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Recommended Citation

Mark R. Manfredo and Clifford J. Shultz II (2007) Risk, Trade, Recovery, and the Consideration of Real Options: The Imperative Coordination of Policy, Marketing, and Finance in the Wake of Catastrophe. Journal of Public Policy & Marketing: Spring 2007, Vol. 26, No. 1, pp. 33-48.

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Risk, Trade, Recovery, and the Consideration of Real Options: The Imperative Coordination of Policy, Marketing, and Finance in the Wake of Catastrophe

Mark R. Manfredo and Clifford J. Shultz II

Recovery from societal and market catastrophe is a daunting process that requires multifunctional, systemic, and long-term efforts. Humanitarian aid and donor assistance are rarely sufficient. Trade and other forms of direct investment in devastated markets offer another kind of recovery assistance. However, risks encountered in recovering economies can deter firms from investing. The authors apply a real-options framework to examine the financial feasibility of trading with recovering economies; they apply the framework to the countries of the war-disintegrated former Yugoslavia. The real-options framework considers the value of managerial flexibility in the presence of risks. The authors discuss implications for policy, marketing management, export development, and economic and societal recovery in several contexts.

Tsunamis, hurricanes, earthquakes, mud slides, terrorist attacks, and war can be massively and incomprehensibly catastrophic events. They can obliterate entire communities and societies, including marketing systems and processes requisite to sustain those societies. "Lucky" survivors often struggle to subsist in the bleakest, most unsafe, unsanitary, and dangerous conditions—often from minute to minute.

The best initial efforts to restore some semblance of stability typically rest in humanitarian aid and other forms of donor assistance from unaffected and/or wealthy countries and institutions, such as the Red Cross, Red Crescent, and the United Nations High Commissioner for Refugees. However, aid and assistance are inadequate for large-scale market reconstruction, full societal recovery, and long-term welfare. Resource-strapped agencies are unable to meet all the needs over time, donor fatigue saps energy from well-intended projects, and the inevitable next catastrophe draws resources and attention from previously devastated regions. Sometimes pledges never materialize, as evidenced with the reconstruction efforts with respect to the World Trade Center, Hurricane Katrina, and many places devastated by the tsunami that swept across the Indian Ocean (e.g., Dewan, Connelly and Lehren 2006; *The New York Times* 2005). Therefore, other mechanisms for market and society reconstruction must be implemented.

Full or optimal recovery requires long-term commitments and coordinated orchestration by numerous institutions, including governments, nongovernmental organizations, firms/marketers, and consumers. Good governance is imperative to the process. Well-governed markets, countries, regions, and communities tend to suffer less damage initially and to recover more quickly from catastrophe (Allenby and Fink 2005; Shultz 2005). Policies that favor investment and broad forms of engagement in devastated areas are needed. This idea has not been lost on others. In referring to recovery efforts in the wake of the recent tsunami, *The Economist* (2005, pp. 51–52) notes that "aid agencies have bombarded fisherman with offers of new boats, but no one has paid to rebuild the factories that used to supply the ice to preserve their catch."

In short, too often, there is no coordinated effort to (re)build a sustainable, functional marketing system; aid agencies favor projects such as schools, but they often neglect important infrastructure projects, such as roads, ports, and sewage. In general, conditions deter private-sector investment, which is vital for enterprise creation, jobs, and socioeconomic development. Potential investors interested in important infrastructure projects and other forms of engagement usually view the devastated areas that would benefit the most as being too risky. This is especially true in war-ravaged and politically volatile areas, where catastrophe can exacerbate tensions, often making them even less inviting. Because further conflict is possible and still

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© 2007, American Marketing Association
ISSN: 0743-9156 (print), 1547-7207 (electronic)

Vol. 26 (1) Spring 2007, 33–48

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more destruction and suffering are likely, a truly vicious cycle of devastation and deprivation results. The cycle becomes particularly difficult to break when governments fear and resist engagement with investors from countries with different cultural and political values, despite obvious societal benefits that can result from investment. Therefore, recovery from catastrophe requires a skillful melding of policy, market understanding and risk assessment, financial services and markets, and marketing practices to rebuild sustainable marketing systems as evinced by prosperous and peaceful societies.

In this article, we address the integration of these issues toward efficacious market and societal recovery in the aftermath of catastrophe. We do this with an eye toward several themes espoused in the call for papers for this special section—namely, the role of marketing in reconstruction from catastrophic devastation, including the roles of economic and trade policy and the social, moral, and legal obligations to assist recovering economies (Mittelstaedt 2007). We contend, perhaps counterintuitively, that there are some inherent advantages to risk and instability if there is flexibility to respond to this uncertainty. Risk and instability can expedite domestic or foreign direct investment (FDI) to the benefit of marketing firms and to the marketing systems, countries, and citizens in the destroyed area, country, or region.

Risk and (War) Recovery

Countries or areas that are recovering from catastrophic military hostilities and are also rebuilding economies are risky markets. There is considerably more risk endemic to the process of marketing to, with, and in these markets and to managing value chains (from source to consumer) than in markets that are not recovering from war (Kwok and Reeb 2000). Notably, risk has been revisited as a scholarly focal point for marketing and public policy, though it has largely been studied from a consumer's perspective (e.g., Johnson 2004). We expand the perspective by taking a cross-disciplinary tack; that is, we consider financial and broad market risks with implications for marketing, managerial decision making, and, ultimately, policy and recovery.

We examine war and other forms of calculated military and paramilitary armed conflict because of the systemic depth and breadth of devastation and the human element that causes and sustains them and, accordingly, because they likely are the most difficult catastrophes from which to recover. Moreover, and as we hinted at previously, other catastrophes can slip into armed conflict and other forms of violence, resulting in more death and destruction. This possibility was and is true of Banda Aceh, Sri Lanka (both devastated by the 2004 tsunami), and even New Orleans (more recently damaged by Hurricane Katrina). Thus, strategies, tactics, and solutions for war recovery likely can be leveraged to provide relief and recovery efforts from other catastrophes.

More specifically, we examine the amalgam of factors that affect risk and recovery in Bosnia–Herzegovina, Croatia, and Slovenia, countries that emanated from the disintegrated Yugoslavia and are still experiencing the economic and social impacts of wars that occurred in the 1990s (e.g., Shultz et al. 2005). Various sources of risk are likely to create considerable variability in the returns from marketing investment in and export to these recovering economies (Kwok and Reeb 2000; Miller 1992),[1] which in turn will affect the pace and scope of recovery. Despite compelling reasons to enter such markets (e.g., pent-up consumer demand, market size, the inevitable need for food), many exporters of value-added food products, for example, have chosen to avoid the countries that emerged from the former Yugoslav republics (FYR) because traditional measures suggest that levels of risk are unacceptable.[2] Although commercial country risk measures are often helpful in providing broad insights into political and economic conditions, they have been found to have little power in predicting periods of intense instability or unique opportunity (e.g., Oetzel, Bettis, and Zenner 2000).

Although any export or business venture in a recovering economy is risky, there may actually be value in this uncertainty, especially if marketing managers have and maintain flexibility to respond to it. Consistent with this idea, Miller (1992) suggests several strategies that companies can employ when they are faced with uncertainty (risks) in international markets. If the value of this strategic flexibility can be quantified at the time an investment decision is made (e.g., during the consideration of an export venture), it may indicate that the venture is more valuable than originally believed. Real-options analysis, also known as contingent claims analysis, is a framework that can be used to value managerial flexibility in the presence of uncertainty (e.g., Copeland and Keenan 1998; Dixit and Pindyck 1994), and it has been suggested for valuing marketing strategy (Dias and Ryals 2002; Ward and Ryals 2001). Failure to consider the existence and value of real options embedded in any risky investment likely underestimates the true value of the investment (Mun 2002).

If U.S. food enterprises intend to invest in more markets replete with more risks, they need a way to evaluate more appropriately marketing relationships in the presence of uncertainty, which may be unruly at times (Thomas 2001). This is particularly true when considering an export venture to FYR and other recovering economies. Although all export ventures are exposed to uncertainty, the lingering perception of instability and war in these countries may be the greatest hindrance for trade to and in the region. Given some shortcomings in previously mentioned measures and techniques, a real-options approach to evaluating prospective export ventures to FYR is compelling. If managers considered the option value of their strategic decisions to enter recovering economies, such as FYR, they may be more inclined to engage these countries, despite considerable uncertainty. In turn, engagement could increase trade to the region and likely render the region less uncertain; that is, risk would be reduced. Considering the real-options value of

[1]These are just a few risks to which exporters and other international marketers may be exposed. For a further delineation and classification of risks faced by firms conducting business in international/foreign markets, see Miller (1992), Kwok and Reeb (2000), Flynn and colleagues (1994), and Reeb, Kwok, and Baek (1998).

[2]We base this conclusion on a series of in-depth interviews (McCracken 1988) we conducted over a 12-year period with members of the food value chain, government authorities, trade associations, and nongovernmental organizations throughout the region, in the United States, and in the European Union (EU). However, we add that exports and other forms of trade and investment should not be limited to food.

