenario methodologies are not new to strategic management (e.g., Wack, 1985), they do not take into account exchange-related factors. Filtering out such factors is central to accurate performance assessment by the MNC parent of the foreign subsidiary experiencing substantial economic turbulence, imports-competition and constraints on the full pass-through of exchange rate changes into subsidiary product pricing (Knetter, 1994). In order to reduce the information asymmetry between parent and its subsidiary, we introduce a three-dimensional mapping paradigm, which facilitates multiple scenario design by anchoring the exchange rate-inflation relationship directly to the firm's product market micro-operating environment.

The foreign subsidiary's currency space map builds on Purchasing Power Parity ("PPP") theory which holds that

changes in the exchange rate linking two countries' currencies may be explained by their underlying differences in inflation rate. If, for example, in 1991, Mexico were to experience inflation at the annual rate of 45% whereas the US inflation rate were limited to 5%, according to PPP theory, the Mexican peso should depreciate against the US dollar by $(.45 - .05)/(1 + .05) = .38$ or 38%. In practice, PPP theory provides a useful gauge of real currency values but seldom predicts nominal exchange rates in emerging economies reliably. There, nominal exchange rates are often overvalued in PPP terms, particularly before traumatic fluctuations such as with the Mexican peso devaluation of 1994, the Thai baht devaluation of 1997, the Brazilian real in 1999, and the Turkish lira in 2001.

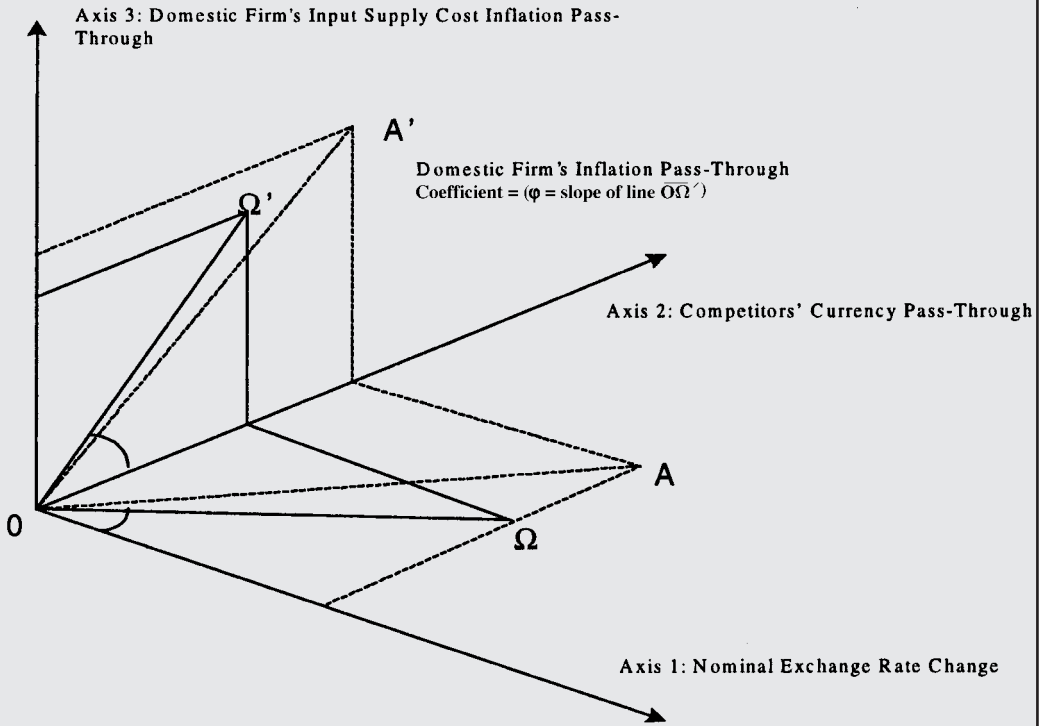
This PPP-based perspective on exchange-rate change is formalized in the currency space map depicted in Figure 2. Axis 1 scales the percentage of nominal exchange rate appreciation or depreciation experienced over time. If $S(0)$ and $S(t)$ denote the local currency price of one unit of reference currency at time 0 and t , respectively, then the index Δ of exchange appreciation ($\Delta < 0$) or depreciation ($\Delta > 0$) is given by:

$$\Delta = \frac{S(t) - S(0)}{S(0)} \quad (1)$$

Axis 2 measures the effective nominal exchange rate appreciation or depreciation experienced by MNC's foreign subsidiary over this same time period. This foreign subsidiary may face rival importers which pass-through on average $\Theta\%$ of any nominal exchange rate change, Δ . The actual pass-through is defined as:

$$\bar{\Theta} = (\Delta \cdot \text{slope} \bar{\Omega}) \quad (2)$$

FIGURE 2
MAPPING THE CURRENCY SPACE IN PRODUCT MARKETS



Note:

If $\Theta = 1$, the domestic firm's importing competitors pass through fully the exchange rate change: see parity line OA .

If $\varphi = 1$, the domestic firm is able fully to pass through input supply cost inflation into output prices: see parity line OA'

An exchange rate pass-through coefficient is measured by the slope of line $\overline{O\Omega}$ relative to Axis 1 in the two-dimensional space formed by Axes 1 and 2. Line \overline{OA} depicts a full pass-through of the nominal exchange rate change where it lies at a 45° angle relative to Axis 1.