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an export venture to the region may also stimulate policies that help promote trade with the region and, more generally, trade with recovering economies, thus expediting recovery.

In light of the preceding text, an objective of this research is to evaluate the real-options value of potential investment in and export ventures to recovering economies. In doing this, we also develop a systematic way of considering and measuring risks associated with an export venture to countries in which scant data are available for quantifying the unique risks of such a project. Furthermore, valuing options that may be present in risky export ventures provides considerable insight into the design of marketing strategies and policies that could be used to enhance trade with these countries, in particular those that capitalize on maintaining managerial flexibility in the presence of risk. Specifically, we examine the case of an enterprise that is evaluating the feasibility of entering the recovering countries of Bosnia–Herzegovina, Croatia, and Slovenia. We examine these three countries given the likely differences in both real and perceived risks of conducting business throughout the FYR.

Although the implications from our real-options analysis can apply to any recovering economy, the countries of FYR are particularly compelling and challenging because they are (1) of sufficient size and sophistication to be of interest to most marketers and (2) still recovering from various levels of war devastation (e.g., Glenny 2000; Pecotich, Renko, and Shultz 1994; Shultz et al. 2005; Silber and Little 1997). In some regions, that devastation manifests in profound disruption of infrastructure, production, and distribution capabilities and can further exacerbate ethnic tensions, all of which impede efficient markets and effective marketing (e.g., *World Factbook* 2005a, b; cf. *World Factbook* 2005c; see also World Bank 2006a, b, c). Yet in other regions—namely, Slovenia and the developed coastal regions of Croatia—the risks are likely not greater than traditional European Union (EU) trading partners. Furthermore, this research presents a framework that managers can adapt when considering export ventures not only to FYR but also to other recovering countries. In this spirit, we hope that managers and policy makers will appreciate the options value of these potential investments and that our analysis will lead to additional trade in recovering economies and, ultimately, to win–win incentives to sustain peace and prosperity through mutually beneficial commerce.

We organize the remainder of this article as follows: First, we examine the recent literature on applications of real options and apply a methodology for crafting a real-options problem that gives the exporting firm the flexibility to abandon, expand, or contract the marketing efforts in response to uncertainty. Second, we outline an efficient framework to model the variability of cash flows to an export venture—a key input in real-options analysis—specifically focusing on the unique and varied risks of conducting business in Slovenia, Croatia, and Bosnia–Herzegovina. Third, using general assumptions, we estimate and present the real-options value of conducting business in each of these countries, and then we consider how the real-options value may change by varying the assumptions of the real-options model. Examining how the real-options value changes under various scenarios for the inputs of the model provides considerable insights into and recommendations for the design of marketing strategies and policies that may be effective in enhancing trade with recovering and emerging economies, such as those in the FYR. In the final section, we summarize our findings and implications, particularly in terms of how the value of these real options adds considerable information to the decision and policy-making process in the context of risky export ventures.

Real-Options Analysis

Discounted cash flow analysis is the standard tool for evaluating the financial feasibility of real investments (Brigham and Houston 2004). If the discounted future cash flows from a project are greater than the initial investment, the net present value (NPV) is positive, which suggests that economic gains to the firm would be realized if the project or investment were adopted. Although the risk of the project is typically accounted for by means of a risk-adjusted discount rate, traditional discounted cash flow techniques do not inherently consider the value of strategic options (i.e., managerial flexibility) in the presence of risk (Mun 2002).

In general, an option provides the right but not the obligation to take some form of action at a specified time or over a specified period. For example, a call option on an individual stock gives the holder of the option the right but not the obligation to buy the stock at a particular price—called the exercise or strike price—over a set period (Hull 2000). This option inherently has value because the holder has the right but not the obligation to invest in the stock at the strike price (Black and Scholes 1973; Merton 1973).[3] Dixit and Pindyck (1994) suggest that in the presence of managerial flexibility, investments in real assets contain option values analogous to that of financial assets. Specifically, an investment contains real-options value if it contains an irreversible financial commitment (i.e., sunk costs), uncertainty in returns over time, and a unique opportunity to invest (Dixit 1989; Dixit and Pindyck 1994; Richards and Patterson 2004).

A general result from options pricing theory is an understanding of the factors that drive an options value. Two of the most important drivers are the time to maturity and the variability of the underlying asset (Black and Scholes 1973; Hull 2000; Merton 1973). For example, the longer the time to invoke the option, the greater is the option value; the more volatile the underlying asset, the more valuable is the option. Indeed, as we show in the next section, it is the volatility of the underlying asset that becomes the prominent factor in real-options analysis. Combining the real-options value of the investment with the result from a traditional static NPV analysis provides a more accurate estimate of the true value of the investment, especially the inherent value of managerial flexibility in the presence of uncertainty.

Applications are numerous, varied, and relevant to marketing and public policy. Dixit and Pindyck (1994) show how to value undeveloped resource reserves, environmental policy design, and entry and exit strategies (see also Amram

[3]The Nobel Prize–winning research of Black and Scholes (1973) defines the value of call option on a dividend-paying stock to be a function of the price of the underlying asset (stock price), the strike price, the time to maturity of the option, the risk-free rate of return, and the volatility of the underlying stock price (see also Merton 1973). Although this research has helped foster the multibillion dollar financial derivatives industry, it has also allowed both scholars and practitioners to apply similar option pricing methods in valuing real options—namely, the option value inherent in real investment decisions (Dixit and Pindyck 1994).

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and Kulatilaka 1999; Copeland and Antikarov 2001; Mun 2002). Other applications include investment timing, market expansion and product development (e.g., Copeland and Keenan 1998), customer relationships (Ward and Ryals 2001), and evaluation of brand extensions (Dias and Ryals 2002). Specifically, Dias and Ryals (2002, p. 116) note that "for brand managers, flexibility such as the ability to increase or decrease brand extension investment depending on future circumstances might be very valuable indeed to enable them to respond to changes in market circumstances." This line of thinking is consistent with that of a marketer who is considering a new venture into a recovering economy. Richards and Patterson (2002) further demonstrate that the uncertainty related to marketing commodity exports can have significant value.

Real-options analysis provides an ideal framework for considering risky investment decisions, such as the decision of whether to trade with a recovering economy. Instead of viewing uncertainty as a negative, real-options analysis views the ability to deal with uncertainty as a positive. The value of managerial flexibility, such as the option to expand or contract marketing efforts after the investment is initiated, must be considered in addition to the NPV of the investment at the time of the investment decision. Only through the valuation of real options can the full potential value of an investment decision be considered. In the following section, we develop the specific case of a food company that is considering investment in a trading venture with the recovering economies of Slovenia, Croatia, and Bosnia–Herzegovina.

Methodology

Similar to other marketers (e.g., Franses 2005; Wittink 2005), we believe that there is some utility in modeling to assist marketing and policy decision making. The development and articulation of our model and subsequent applications follow.

Crafting and Valuing Real Options

In considering the financial feasibility of entering into an export venture with a recovering economy, managers are likely to rely on discounted cash flow analysis—namely, NPV analysis. The NPV is calculated as follows:

$$\text{NPV} = -\text{INVEST} + \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \ldots \frac{CF_n}{(1+i)^n}, \quad (1)$$

where –INVEST is the initial investment in the project, CF_t is the incremental cash flow at time t (t = 1, …, n), and i is the risk-adjusted discount rate.[4] The appropriate risk-adjusted discount rate for a firm depends on many factors, including the firm's cost of capital, debt structure, market risk, and the perceived risks of the project under examination.[5] That is, adjusting discount rates for risk reduces the present value of future cash flows, thus providing a more conservative NPV assessment. Although NPV is the standard metric for assessing any financial investment decision and the standard point of departure for real-options analysis, a most-probable-outcome NPV resulting from decision tree analysis or scenario analysis is also appropriate. Under conventional capital-budgeting decision criteria, the decision to enter the export market would be accepted if the NPV were positive. That is, the present value of the projected cash flows over the life of the export project is greater than the initial investment, in theory providing the firm with an instantaneous increase in wealth through the adoption of the venture. Even in situations in which NPV is projected to be positive, management may still be reluctant to engage in an export venture with a country that is recovering from war because of the substantial unknowns of entering these markets. However, considering the real-options value of the project when assessing initial financial feasibility—namely, the value of managerial flexibility in the presence of uncertainty—should provide additional information to management about the true value of this potential investment. Not only does considering the real-options value of the investment in conjunction with the standard NPV provide management with a true understanding of the real value of the investment considering its inherent volatility, but the real-options value may also be enough incentive to persuade management to engage in the project. Thus, the true value of the export venture, considering its real-options value, is

$$\text{NPV} + \text{Real-options value}. \quad (2)$$

In illustrating the differences in real-options value, we consider Slovenia, Croatia, and Bosnia–Herzegovina. For example, the Slovenian economy is robust, and in 2004, it joined the EU. This is mainly because Slovenia escaped much of the carnage during the wars of the 1990s. At the other extreme, Bosnia–Herzegovina is still reeling from the effects of war and economic devastation. Although conceivably numerous options can be valued in the context of a firm considering an export venture in these countries, the specific real-options problem we examine and apply here is that of the option to choose among various courses of action after the venture is initiated; this is often referred to as a "chooser option" (Copeland and Antikarov 2001; Mun 2002). Thus, management has the option (choice) to expand the export venture, scale back marketing efforts, or abandon the export venture anytime during the project's life.[6] Although it is well known from option pricing theory that the longer the option is available, the greater is the option value, we define the anticipated length of the export venture (and the option to choose) as six years. Although management would undoubtedly view a successful long-term export relationship to return positive cash flows considerably beyond six years, this time frame is reasonable to consider initial financial feasibility of the project and the chooser option under examination.[7] Another important consideration for the real-

[4]The use of risk-adjusted discount rates for international projects is consistent with the findings of Reeb, Kwok, and Baek (1998), who suggest that despite reductions in systematic risk from diversification, risk-adjusted discount rates are justified for international projects.

[5]For a discussion and methods for estimating risk-adjusted discount rates in capital budgeting, see Brigham and Houston (2004).

[6]The consideration of these actions (abandonment, expansion, contraction, or staying the course) is not related to a particular project design or marketing plan, nor do we assign specific probabilities to these actions. These are merely responses to uncertainty or risk that are likely to exist in an export venture to a recovering economy. Provided that management indeed is ensured the flexibility to respond to this risk, *ex ante* real-options value should exist in the presence of a potentially risky investment.

[7]In a case study examining the financial feasibility of introducing a value-added food product to an export market, Henley and Sanders (1994) estimate the cash flows to the venture over a six-year period.

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options value, especially when an export venture to a country recovering from devastation is under consideration, is that flexibility in managing the venture is ensured. This is possible by considering specific marketing strategies with built-in flexibility in a particular project design, as well as the promotion of public policies that promote flexibility and risk taking (e.g., export credit guarantees). If managers do not have the flexibility to respond to risk, real-options value essentially disappears.

Given the complex nature of a chooser option, we use a binomial option pricing model with risk-neutral probabilities (Cox, Ross, and Rubinstein 1979). For complex options, such as that which we outline here, binomial methods are more flexible. They are more intuitive and easier to convey to management and other decision makers than closed-form solutions and differential equation methods (Dixit and Pindyck 1994; Mun 2002; Richards and Patterson 2004).[8] When binomial methods are used in valuing real options, two binomial lattices are needed—one that shows the evolution of the underlying asset and one to derive the option value. The following information is also needed to value a real option: the option's strike price (X), the present value of the underlying asset (S_0), the time to maturity of the option (t), the risk-free rate of interest (r), and the volatility or annualized standard deviation of the underlying asset (σ).

Figure 1 shows the binomial lattice for the underlying asset, S_0; we develop this following Hull's (2000) specification. Here, the underlying asset S_0 reflects the present value of the future cash flows to the export venture. This binomial lattice evolves over six years, commensurate with the initial life of the investment and the options defined. The u and d represent the up and down steps in the binomial lattice; we defined this as

$$u = e^{\sigma\sqrt{\Delta t}},\ d = e^{-\sigma\sqrt{\Delta t}} = \frac{1}{u}, \tag{3}$$

where, again, σ is the volatility of the future cash flows to the export project, e is the exponential function, and Δt is the number of incremental time steps designated per year. If we assume only one time step per year, then $\Delta t = 1$.[9] Note that the down factor, d, is also the inverse of the up factor (1/u). Thus, the underlying lattice in Figure 1 illustrates how S_0 can potentially evolve over time, depending on the predicted volatility of the project represented by σ.

Figure 2 shows the equity lattice for the chooser option, which is needed in conjunction with the underlying lattice in Figure 1 to find the real-options value. Following Mun's (2002) procedures, we use the end nodes of the equity lattice to reflect the maximum value of abandonment, expansion, contraction, or staying the course for the chooser option. In general, each end node of the equity lattice can be expressed as follows:

$$\text{Max}[\Phi_1, \Phi_2, \Phi_3, \Phi_4], \tag{4}$$

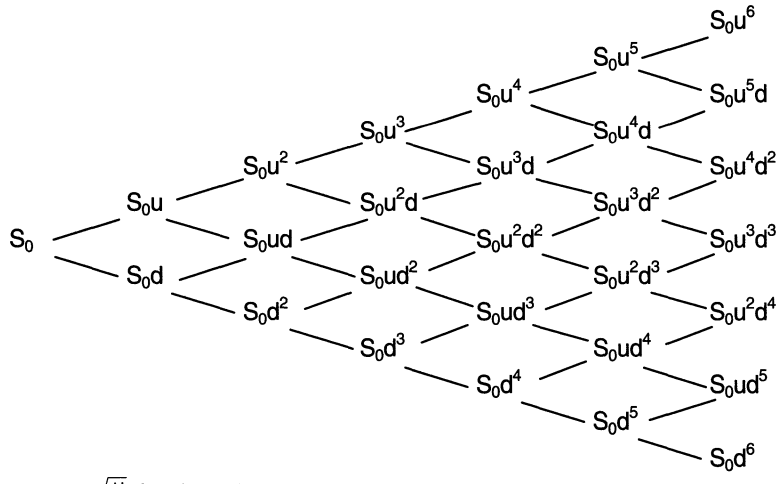
where Φ_1 to Φ_4 reflect the net value to each of the options considered. For Φ_1, the net value of the option is simply the salvage value that would be obtained from abandonment. That is, we assume that that the firm can recover at least a portion of its yearly variable production and marketing costs. The value of the expansion option, Φ_2, is

$$\Phi_2 = \alpha\eta_i - c, \tag{5}$$

[8]Hull (2000) and Mun (2002) show that binomial methods should provide similar real options to closed-form solutions (e.g., Black and Scholes's [1973] pricing methods). In the limit, binomial and closed-form methods should be equal (Hull 2000).

[9]The term $\sqrt{\Delta t}$ is an adjustment to annualize the standard deviation, σ.

Figure 1. Binomial Lattice of Underlying Variable: Present Value of Cash Flows (S_0)



$u = e^{\sigma\sqrt{\Delta t}}$ (up factor)

$d = e^{-\sigma\sqrt{\Delta t}} = \frac{1}{u}$ (down factor)

e = exponential function

S_0 = present value of future cash flows

σ = standard deviation of discounted cash flows

$\sqrt{\Delta t}$ = time factor

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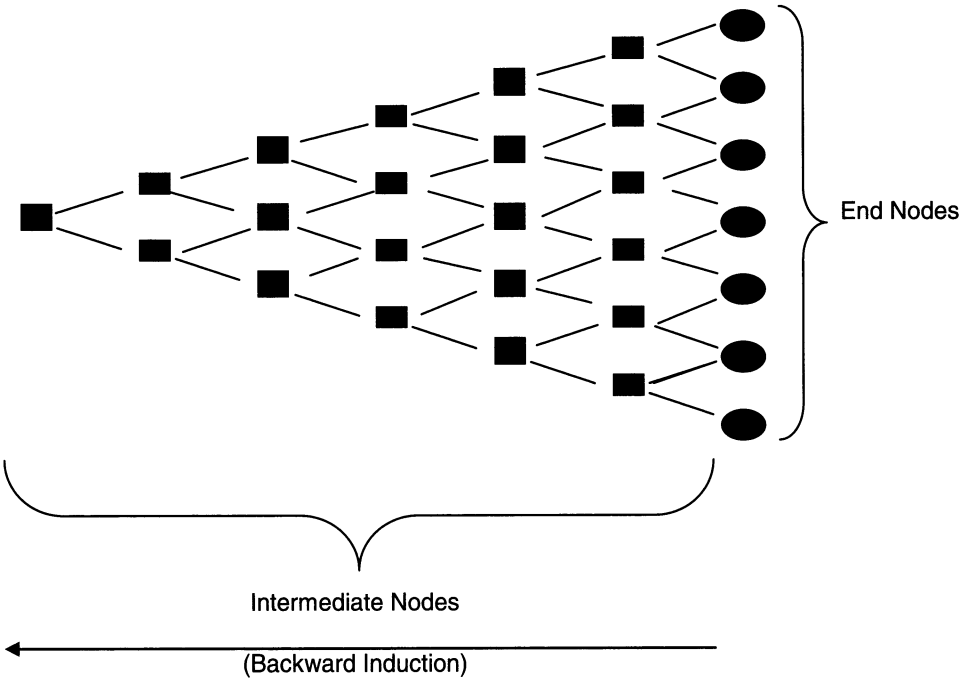
Figure 2. Equity Lattice of the Option to Choose: Abandonment, Expansion, Contraction, or Status Quo



Each end node = Max[Φ_1, Φ_2, Φ_3, Φ_4], where Φ_1 is the value of the abandonment option, Φ_2 is the value of the expansion option, Φ_3 is the value of the contraction option, and Φ_4 reflects staying with the original course of action.