If the firm operates in an autarkic economy, its inflation pass-through would be directly constrained by either governmental policies or specific sector-

rial price rigidities. In most countries, however, international trade looms large on the national scene. Thus foreign-based competition, depending on how well established it is, will generally play a critical role in constricting sectorial domestic inflation. Specifically, for the MNC's subsidiary whose output price increases are constrained by an import-competitor's exchange rate pass-through policy Θ and whose inputs from sector i

experience price inflation at the rate of Π_i , the inflation pass-through coefficient would be defined as:

$$\varphi = \frac{\sum_{i=1}^N w_i \cdot \prod_i}{\Theta \cdot [S(t) - S(0)]/S(0)} \quad (3)$$

where w_i is the percentage of input costs sourced from sector i with $\sum w_i = 1$. In a fluid economy, where increased costs can be fully passed through into the selling price, the pass-through coefficient φ would be equal to 1. As explicit or implicit sectorial price controls constrict the foreign subsidiary's discretion to pass-through higher costs into higher prices, its overall pass-through coefficient may, at times, be considerably larger than 1.

The third axis of Figure 2 measures the percentage change in input costs, which is the numerator of (3). The foreign subsidiary pass-through coefficient is, therefore, depicted by the slope φ in the two-dimensional space formed by Axes 2 and 3. If $\varphi < 1$ then the foreign subsidiary can pass-through fully increases in input costs while generating excess returns. Conversely, if $\varphi > 1$ then the foreign subsidiary fails to pass-through input costs into adequately higher output prices. Consequently, it will suffer negative operating margins. Input costs depend chiefly on the mix of domestic-versus foreign-sourcing available to the foreign subsidiary. If currencies are properly valued and if the foreign subsidiary's competitors fully pass-through exchange rate changes, then foreign subsidiary operations will rest on the 45° parity line $\overline{OA'}$. Windfall gains will be generated when the foreign subsidiary operates below the $\overline{OA'}$ boundary parity line.

EVA-BASED CONTINGENT BUDGETING AND PERFORMANCE ASSESSMENT

Modeling Optimal Managerial Performance

Working through all three dimensions of the currency space map forces MNC parent and foreign subsidiary managers to make explicit the key variables shaping the near-term environment of the foreign subsidiary. This helps to mitigate agency problems in the MNC and enhances goal congruence. Instead of relying on *ex ante* budget forecasting and *ex post* budget variance analysis, the MNC parent should assess the subsidiary's ability to deliver optimal managerial response contingent on a particular scenario as schematized in terms of exchange rate, inflation and currency pass-through rates. Thus, parent and subsidiary will start off by charting multiple scenarios and then work out what, under each scenario, should be the foreign subsidiary's optimal managerial response. When exchange rates, inflation and all the other dimensions of the host country environment materialize, management will revisit the discrete scenarios as sketched *ex ante* and ascertain what should have been the subsidiary's optimal EVA-based performance. Variance analysis can then be carried out against a contingent EVA budget in terms of what had been initially agreed between parent and subsidiary management.

Practically, the multiple scenario analysis advocated here is often difficult to implement when the actual (*ex post*) scenario turns out to be different from the *ex ante* multiple scenarios. This points to the need to formalize the relationship between the currency space map—from which the actual scenario is drawn—and the optimal managerial response. Here, micro-economics can help by providing

an objective (profit) function tailored to the idiosyncrasies of the firm and directly linked to the concept of economic exposure to exchange risk. This approach—to the extent that it emphasizes EVA rather than mere accounting profits—is consistent with value-based strategic management. *Ex ante*, parent and subsidiary management will agree on an EVA model which spells out what should be the optimal local management response under alternative scenarios. The objective is to substitute for an elaborate forecasting exercise, which may be purely speculative in nature, an understanding of what should be the subsidiary management’s optimal response to alternative scenarios.

Consider the case of a US cash register manufacturer and its French MNC parent. We develop for illustrative purposes an optimal managerial response model for this firm using EVA-based performance measures. Assume that the subsidiary is facing strong Japan-based imports competition in its US market. Assume further that its production function is characterized by increasing returns to scale captured through the percentage reduction in average cost for each additional unit sold. Finally, assume that it sources all of its inputs domestically with the option of switching to foreign-sourced inputs.

The cash-flow operating revenue generated over the period (0, t) by the foreign subsidiary is influenced by the pricing policy implemented by Japanese import competitors. A pass-through rate $\Theta(t)$ for an exchange rate change $\Delta S(t)$ along with a local price elasticity of demand of ϵ and local income elasticity of demand of η are assumed. Therefore, the quantity produced by the foreign subsidiary is given by:

$$q(t) = q(0)[1 + \epsilon \cdot \Theta(t) \cdot \Delta S(t)][1 + \eta \cdot \Delta Y] \tag{4}$$

where $q(0)$ is the amount produced in the base period while discretionary pricing will reflect a change from $p(0)$ to $p(t)$ defined as:

$$p(t) = p(0)[1 + \tilde{\Theta}(t) \cdot \Delta S(t)] \tag{5}$$

where the discretionary pass-through policy $\tilde{\Theta}(t)$ may differ from import-competitors’ pass-through policy Θ .