Each intermediate node = Max[Φ_1, Φ_2, Φ_3, Φ_4, Ω], where Φ_1 to Φ_4 are defined as before, and $\Omega = e^{-r\Delta t}[pV_u + (1 - p)V_d]$, where e is the exponential function, r is the risk-free rate of interest, p is the up probability, $1 - p$ is the down probability, V_u is the value of the previous up node, and V_d is the value of the previous down node.

where α is the amount that sales are expected to expand (e.g., $\alpha = 2$ indicates a doubling of sales), η_i is the value taken from the corresponding end node in the underlying lattice (Figure 1), and c is the cost of expansion. Similarly, the option to scale back marketing efforts, Φ_3, can be expressed as follows:

$$\Phi_3 = \beta\eta_i + s, \tag{6}$$

where β is the amount that sales are expected to contract from the scaling back efforts (e.g., $\beta = .5$ indicates a reduction of sales by 50%) and s is the cost savings from reducing marketing efforts. Finally, the option to stay the course, Φ_4, is merely the value in the corresponding node of the underlying lattice (η_i).

After we calculate the end nodes of the equity lattice, we use backward induction to find the intermediate nodes of the equity lattice. The intermediate nodes are all nodes to the left of the end nodes in the equity lattice (Figure 2). In doing this, it is necessary to calculate risk-neutralized probabilities. Using both the up and down factors examined in Equation 3, we determine that the probability of an up movement on the binomial lattice is equal to

$$p = \frac{e^{r\Delta t} - d}{u - d}, \tag{7}$$

where e is the exponential function, r is the risk-free interest rate, Δt is the number of time steps ($\Delta t = 1$), and u and d are the up and down factors, respectively, as shown in Equation 3. Thus, the probability of a down movement on the binomial lattice is merely $1 - p$. When we use these risk-neutralized probabilities and backward induction, each of the intermediate nodes can be expressed as follows:

$$\text{Max}[\Phi_1, \Phi_2, \Phi_3, \Phi_4, \Omega], \tag{8}$$

where Φ_1, Φ_2, Φ_3, and Φ_4 are defined as before and Ω is

$$\Omega = e^{-r\Delta t}[pV_u + (1 - p)V_d], \tag{9}$$

where, again, e is the exponential function, r is the risk-free rate of interest, p is the risk-neutralized up probability, $1 - p$ is the risk-neutralized down probability, V_u is the value of the previous up node, and V_d is the value of the previous down node. Moving from right to left on the lattice ultimately leads back to the first node in the equity lattice. Following this backward induction procedure, the value of the first node of the equity lattice reflects the present value of future cash flows to the project, given the combined options to abandon, expand, scale back, or stay the course. Therefore, the real-options value is merely the difference between the value in the first node in the equity lattice in Figure 2,

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V_0, and the static present value of the future cash flow stream, S_0 ($V_0 - S_0$ = Real-options value).[10]

Indeed, it is σ that ultimately drives the real-options result. From options pricing theory, a positive relationship is known to exist between volatility (σ) and the value of an option. Although, at first glance, this suggests that highly risky projects imply greater real-options value, this is not the case. *Ex ante* real-options value exists only if there is flexibility in the project design itself such that management can respond to uncertainty. If this flexibility does not exist, the option value is essentially zero. Furthermore, *ex post* real-options value (after the project is engaged) may decline or even go to zero if the risks considered *ex ante* do not materialize or if the flexibility to respond to risk is somehow constrained. This is similar to how financial options may lose value over time if the level or the volatility of the underlying financial asset changes. Meaningful estimates or forecasts of σ, usually based on historical data, are also needed to assess real-options value adequately. However, deriving estimates of σ associated with the cash flows of a new export venture to a recovering country is difficult, given that there is likely no history of similar transactions and an overall paucity of publicly available, high-quality data to derive such an estimate. Despite this, the incorporation of Monte Carlo simulation methods, coupled with existing knowledge of risk assessment and classification presented in the international business literature, can be used to capture robustly the likely risks associated with an export venture into FYR in an estimate of σ.

The preceding binomial option pricing model is an efficient method of estimating the real-options value of an export venture (specifically, the chooser option defined) at the time of the investment decision. Therefore, the binomial option pricing model should not be confused with the traditional decision tree analysis often used in project valuation. Although binomial option pricing and decision tree analysis appear similar, they are indeed different. Decision tree analysis is important for graphically depicting strategic initiatives and strategies over time. That is, decision tree analysis illustrates the strategic pathways that a firm can take throughout the course of the project. Decision trees are also useful in comparing alternative designs of a project. Identifying and understanding the decision points in the project, the nature of the decisions to be made, and the costs/benefits and probabilities associated with each outcome and each node of a decision tree lattice provide critical information to the decision maker. Depending on the specific project design, there may be strategic options that need to be valued at each node in a comprehensive decision tree that thoroughly analyzes all strategic decisions. This may be the most important complementary aspect of the two methods. In this case, binomial option pricing methods (which we presented previously) can be used to value certain real options that may be available at different decision nodes in a comprehensive project design.[11] However, it is important to remember the differences between relating options pricing, as we described previously, to actual project design and implementation.

Monte Carlo Simulation for Estimating Risk

In the context of international trade, numerous factors are likely to create variability in the project's cash flow stream. Researchers have suggested many alternative ways to classify these risks (Flynn et al. 1994; Miller 1992; Reeb, Kwok, and Baek 1998). For example, Miller (1992) takes a general management view of risks and develops three major categories of interrelated uncertainties: general environmental uncertainties, industry uncertainties, and firm uncertainties.[12] General environmental uncertainties focus on the factors that affect all industries, including political uncertainties (e.g., war, political turmoil), government policy uncertainties (e.g., price controls, trade restrictions), macroeconomic uncertainties (e.g., inflation, foreign exchange risks, changes in relative prices), social uncertainties (e.g., social unrest), and natural uncertainties (e.g., natural disasters). Under industry uncertainties, Miller develops subclassifications reflecting risk factors that are specific to the industry that the firm operates—namely, uncertainties arising from the input market or the product market or competitive uncertainties. Specific examples of these risks include changes in market supply, miscalculations of market demand and product acceptance, and competition. The classification of firm uncertainties are related to the risk factors that are firm specific, including delays in payment, culture-based misunderstandings, unreliable third parties, transportation bottlenecks, problems with customs brokers, and other issues that may disrupt product flow and payment.

Flynn and colleagues (1994) note that many people view Miller's (1992) general environmental uncertainties as the most important drivers of volatility, encompassing many, if not most, of the aforementioned risks. Indeed, it is likely that most managers immediately consider these risks when evaluating decisions to introduce a new product to a recovering region. Although numerous commercial rating services provide political risk assessments and related information designed for exporters, which attempt to gauge these risks (e.g., Dun & Bradstreet), according to Oetzel, Bettis, and Zenner (2000), these country risk measures, though informative in general, provide little value in predicting periods of major instability in a country. Although it is clear that numerous risks drive the variability of cash flows, these risks are difficult to quantify and predict with any precision. For example, what is the probability that war will break out again in Bosnia–Herzegovina, that product will be lost in transit, or that infrastructure bottlenecks will delay delivery of the product and jeopardize a key business relationship with an importer?

[10]Binomial option pricing methods incorporate recombining lattices (Cox, Ross, and Rubinstein 1979; Hull 2000). Therefore, it is important not to confuse the binomial option pricing method shown here, which is explicitly used to value the real option, with traditional decision tree analysis, which may or may not incorporate recombining lattices.

[11]Mun (2002, pp. 242–45) details the differences in real-options valuation versus that of decision tree analysis, as well as how the two forms of analysis can be used together to conduct complex project decision and decision analysis.

[12]Flynn and colleagues (1994) and Reeb, Kwok, and Baek (1998) provide alternative classifications of risk, but they are similar in concept to Miller's (1992) taxonomy of risks.

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Copeland and Antikarov (2001) note that Monte Carlo simulation provides a robust method of incorporating multiple risks to arrive at a single measure of the volatility of future discounted cash flows, σ, to use in the valuation of real options; they suggest that only three or four key risk drivers need to be explicitly modeled to keep the simulation robust and tractable. Following this suggestion, we develop a Monte Carlo simulation model to derive an *ex ante* estimate of the variability of cash flows of an export venture to the countries of Slovenia, Croatia, and Bosnia–Herzegovina. We assume that each of the following factors drives the variability of future cash flows to the venture: price, quantity sold, major disruptions, and foreign exchange rates. Focusing on these factors keeps the simulation tractable and also adequately and robustly captures the influence of the myriad risk factors that previous researchers have identified.

In estimating the future cash flows of an export venture, a firm usually has some estimate of the price that it will charge for the product, the quantity of the product it anticipates selling, and the costs associated with producing and marketing the product. These factors are unique and depend on the specific product marketed and the unique cost structure of the firm, and knowledge of these factors is critical in estimating the expected cash flows to an export venture. However, the Monte Carlo simulation model we develop here is general enough to estimate the variability of cash flows (σ) for any export venture into a developing or emerging economy.[13]

We make the following baseline assumptions in the Monte Carlo simulation, and then we apply the risk factors examined in the next section to this base case, depending on the country examined. First, we assume that both price and quantity are one, such that revenue (price × quantity) is also one.[14] Second, we assume that variable costs to the export venture are a fixed 80% of total sales. Because fixed costs do not vary with the quantity of sales, we do not explicitly model fixed costs. Therefore, we assume that the cash flows to the project for each year are revenue less costs.[15] Third, we assume that the initial life of the export venture under consideration is six years. We conduct the Monte Carlo simulation using 10,000 iterations; therefore, we incorporate almost every conceivable scenario, providing a robust simulation of the discounted cash flows. Thus, with each draw in the simulation, we estimate new values for the cash flows for Periods 1–6 (CF_1–CF_6) of the project, and we discount these cash flows using a risk-adjusted discount rate of 15%.[16] From this simulated discounted cash flow stream, we estimate σ as the standard deviation of r defined as follows:

$$r = \ln\left(\frac{PV_1 + CF_1}{PV_0}\right), \tag{10}$$

where PV_1 is the current value of future cash flows in Period 1, CF_1 is the cash flow (not discounted) at Year 1, and PV_0 is the current value of discounted cash flows at Year 0. As Mun (2002) suggests, only PV_1 and CF_1 are stochastic in Equation 10, whereas PV_0 is the static present value of the future cash flow stream. That is, at the completion of the 10,000 iterations of the Monte Carlo simulation, a distribution of r is produced, and we use the standard deviation of this distribution, σ, in the binomial option pricing model. Given this baseline model, we incorporate the following major risk factors in considering export ventures to Slovenia, Croatia, and Bosnia–Herzegovina: price, quantity sold, major disruptions, and foreign exchange risks. In the following sections, we describe how these factors are modeled.

Price

We designate price as a stochastic input variable in the Monte Carlo simulation. For each country modeled, we assume that the initial export selling price of $1.00 grows at 4% per year, consistent with average inflation witnessed during the past decade. The initial $1.00 price assumes stable exchange rates; thus, it reflects the relative price of the good in both the exporting and the importing country. However, a distribution around the trend inflation rate of 4% is established to account for uncertainty in this price point over time. We assume that the distribution around the price trend is lognormal; the mean of the distribution is set at the previous period's price, and the standard deviation of the distribution is the standard deviation of historical exchange rate returns of the specific importing country (foreign currency/U.S. dollar) for the period of 1995–2003 (13% for Slovenia, 12% for Croatia, and 8.8% for Bosnia–Herzegovina).[17] We assume that the distribution around the trend is lognormal because (1) the lognormal distribution is commonly used to describe financial asset returns, such as foreign exchange rate returns that we used to create the distribution around the trend, and (2) the lognormal distribution has a slightly longer and narrower right tail than the normal distribution. This is consistent with most price behavior. That is, prices tend to be sticky downward but not upward.

The preceding method preserves the constant trend in price (4%) but also places a range around the price trend to account for variability in the price over time. Although it is

[13]For a detailed explanation of Monte Carlo simulation methods for use in real-options analysis, see Mun (2002) and Copeland and Antikarov (2001). The @RISK program is an Excel add-in program commonly used by financial analysts to incorporate risk in financial modeling, and it is used to program the Monte Carlo simulation model used in this research.

[14]Because σ is an estimate of the standard deviation of returns, r, defined in Equation 10, and returns are percentages, only the variability of price and quantity is important in its calculation. Therefore, the levels of prices and quantity sold are immaterial from a mathematical perspective in the estimation of r and σ. The assumption that both price and quantity equal 1 allows for simplicity in modeling.

[15]Accounting revenue arguably does not equal cash flow. Noncash expenses, such as depreciation, are routinely added back to net income in determining the relevant cash flows to an investment project. However, this model focuses on the variability of cash flows from the exporting venture. Cash flows that are unique relative to a firm's accounting practices, such as depreciation, are firm specific and are not likely to be influenced by risks inherent in exporting to an emerging market.

[16]To focus on the primary factors that drive the variability of the cash flows from the export venture only, we assume that the risk-adjusted discount rate is fixed at 15%. We use this risk-adjusted discount rate for illustrative purposes. A firm's unique risk-adjusted discount rate is a function of its cost of capital, capital structure, market risk, and project risks.

[17]Before the introduction of the euro, the Bosnian mark was pegged to the German mark and is now effectively pegged to the euro. Therefore, the 8.8% standard deviation noted for Bosina–Herzegovina reflects the annualized standard deviation of euro/$ exchange rate returns from the launch of the euro in 2002–2003.

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reasonable that price increases linearly through time with inflation, it is also reasonable to assume that prices charged by the exporter may need to be raised or lowered in response to various factors—namely, exchange rate volatility. Indeed, exchange rate fluctuations may actually lower or raise the price of the exported good in the importing country. If exchange rate movements are such that the price of the good in the importing country increases, it may be necessary for the exporter to lower its invoice price to the importer to keep prices in the importing country stable. It is also likely that over time, the exporter will need to adjust prices to account for changes in the supply and demand of the product in the importing country that may or may not be due to changes in the exchange rate. Therefore, the procedure reasonably accounts for the uncertainty in prices over time that may be caused by several factors.

Quantity Sold

We also designate quantity sold as stochastic in the Monte Carlo simulation. It is likely to fluctuate greatly over time for several reasons, including acceptance of the product in the importing market, increased or decreased demand for the product over time, competitive response, the strength and success of business relationships along the supply chain, and so forth. Moreover, large currency devaluations in the importing country may cause local demand for the product to fall greatly, thus reducing the quantity of the product sold in a given year. Conversely, an appreciation of the local currency relative to the dollar may induce greater demand for the imported product.

We begin with the quantity sold as one, and we allow quantity sold through time to take on three different annual growth trends with equal probability of occurrence in the Monte Carlo simulation: rapid growth, moderate growth, or declining growth. We assume these growth trends for each of the countries under examination. For rapid growth, we designate the growth rate as a uniform distribution in which the rate can range from 15% to 45%. The moderate and declining growth rates are also designated as uniform distributions. For moderate growth, the values range from 2% to 10% and, for declining growth, from –10% to –1%. Thus, at any given iteration of the simulation, rapid, moderate, or declining annual growth rates commensurate with the uniform distributions established have an equal chance of being drawn. The uniform distribution is appropriate for considering a range of values that have an equal probability of occurrence. Although there may be cases in which management has information or prior experiences that suggest that the distribution of potential growth rates is not uniform, a range of growth rates with equal probability of occurrence picks up the considerable uncertainty surrounding the quantity of goods that are likely to be sold into a market that is recovering from devastation. Furthermore, we place a distribution around the growth trend to account for variability in the trend over time. We assume that this distribution is normal; the mean is the previous year's quantity sold, and the standard deviation is 2% for Year 1 and increases 1% annually for Years 2–6. Thus, the uncertainty around the trend quantity sold increases as the time horizon increases. Because there is no guidance or experience available in determining the appropriate distribution to use in establishing a cone of uncertainty around a trend variable, such as quantity sold, the normal distribution is a safe assumption and is robust for establishing variation around a trend variable. Although the assumptions about the distribution around the trend are subjective, they adequately consider variability in quantity sold over time. In essence, it is nearly impossible to predict the quantity of product sold over time with any degree of accuracy over the long run, so the simulation assumptions we present here account for the variability that may arise in the cash flows over time due to the quantity of product sold into the respective country. We also consider costs, which fluctuate with the quantity of product sold (e.g., variable costs), and fix them at 80% of total sales revenue; however, costs are likely to be considerably higher if there is a major disruption in the export venture.

Major Disruptions

When considering the launch of a new product into a recovering economy, management is likely to consider the worst scenario, namely, major disruptions to the ongoing export venture that could eventually bring harm to the venture itself, as well as to the entire firm and its stakeholders. In a Monte Carlo simulation framework, these major disruptions are likely to be events that are not captured by the normal stochastic modeling of price and quantity we described in the previous two sections. For example, delays in payment, or even default in payment by an import customer, would likely strain the marketing relationship to the point that the relationship would be severed. Similarly, key import customers may become dissatisfied with aspects of the exporter and decide to sever the relationship. Loss of product due to poor infrastructure, corruption, lack of proper product handling, and theft is also a concern. For a perishable food product, lapses in proper product handing could create a food safety scare that may damage brand reputation to the extent that consumer demand for the product is effectively reduced to zero. Furthermore, local and national governmental controls may make it difficult to complete an international business transaction successfully or may disrupt an ongoing relationship with an importer. Other major disruptions may be caused by instabilities in the local and national government, the banking system of the destination country, political strife, and, in the worst case, a resurgence of war.

Given that political risks tend to be much more systematic in nature, Oetzel, Bettis, and Zenner (2000) suggest that political risks are often encompassed in currency exchange rate fluctuations. However, many of the risks outlined are nonsystematic in nature and likely are not captured by exchange rate fluctuations. Indeed, major disruptions are likely to represent unique shocks to the cash flow stream that could create considerable variability of discounted cash flows; these may best be modeled by a jump diffusion process (Richards and Patterson 2004). However, modeling a jump diffusion process requires a considerable amount of historical data (e.g., firm-level export transaction data to the FYR) to pick up and model the shocks that the firm may have realized in the past. For a firm in the initial stages of considering an export relationship to the FYR, or perhaps to any recovering region, data of this nature do not exist. Therefore, we explicitly model major disruptions in the Monte Carlo simulation.