The total percentage decrease/increase in average operating cost is simply the per unit percentage decrease/increase in average cost multiplied by the number of additional units sold. Thus, average operating cost over the period (0, t) is given as:

$$c(t) = \sum_{i=1}^N c_i(0) \cdot [1 - \delta \cdot \Delta q(t)] \times [1 + \lambda \cdot w_i \cdot \Delta]_i + (1 - \lambda) \cdot \Theta_i \Delta S(t) \tag{6}$$

where δ is the scale elasticity coefficient and $\Delta q(t)$ the change in quantity produced. Furthermore, the base operating cost $c_i(0)$ for each input i should be adjusted by the inflation pass-through coefficient of λ percent locally-sourced inputs, whereas the pass-through policy Θ_i of foreign suppliers should result in a changing mix between locally-sourced and foreign-sourced inputs.

In addition to operating costs, we need to take into account a charge for capital employed at a rate that compensates relevant debt and equity investors. An additional WACC charge captures the EVA concept as applied to the MNC subsidiary operation. The WACC charge re-

quires adjustment to reflect two factors: 1) the mix of domestic debt and foreign-denominated debt at the respective rates of k_D^d and k_D^f ; and 2) the degree of capital market segmentation between the parent's home capital market and its foreign subsidiary's host capital market.

Assuming that α percent of debt is sourced domestically, then the blended cost of debt, k_D , is defined as:

$$k_D = \alpha \cdot k_D^d + (1 - \alpha) \cdot k_D^f \quad (7)$$

Caution should be exercised, however, in computing the cost of foreign-sourced debt, k_D^f , since the nominal cost of foreign debt, k_D^{f*} , seldom approximates the effective cost of financing when exchange gains or losses are recognized. Accordingly, we formulate the cost of foreign-sourced debt as:

$$k_D^f = k_D^{f*} + (1 + k_D^{f*}) \cdot \frac{F(t)^* - S(0)}{S(0)} \quad (8)$$

where the effective cost of debt is decomposed into the sum of the nominal cost of debt adjusted by the percentage exchange gains or losses approximated by the forward (no-profit)¹ exchange rate $F(t)^*$. This last adjustment is critical for many emerging-market capital markets that may maintain exchange rates at overvalued levels, thereby disguising the true cost of debt financing.

Several factors are considered in accounting for discrepancies in the business risk and financial risk between the foreign subsidiary and its parent. Applying the Capital Asset Pricing Model ("CAPM")² we obtain the following cost of equity, k_E , for the foreign subsidiary:

$$k_E = r_f + (r_m - r_f) \times [\beta^U + (\beta^L - \beta^U)] \cdot \beta^{Country} \quad (9)$$

where r_f estimates the long-term risk-free rate and r_m estimates the market portfolio yield in the referent capital market of the foreign subsidiary. The risk factor, β , is decomposed into three components: 1) a core business risk component represented by the unlevered asset β^U , assuming the subsidiary is all-equity financed; 2) a financial risk component represented by $\beta^L - \beta^U$, the difference between business risk, β^U , and risk related to the firm's financial leverage, β^L ; and 3) a country risk component, $\beta^{Country}$, which incorporates the risk premium resulting from operating in a foreign country.

To complicate matters further, the foreign subsidiary may or may not belong to the same business risk class as its MNC parent, and it may rely on a different level of financial leverage. The possibility of variance in business and financial risk between foreign subsidiary and the MNC parent lends itself to a taxonomic framework for assessing subsidiary equity costs summarized in Figure 3 below. Even if MNC parent and foreign subsidiary's business risk are congruent, the β for foreign operations should be estimated independently by using, for example, a pure-play³ β as a proxy or by using multiple regression-based methods. Only in the rare instance where the foreign subsidiary's capital market is fully-integrated with the MNC parent's can the same β be used to estimate an equity capital charge consistent with an EVA approach.

It is interesting to note that $\beta^{Country}$ is itself partially a function of the volatility of the host country's stock market, and its correlation with a referent, e.g., US benchmark portfolio. Thus β for the foreign subsidiary with respect to the MNC parent's benchmark portfolio is estimated by computing the β of the foreign

FIGURE 3
FRAMEWORK FOR ASSESSING FOREIGN SUBSIDIARY EQUITY COSTS UNDER
CONDITIONS OF CAPITAL MARKET SEGMENTATION

		FINANCIAL RISK ($\beta^F - \beta^U$)	
		Same as Parent	Different from Parent
BUSINESS RISK (β^U)	Same as Parent	Use Parent β or a proxy from a "pure play" depending on the degree of capital market segmentation.	Unlever Parent β and relever to the foreign subsidiary's appropriate capital structure.
	Different from Parent	Use a local "pure-play" β as proxy. Unlever and relever it to foreign Subsidiary's appropriate target financial leverage.	Use a local "pure-play" β as a proxy. Relever it to appropriate target capital structure.

subsidiary relative to a local market portfolio—Figure 3 indicates the adjustments necessary to accomplish this computation—and then multiplying the result by the foreign subsidiary's $\beta^{Country}$. This is a reasonable approach to computing the foreign subsidiary's relevant cost of equity capital if the foreign subsidiary is previously geared to its local market (Lessard, 1996).⁴ The total capital cost, $f(t)$, to be charged against free cash flows can now be formulated as:

$$f(t) = k_D \cdot \frac{D}{D + E} \cdot (1 - T) + k_E \cdot \frac{E}{D + E} \quad (10)$$

where D and E are the adjusted market value of debt and equity financing⁵ respectively, and where k_D and k_E are the effective cost of debt and equity financing adjusted for capital market segmen-

tation as given in (7) and (9) above. T is the corporate income tax rate at which interest expenses are tax-deductible.

With terms capturing cash flow revenues, operating costs and capital costs characterizing the foreign subsidiary's situation, we can now formulate the EVA-based performance as:

$$EVA(t) = \{[p(t) - c(t)] \cdot q(t) - d(t)\} \times (1 - T) + d(t) - f(t) \quad (11)$$

where $d(t)$ is tax-deductible accounting depreciation at the corporate tax rate T .⁶ If the decision variables at the discretion of the local management are limited to pricing at $\hat{\Theta}$, a sourcing mix of $\bar{\lambda}$ and a financing mix of $\bar{\alpha}$, then optimal management performance is defined by solving:

$$\frac{\partial EVA(t)}{\partial \Theta} = 0,$$

$$\frac{\partial EVA}{\partial \lambda} = 0 \quad \text{and}$$

$$\frac{\partial EVA(t)}{\partial \alpha} = 0$$

subject to:

$$\text{Prob}\{(1 - \alpha)e(t)[\tilde{S}(t) - S(0)] \leq L\} \geq P \tag{12a-d}$$

Here, the constraint placed upon the optimization exercise simply reflects the MNC parent's tolerance for translation losses resulting from holding a pro-forma translation exposure, $e(t)$.⁷ This loss should not exceed a dollar amount L with a probability of P . This stochastic constraint placed on optimizing the subsidiary's cash flow performance accounts for the fact that at the outset of the operating cycle, translation losses are not known with certainty since they are a function of the end of the period exchange rate $\tilde{S}(t)$.

By removing translation effects from the optimal performance model, we directly link operations by the foreign subsidiary to MNC shareholder value creation or destruction, and thereby enhance goal congruence between MNC parent and foreign subsidiary. Many other decisions undertaken by the foreign subsidiary, e.g., stretching the maturity structure of accounts receivable, or sourcing inputs from imports, will similarly influence the translation loss constraint and could similarly be incorporated into a more sophisticated model of foreign subsidiary value creation or destruction.

This model rests on management's ability to generate a number of informa-

tional inputs such as income and price elasticity, currency pass-through and an adequate rendering of production function attributes such as the degree of increasing returns to scale. There are well-accepted methodologies for deriving estimates for these informational inputs, including currency pass-through estimates (Knetter, 1994; Jacque, 1996). Once informational inputs have been generated, management may estimate the foreign subsidiary's cash flows as a prelude to developing a quantitative model as illustrated here.

Equipped with such an EVA model of its US operations the French MNC is no longer dependent on exhaustive but discrete multiple scenario analysis; it can utilize instead a continuous model for contingent budgetary variance analysis. Sales and production budget proposals will be based on varying estimates of the US subsidiary's cost of capital $f(t)$, exchange rate changes $\Delta S(t)$, and corresponding pass-through policy $\Theta(t)$ implemented by its Japan-based competitors over the operating cycle $[0, t]$. *Ex post*, it should be relatively easy to compute what should have been the US operation's EVA given the actual exchange rate changes $\Delta S(t)$, a reliable estimate of capital costs $f(t)$ and imports competition pass-through policy $\Theta(t)$, both of which may be derived from examination of sectorial time series using multiple regression techniques. Following equation 11 above, we estimate optimal unit price ($p(t)$), unit cost ($c(t)$), quantity sold ($q(t)$), depreciation ($d(t)$), and cost of capital ($f(t)$) to derive the economic value added or destroyed over the relevant time period ($EVA(t)$). We provide a summary numerical illustration of such computation and their interpretation in an appendix.

Model Implications

Once such a model has been set up, the focus of the control process can shift to management's ability to respond optimally to various contingencies. For example, US subsidiary managers may examine the EVA implications of sourcing more of its cash register inputs from abroad—France or Japan instead of the US—in light of a Japan-based competitor's expected pass-through of forecasted depreciation in the yen against the US dollar. Proposed changes in subsidiary capital structure or capital sourcing may compel review of appropriate capital charges to assess against the expected operating profits from sale of cash registers. In such situations, subsidiary management will have incentives to formalize relationships between the subsidiary's currency space and capital market conditions.