The *Dun & Bradstreet Exporters' Encyclopedia* (see Dun & Bradstreet 2001) publishes information useful for

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exporters, including information on credit and payment conditions, such as local delays and foreign exchange delays. Local delays represent the average time beyond the designated payment terms that an importer in the destination country delays the deposit of payment in its local bank. Foreign exchange delays reflect the average time between the deposit of funds in a local (foreign) bank and receipt of funds by the exporter. Both measures provide at least some information about the nonsystematic risks we discussed previously—namely, risks that affect payment. For Croatia, local delays ranged from one to three months, and foreign exchange delays also ranged from one to three months. Furthermore, Dun & Bradstreet suggested that new import customers should obtain letters of credit, but more flexible terms could be used for established customers. For Slovenia, local delays were reported between zero and two months, and foreign exchange delays were reported between zero and one month. Local and foreign exchange delays were not reported for Bosnia–Herzegovina, but local delays and foreign exchange delays for Ukraine were reported between four and five months, and letters of credit were recommended for all customers, both new and established. Although Ukraine is not part of the FYR and has not recently suffered the atrocities of civil war, it represents a transitioning economy because it is recovering from marked political upheaval; furthermore, it is rated as a very-high-risk country by Dun & Bradstreet (2002). Thus, the information for Ukraine is likely to be similar to that of Bosnia–Herzegovina, though the absence of such data from Bosnia–Herzegovina hints at even greater risk. On the basis of local delays, foreign exchange delays, and the fact that Slovenia is now part of the EU and has suffered little damage during the Yugoslav wars of the 1990s, Slovenia is likely to have the smallest probability of a major disruption; conversely, Bosnia–Herzegovina is likely to have the largest.

In the Monte Carlo simulation, we assume that if a major disruption occurs, a considerable reduction in top-line revenue will be realized. Although many exporters are likely to use some form of product payment insurance, a major disruption could cause serious problems, such as the severing of a customer relationship, which would cause a major loss in income for that year. However, this reduction in top-line revenue is likely to differ from country to country. For example, if a major disruption were to occur in Slovenia, the impact to revenue would be much less severe and temporary than in, for example, Bosnia–Herzegovina. Therefore, we model reduction in revenue using a uniform distribution, ranging between –1% and –10% for Slovenia, –2% and –20% for Croatia, and –5% and –50% for Bosnia–Herzegovina. The uniform distribution is appropriate when modeling ranges in which values within the ranges are assumed to have an equal probability of occurrence. In the case of Bosnia–Herzegovina, for example, if a major disruption were to occur, reduction in revenue would be between –5% and –50%, and any value within this range has an equal chance of being drawn in the simulation. In modeling major disruptions themselves, we use subjective probabilities that incorporate the Dun & Bradstreet local delay and foreign exchange delay measures as guides. For Slovenia, we assume that there is a 95% chance of no major disruption and a 5% chance of a major disruption. For Croatia, we assume that there is a 70% chance of no major disruption and a 30% chance of a major disruption. Finally, for Bosnia, we assume that there is a 60% chance of a major disruption and a 40% chance of no major disruption.

Although top-line revenues are likely to suffer during times of a major disruption, increased costs to the export venture are also likely to be realized. Indeed, the firm will likely incur considerable costs in attempting to collect payment, reestablish customers, negotiate contracts and contingencies, travel, and so forth. Thus, when a major disruption is realized in the Monte Carlo simulation, variable costs increase as well. Similar to the impact on top-line revenue, the costs associated with remedying a major disruption are likely to be considerably less for a more developed country, such as Slovenia, than for a less developed country, such as Bosnia–Herzegovina. As described previously, we assume that variable costs are 80% of revenue and that they increase by 1%–10% for Slovenia, 2%–25% for Croatia, and 5%–30% for Bosnia–Herzegovina in the case of a major disruption; the ranges for the cost increase are represented by a uniform distribution. Again, with Bosnia–Herzegovina as the example, if a major disruption were to occur, costs would increase anywhere between 5% and 30%, and there would be the equal probability of occurrence under the uniform distribution.

Foreign Exchange Risk

Oetzel, Bettis, and Zenner (2000) use shocks in foreign exchange rates (foreign currency/U.S. dollar) as a proxy for political risk. If exchange rates are floating and foreign exchange markets are efficient, the exchange rate between two countries should reflect factors that drive the supply and demand for the foreign currency, including macroeconomic and political factors. It is difficult to model explicitly the changes in value that arise because of general exchange rate fluctuations in a given period (e.g., year). Each individual export transaction is exposed to exchange rate volatility, and this volatility can be managed with various risk management approaches (e.g., Butler 2004; Henley and Sanders 1994; Jacque 1981).

Although we capture routine exchange rate fluctuations in the modeling of price in the Monte Carlo simulation, a bigger concern is how large devaluations in foreign currency relative to the U.S. dollar affect the demand for imports in the destination country. Large devaluations in currency, defined as devaluations greater than 20% (Oetzel, Bettis, and Zenner 2000), are rare events (shocks) and should be modeled as such. The standard deviation around price trend that we described previously is consistent with the standard deviation of relative historical exchange rate changes for the countries examined, but it does not consider explicit shocks to the exchange rate regimes (e.g., Oanda Corporation 2003). Moreover, Bosnia–Herzegovina has a fixed exchange rate mechanism that is tied directly to the euro. Thus, the risk with a fixed exchange rate mechanism is that the foreign government (e.g., the Bosnian government) devalues the currency relative to the pegged currency, disrupting the Bosnian mark/U.S. dollar exchange rate and potentially making U.S. imports more expensive to Bosnia–Herzegovina consumers. Indeed, major devaluations of recent years (e.g., the devaluation of the Argentine peso) has greatly increased the price of U.S. goods and services in Argentina; we revisit this comparison subsequently.

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We specify the potential for exchange rate shocks in the Monte Carlo simulation. From 1995 to 2003, year-to-year exchange rate returns did not exceed 20% for Slovenia; therefore, we do not model exchange rate shocks for this country. However, from 1999 to 2000, the Croatian kuna lost approximately 21% of its value, constituting one major devaluation from 1995 to 2003. Given that the Bosnian currency is pegged to the euro, we use historical exchange rate data for the Argentine peso (1995–2003) to define the probability of a major devaluation in a fixed exchange rate regime. Over this time span, there was one major devaluation in the Argentine peso relative to the U.S. dollar, which occurred in January 2002, from which time the Argentine peso was allowed to float freely relative to the dollar. Following this, we designate that there is a one-eighth chance of devaluation occurring (i.e., from 1995 to 2003, one major devaluation occurred) in both the Croatian kuna and the Bosnian mark relative to the U.S. dollar. If a major devaluation occurs at any iteration of the Monte Carlo simulation, we assume that revenues are reduced by 20%–50% following a uniform distribution, a likely result due to the likely decreased demand for U.S. imports. Again, the uniform distribution is appropriate in this case because a range of values is established, and we assume that all percentages between these ranges have an equal probability of occurrence if a major devaluation is realized. Although a large devaluation in the U.S. dollar relative to these foreign currencies may influence consumers in the importing country to purchase U.S. exports—a likely scenario as the dollar continues to weaken in world currency markets—the more relevant downside risk to an exporter is that of the foreign currency declining in value relative to the U.S. dollar.

Results

Table 1 presents the estimated σ for Slovenia (.369, or 36.9%), Croatia (.419, or 41.9%), and Bosnia–Herzegovina (.716, or 71.6%). Not surprisingly, Bosnia–Herzegovina has the highest standard deviation of annual discounted cash flows. Indeed, although any export venture is risky, most exporters would view a 72% annual standard deviation in discounted cash flows as an indication of unruly risk at best. However, the consideration of the real-options value in light of this risk provides considerable insight into the inherent value of this volatility, especially in the presence of managerial flexibility.

To make the results general and ultimately to draw policy and marketing implications from the real-options values estimated, we assume the following for the chooser option: The present value of future cash flows, S_0, is \$100,000. Therefore, from a static NPV perspective, if S_0 is greater than the initial investment for the export venture, NPV is positive, and management should engage in the project. For the option to abandon, we assume that the salvage value is \$50,000. If management deems a pullout to be necessary over the six-year initial life of the venture, the firm will be able to recover or save \$50,000 from its actions. In considering the option to expand, we assume that the expansion factor, α, in Equation 5 is 2 and that expansion costs, c, are \$50,000, such that expansion efforts will realize a twofold increase in sales but cost the firm an additional \$50,000. Similarly, in considering the option to reduce or contract marketing efforts, β in Equation 6 is .5, so that a reduction in marketing efforts will realize a decrease in sales by 50% but will come at a cost savings, s, of \$25,000. Each individual exporting firm will have its own costs and unique assumptions for the chooser option, depending on the specific design for the project as determined before engaging in the venture, but the general assumptions we present here, with the estimates of σ presented in Table 1 for Slovenia, Croatia, and Bosnia–Herzegovina, provide baseline real-options values that can be further examined.