This reduces many control problems in the budgeting process. It nurtures a fruitful dialogue between the MNC parent and its foreign subsidiary by forcing onto paper the architecture of the foreign subsidiary operations and how it relates to the competitive environment the foreign subsidiary faces. By freeing the control process from its usual arbitrariness, it should foster a more congruent system. Furthermore, by routinizing the control process, the MNC may be able to decentralize control without losing coordination among MNC units. The challenge then becomes one of opening up and working inside the "black box," that is, designing an EVA performance model under assumptions that best characterize the nature of the competitive environment and the strategic focus of a given foreign subsidiary. This can be done objectively, especially if the MNC's foreign subsidiary has been doing business for

some time in a particular locale. A track record of performance is readily available. Important informational inputs such as pricing measures, income and price elasticities, and input cost responses to various levels of sales may again be estimated through regression analyses.

A similar philosophy may be applied to resolving the thorny issue of allocating unwanted translation gains or losses between MNC parent and foreign subsidiary. A contingent translation budget may be associated with the EVA model we sketched out above although some of the linkages between these two models still require further work. For the moment, however, we might briefly explore how the contingent translation budget might work with the EVA model. Assume that the MNC parent will tolerate some maximum amount of translation losses above which it will then constrain the foreign subsidiary's operating decisions. To operationalize the concept of a contingent translation budget, the foreign subsidiary's *pro-forma* balance sheet would be modeled with each accounting entry formulated as a function of where the firm is positioned in the currency space. The equation is:

$$\text{Translation Budget} = e(t) \cdot [S(t) - S(0)] \quad (13)$$

where $e(t)$ is the *pro-forma* translation exposure defined as:

$$e(t) = a(t, \Theta, \lambda, \alpha) - l(t, \Theta, \lambda, \alpha) \quad (14)$$

and $a(t, \Theta, \lambda, \alpha)$ and $l(t, \Theta, \lambda, \alpha)$ are *pro-forma* exposed balance sheet items.⁸ Clearly, operating decisions as embodied in Θ , λ and α will influence the amount of exposed assets and liabilities. It may

affect translation gains or losses so substantially as to violate the stochastic constraints in (12) above, and thereby bound operating decisions Θ , λ and α . Translation effects, which are often a source of conflict and result in myopic decision-making, are removed from the cash-flow model and relegated to simply imposing boundary conditions on the foreign subsidiary's discretionary policies.

CONCLUSION

In an international setting, problems of goal incongruence and information asymmetry are exacerbated by exchange rate fluctuations between the reporting foreign subsidiary's local currency and the MNC parent's reference currency. We developed a currency-space map designed to nurture a dialogue between MNC parent and subsidiary, thereby mitigating the information asymmetry problem. This set the stage for operationalizing an EVA-based contingent budgeting framework. In the context of an MNC parent-foreign subsidiary reporting relationship, it directly aligns operating decisions with shareholder value creation. In the process, it enhances goal congruence not just between a single foreign subsidiary and MNC parent, but throughout the MNC's network of foreign operations. It also promotes the development of common criteria for evaluation of all foreign and domestic operations by controlling for local exchange, inflation and competitor pass-through policies, and by measuring performance with a single EVA-based measure. It challenges previous research suggesting that MNCs use different performance criteria for foreign operations (e.g., Abdallah, 1984; Bushman et al. 1995), and concurs with recent findings indicating that MNC managers seek to evaluate the performance of foreign subsidiaries as they do domestic operations (Borkowski, 1999).

Our framework deals with central issues in budgeting and performance assessment affected by fluctuating exchange rates; yet, it is not meant to be an exhaustive treatment of all factors affecting the international control conundrum. For example, exchange rate translation effects within the MNC may also be a source of conflict between headquarters and subsidiary units, and result in myopic decision-making. In our framework, these effects are removed from the cash-flow model and relegated to simply imposing boundary conditions on the foreign subsidiary's discretionary policies. This modeling choice implies that translation policy is *not* part of the budgeting and performance assessment process. Future research on control might reincorporate translation policy variables into the cash-flow model, reflecting the possibility that foreign subsidiary and parent managers may have latitude to tailor through negotiation certain of these variables to reflect foreseeable changes in the local environment.

The model can also be extended to incorporate the thorny problem created by the transfer-pricing practices affecting the cost of product inputs imported from sister MNC affiliates. As Brickly et al. (1995) point out, even in purely domestic settings, transfer-pricing policies may have a substantial impact on the allocation of operating profits between subsidiary and parent. In a foreign context, the interactive effect of fluctuating exchange rates and poorly conceived and executed transfer pricing policy distort the budgeting and performance assessment processes and blunt managerial motivation. Future research might incorporate variables into the cash-flow model reflecting transfer-pricing policy within the MNC. This way, performance assessment of a foreign subsidiary buying from or selling

to MNC affiliates would better reflect the adroit management of factors within rather than outside its control.

NOTES

1. The no-profit rate is, in the absence of actively-traded forward contracts, derived from the Interest Rate Parity Theorem.

2. Cochrane (1999) discusses a number of alternative approaches which may be incorporated into our analyses consistent with the reader's preference for CAPM refinement.

3. By "pure play" asset β , we are referring to the asset β appropriate to a stand-alone firm exhibiting the same business risk profile as the foreign subsidiary whose cost of capital we are trying to estimate.

4. Lessard (1996) describes the components of a country beta such as we contemplate in the paper. The country beta is the product of two underlying dimensions: 1) the volatility of the stock market of the country in question relative to that of the MNC parent; and 2) the correlation of these changes in value with benchmark portfolios in the MNC parent's home country. Using this approach, Lessard generates country betas relative to the US market portfolio for 13 emerging-market countries and Japan.