Table 2 presents the real-options values for export ventures to Slovenia, Croatia, and Bosnia–Herzegovina based on the foregoing assumptions. The real-options value is \$70,090 for Slovenia, \$74,010 for Croatia, and \$96,707 for Bosnia–Herzegovina. For illustrative purposes, Figure 3 shows both the underlying and the equity lattice for the case of Bosnia–Herzegovina; the real-options value of \$96,707 is the difference between the initial node on the equity lattice and the initial node on the underlying lattice, respectively. Consistent with option pricing theory (e.g., Black and Scholes 1973; Cox, Ross, and Rubinstein 1979; Hull 2000), the larger the σ, the larger is the real-options value, when all other factors are held constant. These results confirm this theory and, if we hold all other assumptions constant, show that the export venture with the highest estimate of σ (Bosnia–Herzegovina) has the highest real-options value, whereas Slovenia, the least risky venture, has the lowest. Moreover, the results are compelling from an export marketing and development perspective; indeed, they suggest that there is considerable value in the presence of risk, especially if management has the ability to adapt to this risk through flexible marketing strategies. Indeed, flexible project designs provide greater real-options value than projects

Table 1. Estimates of σ from a Monte Carlo Simulation for Slovenia, Croatia, and Bosnia–Herzegovina

	σ
Slovenia	.369
Croatia	.419
Bosnia–Herzegovina	.716

Table 2. Estimated Real-Options Values for Slovenia, Croatia, and Bosnia–Herzegovina

	Real-Options Value
Slovenia	\$ 70,090
Croatia	\$ 74,010
Bosnia–Herzegovina	\$ 96,707
Baseline Assumptions	
Present value of future cash flows	\$100,000
Cost savings from option to abandon	\$ 50,000
Increased costs from option to expand marketing efforts	\$ 50,000
Expansion factor (α)	2.00
Cost savings from option to scale back marketing efforts	\$ 25,000
Contraction factor (β)	.50

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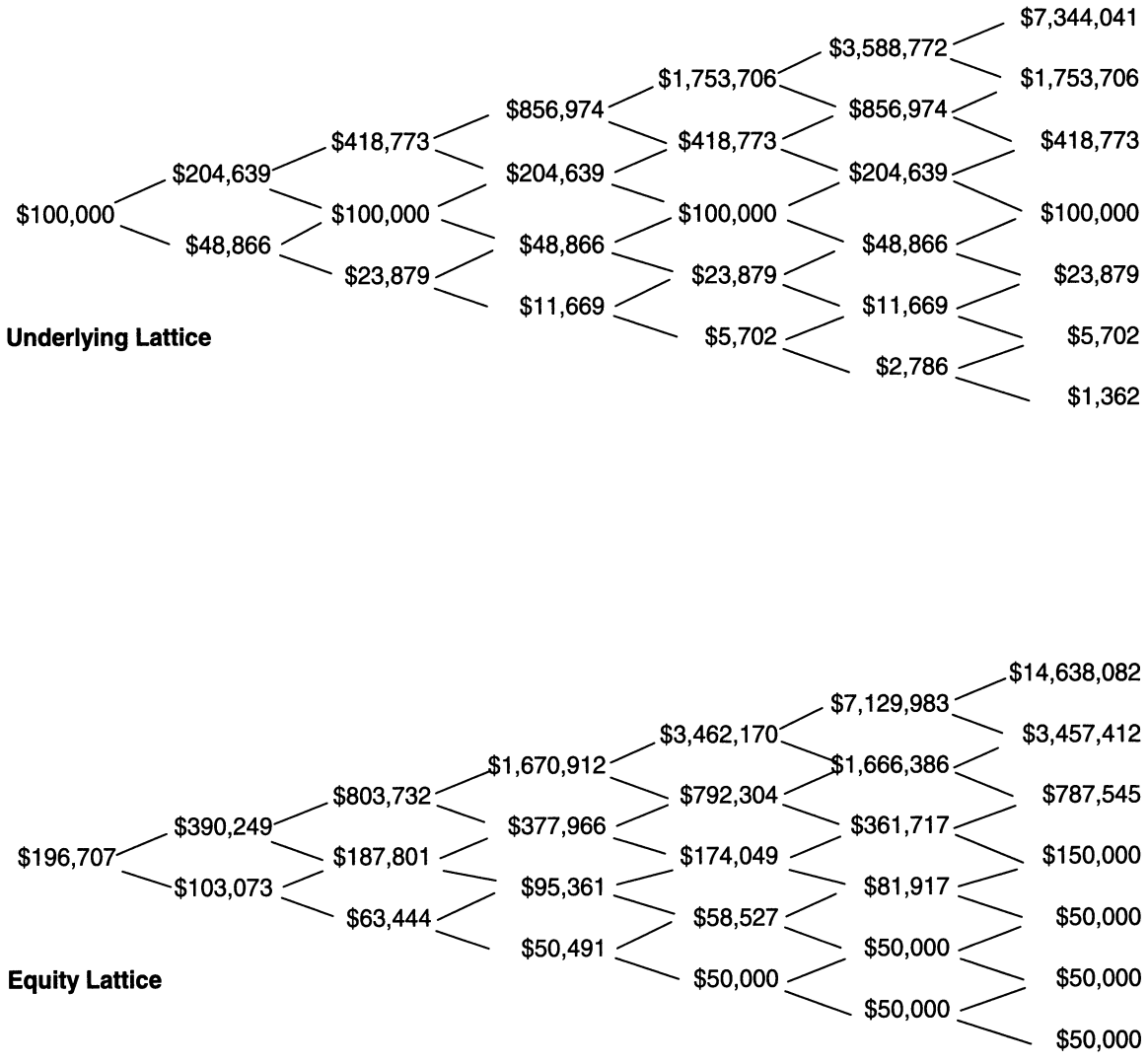
Figure 3. Underlying Lattice and Equity Lattice Using Baseline Assumptions: Bosnia–Herzegovina



with fewer built-in options. This value is not considered by traditional static NPV analysis. Intuitively, riskier projects have larger real-options values because management has the flexibility to respond to this risk. Therefore, it is important to remember a true definition of risk—that is, the variability of outcomes. Accordingly, risk can be valuable because upside risks result in positive outcomes to the firm and its customers, and management may indeed be able to weather downside risks through proper risk management and the flexibility to respond.

For Bosnia–Herzegovina, for example, if an exporter determined that the NPV of an export venture to Bosnia–Herzegovina was $100,000, the true value of the project, considering the combined options to abandon, expand, contract, or stay the course, would make the project more valuable than previously considered ($96,707 more under these baseline assumptions). Similarly, if the project were deemed to have a negative NPV—for example, a negative NPV of $50,000—the true value of the project would be a positive $46,707 if the real-options value were considered, making the project financially feasible. Regardless of the assumptions made, these results show that there is a clear economic advantage to taking risks, and the risks of an export transaction with a recovering economy should be valued accordingly to make a more accurate assessment of the costs and benefits of such a venture. Exporters that are risk takers and are exceptionally skillful at adapting to changing market conditions and, at times, to unruly risks are likely to find these *ex ante* real-options values compelling. Similarly, exporters that are highly educated on the business and marketing practices of the region are likely to maneuver better through the myriad risks associated with exporting to a country such as Bosnia–Herzegovina (and, implicitly, other recovering economies) and thus will likely find the *ex ante* real-options value of the project as an extra incentive to begin an export venture into the country. However, the existence of this *ex ante* real-options value is conditioned on the premise that flexibility in responding to risk indeed exists and is ensured.

Although the relationship between volatility and real-options value is clear, important marketing and policy implications can also be drawn through a careful examination of the other assumptions that define the chooser option. Table 3 presents the baseline real-option value for Bosnia–

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Table 3. Changes in Real-Options Value (Chooser Option) for an Export Venture to Bosnia–Herzegovina Resulting from Changes in Baseline Real-Options Assumptions

Real-Options Assumptions		Changes in Real-Options Assumptions and the Real-Options Value from the Baseline				
Cost savings from option to abandon		$ 0	$ 25,000	**$ 50,000**	$ 75,000	$100,000
Real-options value		$ 87,994	$ 87,944	**$ 96,707**	$109,342	$122,237
Increased costs from option to expand marketing efforts		$ 0	$ 25,000	**$ 50,000**	$ 75,000	$100,000
Real-options value		$110,620	$103,664	**$ 96,707**	$ 89,869	$ 83,140
Expansion factor (α)	.00	1.00	1.50	**2.00**	2.50	3.00
Real-options value	$17,772	$ 17,772	$ 50,456	**$ 96,707**	$143,304	$189,900
Cost savings from option to scale back marketing efforts		$ 0	**$ 25,000**	$ 50,000	$ 75,000	$100,000
Real-options value		$ 96,707	**$ 96,707**	$100,456	$113,655	$128,481
Contraction factor (β)		.00	.25	**.50**	.75	1.00
Real-options value		$ 96,707	$ 96,707	**$ 96,707**	$ 96,707	$ 96,707

Notes: Numbers that are in bold and underlined represent the baseline real-options assumptions. The number in bold ($96,707) represents the baseline real-options value, incorporating the baseline assumptions. All other underlined numbers represent deviations from the baseline assumptions, with subsequent changes in the real-options value below the respective number. For example, changing the cost savings from the option to abandon to $25,000 from $50,000 (baseline) lowers the real-options value of the chooser option to $87,944, if all other assumptions are held constant at their baseline values.