5. See definition of "managerial" balance sheet in Figure 2 above.

6. In choosing the appropriate corporate tax rate, T , we take the following approach. From the foreign subsidiary perspective, EVA-based performance is assessed using the foreign subsidiary's local corporate tax rate. From the parent MNC's perspective, EVA-based performance is assessed using the parent's corporate tax rate. Of course, national tax treatment of MNCs may differ substantially. A slightly more refined decision rule for the MNC parent, assuming that it is US based, would be to use the parent's

corporate tax rate unless it is lower than the foreign subsidiary's local corporate tax rate. In this case, foreign-sourced income pooling principles would likely apply.

7. Statement Number 52 of the US Financial Accounting Standards Board indicates that translation exposure is the foreign subsidiary's net worth exclusive of asset or liability items denominated in the MNC parent's currency, such as dollar-denominated debt.

8. So-called "exposed" balance sheet accounts are translated from the local currency into the reference currency by using the current exchange rate $S(t)$ prevailing at time of consolidation.

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APPENDIX

This appendix provides an example of how the EVA-based control framework may be implemented in the course of budgeting negotiations for the coming fiscal year between foreign subsidiary and parent management in an MNC. Consider the following stylized facts as a basis for the illustration. A Thailand-based foreign subsidiary of a US-based MNC produces automobile components for sale to Thailand-based automobile assemblers. The MNC has subsidiary operations in several countries. It is May 1997 and the fiscal year for the MNC begins on July 1, 1997 and ends on June 30, 1998.

During negotiations over the budget for the upcoming fiscal year, the foreign subsidiary management team proposes a temporary expansion of its Thailand-based production facilities to accommodate an anticipated short-term increase in demand for automobile components in the coming fiscal year. Given increasing returns to scale in production, the proposal for temporarily increasing production will also drive down unit costs in the face of stiff competition from rivals in Thailand linked to Japan-based MNCs importing similar components. The foreign subsidiary holds a substantial percentage share of the overall market and is interested in retaining its percentage share over the coming fiscal year. Its components are produced from two inputs both sourced from the US MNC parent. The proposed plant expansion will be completed over one month (June 1997) and expanded production will commence at constant monthly production levels on July 1, 1997, ending on June 30, 1998. Starting July 1, 1998, pro-

duction will resume at the previous fiscal year's (1996-1997) levels.

Both foreign subsidiary and parent managers will evaluate this project in EVA terms *ex ante* for budgeting purposes in May 1997, and *ex post* for performance evaluation purposes in July 1998. As we summarize these processes, recall the equation (Equation 11) used to compute the EVA produced by a given project:

$$EVA(t) = \{[p(t) - c(t)] \cdot q(t) - d(t)\}(1 - T) + d(t) - f(t) \quad (11)$$

Here the time index t spans the 1997-1998 fiscal year. To obtain this EVA estimate, we first make estimates of quantity $q(t)$, average unit pricing $p(t)$, average unit cost $c(t)$, capital costs $f(t)$, tax (T) and depreciation expenses $d(t)$ terms. These *pro-forma* inputs for budget negotiation prior to the commencement of the fiscal year are provided in Table A1 directly below. Changes in key model variables and optimal EVA results used in *ex post* performance assessment are provided in Table A2 further below. We conclude the appendix with a discussion of how our variance analysis would be applied to evaluate the subsidiary manager's performance.

The onset of the Asian financial crisis in Thailand in mid-1997 and the substantial devaluation of the baht from approximately 25 baht/dollar to approximately 50 baht/dollar undermine many of the budgetary assumptions and estimates agreed to earlier by subsidiary and MNC parent management teams. A review of key changes and their impact on the original EVA estimate are provided in Table A2.

TABLE A1
EVA EVALUATION OF PROJECT: *EX ANTE* MAY 1997 BUDGETING MEETING

Term	Definition	Estimate	Comment
$q(0)$	1996-1997 annual production level	100,000 units	Based on historical production data furnished by subsidiary management.
$\Delta Y(t)$	Anticipated change in income in 1997-1998	.08	Anticipated 8% growth in gross domestic product in Thailand in 1997-1998.
η	Anticipated income elasticity of demand	1.25	Anticipated temporary increase in the demand in 1997-1998 for automobile components (and finished automobiles) in Thailand implies positive income elasticity term. Income elasticity term swamps any price elasticity effects (ϵ), which may be ignored in this example.
$q(t)$	Anticipated production level in 1997-1998	110,000 units	$q(t) = q(0)[1 + \eta \cdot \Delta Y]$ (Truncated Equation 4)
$p(0)$	1996-1997 average unit pricing	1,000 baht	Based on historical production data furnished by subsidiary management. Subsidiary sells single automobile component made of two inputs of equal value. Both component inputs are sourced from MNC parent (US). One component input may be, but is not currently, sourced locally (Thailand) (switching option).
$\tilde{\theta}(t)$	Anticipated discretionary exchange passthrough rate in 1997-1998	.4	Though sectorial government price controls may permit up to 50% passthrough ($\theta(t)$), subsidiary chooses to pass through only 40% in order to match rival's anticipated 1997-1998 passthrough rate (θ) of 40%. This allows subsidiary to match rival's unit pricing and retain market share.
$\Delta S(t)$	Anticipated percentage change in baht/dollar exchange rate in 1997-1998	.4	Anticipated depreciation of baht from 25 baht/US dollar to 35 baht/US dollar in 1997-1998 (40% depreciation).
$p(t)$	Anticipated average unit pricing in 1997-1998	1160 baht	$p(t) = p(0)[1 + \tilde{\theta}(t) \cdot \Delta S(t)]$ (Equation 5)
$c_i(0)$	1996-1997 average unit costs	800 baht (for final component made of inputs $i = 1$ and 2)	Based on historical production data furnished by subsidiary management. Automobile component made of two inputs, each costing 400 baht. Both component inputs currently sourced from the MNC parent (US). One component input may be, but is not currently, sourced domestically (Thailand) (switching option for 50% of component inputs).
δ	Anticipated 1997-1998 scale elasticity	.9	Anticipated average unit cost reduction of 10% from increase in 1997-1998 production level of 10%.
$\Delta q(t)$	Anticipated percentage change in annual production for 1997-1998	.1	Anticipated increase in production levels from 100,000 units in 1996-1997 to 110,000 units produced in 1997-1998 (10% increase).
$\tilde{\lambda}$	Anticipated percentage of locally-sourced inputs to produce automobile components in 1997-1998	0	Subsidiary currently sources both inputs from MNC parent (US). One of the inputs may be, but is not currently, sourced locally (switching option for 50% of inputs). Anticipated continuation of this sourcing strategy in 1997-1998.
w_i	Anticipated percentage cost contribution of locally sourced inputs to final automobile components produced in 1997-1998	0	Subsidiary currently sources both inputs from MNC parent (US), although one of the inputs may also be sourced locally (switching option for 50% of inputs). Anticipated continuation of this sourcing strategy in 1997-1998.
$\Delta \Pi_i$	Anticipated price inflation related to each locally-sourced input used in manufacture of final auto components made in 1997-1998	.1 (for input $i = 1$, which may be, but is not currently, sourced locally)	Subsidiary currently sources both inputs from MNC parent (US), although one of the inputs may also be sourced locally (switching option for 50% of inputs). Anticipated continuation of this sourcing strategy in 1997-1998. Anticipated "shadow" price inflation rate of 10%.
$c(t)$	Anticipated average unit cost in 1997-1998	844 baht	$c(t) = \sum_{i=1}^2 c_i(0) \cdot [1 - \delta \cdot \Delta q(t)][1 + \tilde{\lambda} \cdot w_i \cdot \Delta \Pi_i + (1 - \tilde{\lambda}) \cdot \tilde{\theta}(t) \cdot \Delta S(t)]$ (Equation 6)

TABLE A1
(CONTINUED)

Term	Definition	Estimate	Comment
<i>D</i>	Anticipated debt capital to be employed in project	12.5 million baht (June 1997)	Anticipated debt capital contribution for 50% of overall capital employed from May 1997 to finance plant facilities expansion.
<i>E</i>	Anticipated equity capital to be employed in project	12.5 million baht (June 1997)	Anticipated equity capital contribution for 50% of overall capital employed from May 1997 to finance plant facilities expansion.
k_D	Anticipated rate on debt capital	.1	Assumed by authors. Computational details available on request.
k_E	Anticipated rate on equity capital	.2	Assumed by authors. Computational details available on request.
<i>T</i>	Anticipated corporate tax rate 1997-1998	.3	Based on historical production data furnished by subsidiary management.
$f(t)$	Anticipated capital charge for 1997-1998 plant expansion project capital	3.38 million baht	$f(t) = \left[k_D \cdot \frac{D}{D+E} \cdot (1-T) + k_E \cdot \frac{E}{D+E} \right] \cdot [D+E]$ <p style="text-align: right;">(Equation 10)</p>
$d(t)$	Anticipated tax-deductible depreciation in 1997-1998	2.5 million baht	Based on actual and estimated depreciation expenses furnished by subsidiary management.
$EVA(t)$	Anticipated economic value created (destroyed) by proposed project for 1997-1998 fiscal year	32.13 million baht 918,000 dollars (at 35 baht/dollar)	$EVA(t) = \{ [p(t) - c(t)] \cdot q(t) - d(t)(1-T) + d(t) - f(t) \}$ <p>(Equation 11)</p>

The tables below provide three measures of EVA: 1) *ex ante* anticipated EVA (32.13 million baht); 2) *ex post* optimal EVA* (5.05 million baht); and 3) *ex post* actual \overline{EVA} (4 million baht). The two *ex post* EVA measures remain positive, though much reduced, even after the impact of the 1997 crisis. For purposes of our analysis, the important issue for MNC management is not necessarily whether the subsidiary managers are able to generate a positive EVA, but how well they perform relative to the optimal EVA response indicated by the model.

At the *ex post* performance assessment in July 1998, the MNC parent should use the optimal $EVA(t)$ (5.05 million baht) to assess the subsidiary rather than the *ex ante* EVA anticipated prior to the onset of the crisis in May 1997 (32.13 million baht). The 5.05 million baht result accounts for many macro- and microeconomic factors largely outside the control of the subsidiary management team (e.g.,

$\Delta Y(t)$, η , $\Delta S(t)$, $\Delta q(t)$, w_i and $\Delta \Pi_i$). The key discretionary terms are the exchange rate passthrough ($\tilde{\Theta}(t)$), component input switching ($\tilde{\lambda}$) and funding source ($\tilde{\alpha}$) terms. *Ex post* actual $EVA(t)$ results (4 million baht) are substantially below the optimal 5.05 million baht level and should be cause for closer scrutiny by the MNC parent. Transaction costs such as the costs of switching suppliers and lowering production levels may provide subsidiary and MNC parent management with a partial explanation for some $EVA(t)$ variance from the optimal response indicated by our model. The MNC parent management may then decompose residual variance into components linked to subsidiary's actual production levels, average unit pricing, average unit costs, and average capital costs. This information may be used to refine the EVA model further for future use in *ex ante* budgeting and *ex post* performance assessment.

TABLE A2
EVA EVALUATION OF PROJECT: *EX POST* JULY 1998 PERFORMANCE
EVALUATION MEETING

Term	Definition	Estimate	Comment
$\Delta Y(t)$	Actual change in income in 1997-1998	-.10	Actual 10% reduction in real income in Thailand in 1997-1998.
η	Actual 1997-1998 elasticity of demand	2	Precipitous fall in baht/dollar exchange rate and real income stifles demand for automobile components (and finished automobiles) in Thailand. Crisis conditions exacerbate income elasticity particularly for durable goods. Income elasticity term swamps any price elasticity effects (ϵ), which may be ignored in this example.
$q(t)$	Actual production level in 1997-1998 given change in $\Delta Y(t)$ and η	80,000 units	$q(t) = q(0)[1 + \eta \cdot \Delta Y]$ (Truncated Equation 4)
$\tilde{\Theta}(t)$	Actual discretionary exchange passthrough rate in 1997-1998 average unit pricing	.3	Rival passes through smaller-than-expected percentage of actual 100% baht/dollar depreciation. Subsidiary matches rival's pass through rate (Θ) of only 30% of actual depreciation in order to match rival's unit pricing and retain market share.
$\Delta S(t)$	Actual percentage change in baht/dollar exchange rate in 1997-1998	1	Devaluation of baht from 25 baht/US dollar to approximately 50 baht/US dollar in mid-1997, and remaining unchanged throughout rest of 1997-1998 fiscal year (100% depreciation).
$p(t)$	Actual average unit pricing in 1997-1998 given change in $\tilde{\Theta}(t)$	1300 baht	$p(t) = p(0)[1 + \tilde{\Theta}(t) \cdot \Delta S(t)]$ (Equation 5)
$\Delta q(t)$	Actual percentage change in annual production level for 1997-1998	-.10	Expected decrease in production levels from 100,000 units in 1996-1997 to 79,200 units to have been produced in 1997-1998 given changes summarized above (21% decrease).
$\tilde{\lambda}$	Actual percentage of locally-sourced inputs to produce automobile components in 1997-1998	.5	Subsidiary previously sourced both inputs from MNC parent (US). Crisis results in switch to domestic supplier (50% of inputs) in 1997-1998.
w_i	Actual percentage cost contribution of locally sourced inputs to final automobile components produced in 1997-1998	1	Component produced by subsidiary has only two inputs. One is sourced locally in response to crisis in 1997-1998. It represents 100% of overall cost contribution from locally produced inputs.
$\Delta \Pi_i$	Actual price inflation related to each locally-sourced input used in manufacture of final auto components made in 1997-1998	.25 (for input $i = 1$, which is sourced locally in response to crisis)	Subsidiary switches one component input to domestic (Thailand) sourcing. Experiences 25% price inflation for this locally sourced input. This 25% increase in domestically-sourced input is still lower than 30% increase in foreign-sourced inputs (30% of 100% depreciation passed through in foreign-sourced input prices).
$c(t)$	Actual average unit cost in 1997-1998 given changes in, $\Delta q(t)$, λ , w_i , $\Delta \Pi_i$ and $\tilde{\Theta}(t)$	1204 baht	$c(t) = \sum_{i=1}^2 c_i(0) \cdot [1 - \delta \cdot \Delta q(t)] [1 + \tilde{\lambda} \cdot w_i \cdot \Delta \Pi_i + (1 - \tilde{\lambda}) \cdot \tilde{\Theta}(t) \cdot \Delta S(t)]$ (Equation 6)
$EVA(t)^*$	Optimal economic value created by proposed project for 1997-1998 fiscal year given changes in $p(t)$, $c(t)$, $q(t)$ and $f(t)$	5.05 million baht (101,000 dollars (at 50 baht/dollar))	$EVA(t) = \{[p(t) - c(t)] \cdot q(t) - d(t)(1 - T) + d(t) - f(t)\}$ (Equation 11)
$\overline{EVA}(t)$	Actual economic value created by project in 1997-1998 fiscal year	4 million baht (80,000 dollars (at 50 baht/dollar))	Actual project performance results provided by subsidiary management.