Herzegovina ($96,707) and then considers how the real-options value would change given changes in real-options assumptions, all else being equal. In the abandonment option, there is a positive relationship between the money saved from abandoning the export venture and the real-options value. For example, if the savings from abandonment were $100,000, the real-options value would be $122,237. If there were no value to the firm to abandon the export venture after it engages in it, the real-options value would still be substantial at $87,994 considering the chooser option, even though the abandonment option on its own would be worthless. This result suggests that the combined options to expand and/or contract marketing efforts are more valuable in the presence of risk than the option to abandon the export venture. Under the presented scenario assumptions, at least $28,000 in cost savings must be realized before the abandonment option contributes to the value of the chooser option.

Indeed, the option to expand in the face of risk is most valuable from a real-options perspective. Varying the expansion factor from two times sales to three times sales raises the real-options value to $189,900, almost doubling it. At the other extreme, if no additional sales are realized when additional marketing efforts and marketing costs are undertaken, the real-options value declines dramatically to $17,772. If market share expands by 50% because of these increased efforts, the real-options value increases considerably to $50,456. Similarly, in the context of the option to expand marketing efforts, the lower the costs of this market expansion, the higher is the real-options value, if we hold all other assumptions constant at the baseline levels. If sales are assumed to double but no additional marketing costs are realized, the real-options value rises to $110,620 from the baseline of $96,707, for which $50,000 in additional marketing costs are assumed; this represents an increase of $13,913 in real-options value. Furthermore, if expansion costs are assumed to be $100,000, the real-options value declines to $83,140, a difference of –$13,567 from the baseline. When the factors underlying the expansion portion of the chooser option (the option to expand marketing efforts) are considered, the assumption related to additional market share drives the bulk of the real-options value.

Perhaps the most notable result, however, comes from considering how the real-options value changes as a result of the changes in the assumptions underlying the option to contract or scale back marketing efforts. Here, the real-options value does not change as the contraction factor varies from zero to one, confirming an obvious result that losing market share does not contribute to real-options value. Note, too, that the savings realized from the choice to scale back marketing efforts must be substantial to illicit a change in the real-options value. Under the presented assumptions, the cost savings from scaling back marketing efforts need to be greater than $39,000 before the real-options value of the project increases relative to the baseline value of $96,707. Indeed, as the cost savings from scaling back marketing efforts increase, so does the real-options value. The value obtained from the option to expand marketing efforts dwarfs that of the option to contract marketing efforts. Even at a fairly extreme contraction of sales, .25, and $50,000 realized in cost savings, the value of the expansion factor assumed must be less than 2 to achieve any increase in the real-options value from a contraction of marketing efforts.

Imperative Redux: The Coordination of Marketing, Finance, and Public Policy

Economies recovering from catastrophes are risky markets in which to invest, but investment in them is vital for recovery. Therefore, policy makers and marketers must find and use tools to understand investment risk and stimulate invest-

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ment to the immediate and long-term benefit of numerous stakeholders. Unfortunately, given the depth and breadth of devastation from many catastrophes, extant fears, and simply "easier" or "safer" investment opportunities, even if a helpful export venture is initially deemed to be feasible on the basis of traditional evaluation metrics, decision makers likely would not support such a venture. The real and perceived risks of conducting business in a recovering economy may overshadow any potential opportunity; management is likely to view the project as being too risky. These factors and the subsequent choice not to invest in markets ravaged by catastrophe clearly retard societal recovery, resulting in additional hardships and suffering. However, considering the real-options value when evaluating the financial feasibility of an export venture should provide an additional incentive for firms to adopt such a risky venture beyond traditional risk assessment and moral imperatives. Examining and measuring the risks and, ultimately, the real-options value of, for example, export marketing to FYR provides substantial insights for marketers who are considering similar ventures and also provides guidance to policy makers who are charged with assisting recovering economies.

Key to understanding the real-options value of any export or FDI project to a recovering economy is the efficient assessment and estimation of the variability of future cash flows to the project. We appreciate that some readers may find this statement to be rather callous. However, the realities of donor fatigue, resource scarcity, and the probability of future catastrophes suggest that the private sector, including marketing firms, must have financial incentives to invest in currently recovering economies.

The most meaningful risk assessments probably arise from longitudinal field research in the recovering country or area of interest (e.g., Shultz et al. 2005), but most managers who are pressed for time and forced to make decisions in the absence of data will likely not opt for this labor-intensive and time-consuming method. We submit that deterrents to extensive fieldwork or the lack of data to make volatility estimates need not be obstacles to the estimation and consideration of the real-options value. The framework we presented in this research provides a logical, efficient, and robust method to forecast the variability (risks) associated with investment projects in recovering economies. Indeed, in the absence of data, it provides a tool (1) to make reasonable assessments of risk; (2) to enable potential investors to attach value to risk; and, ultimately, (3) to stimulate investment in recovering economies, which is paramount for optimal recovery and is to the benefit of marketers, policy makers, and citizen stakeholders of the devastated country or region.

Market environments with high levels of risk indeed contain considerable real-options value. This is especially true if the investment is considered in terms of conditional responses to uncertainty, provided that management maintains the flexibility to respond to the uncertainty. In the context of an export marketing venture to the countries of Slovenia, Croatia, and Bosnia–Herzegovina, these conditional responses are assumed to be the combined option to abandon the project, to expand marketing efforts, or to scale back marketing efforts. Bosnia–Herzegovina, the FYR struggling most to emerge from the devastation of war, has the highest measured risk and, therefore, the highest real-options value in the presence of managerial flexibility. The highest-risk projects inherently carry the highest real-options value, which argues for marketing strategies that are flexible in the presence of this risk and ensure this flexibility, such that real-options value is preserved. For example, specific marketing strategies, such as strategic alliances, should contain enforceable language that enables management to respond to uncertainty. Ultimately, marketing and public policies that favor FDI should reward flexibility and readiness to respond to both good and bad outcomes that may arise during the course of conducting business in a recovering economy. Moreover, investments and investment incentives invoked by policy makers should facilitate market entry and should target sectors that are vital to individual and societal welfare. A few sectors come to mind as possible examples: food and agribusiness, health care, communications technologies, and other industries that connect citizens and institutions to local and global marketing systems that tangibly enhance socioeconomic recovery. A commonality among them, aside from a demonstrable impact on consumer and societal value, is that return on investment is likely or certainly possible, even if the investment environment deteriorates.

Our results indicate that the option to expand the export marketing venture after it has been initiated contributes most to the value of a chooser option. As we described in the previous section and in Table 3, real-options value increases commensurate with the assumption about increased market share from expansion and is inversely related to the cost of the expansion. Therefore, "lean" marketing strategies that promote rapid market expansion and penetration at a reasonably low cost should be designed and implemented. These are likely strategies that also would benefit from first-hand knowledge of local market conditions, solid relationships with customers and other decision makers in the importing country, and policies that foster a certain level of business risk taking (e.g., export guarantee programs designed to foster trade and development) in recovering economies.

Although an option to expand contributes greatly to the value of the chooser option, an option to abandon the export venture completely could also be valuable; this is particularly true when the cost saving or cost recovery realized from abandonment is higher. This result suggests that there are strong benefits from policies that focus on attracting initial investment compared with policies that encourage large-scale capital investments in the recovering region. Again, the aforementioned sectors come to mind as examples. Capital investments in factories, processing facilities, distribution centers, or other fixed assets may not be salvageable if the venture needs to be abandoned. Conversely, marketing ventures that rely more on leasing arrangements, strategic alliances with local partners, and other strategies that are variable-cost intensive versus fixed-cost intensive potentially provide greater value to the option to abandon in the context of the chooser option. Although the option to abandon contributes to the overall value of the chooser option, the impact of the option merely to scale back marketing efforts is the least valuable; the option to scale back marketing efforts is valuable only if the cost savings from doing so

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are substantial. Given these contingencies and the inevitable impact on the marketing system (especially suffering humans), policies should be developed to reward companies for staying the course and being aggressive with their marketing efforts to abet recovery, even in the face of risk.

Finally, we reemphasize that this framework can be applied to several contexts—for example, in the recovering economies in the Middle East, Central Asia, Sri Lanka, Banda Aceh, and even New Orleans. The factors driving the variability of the discounted cash flows over the initial life of the venture are likely the same. Furthermore, considering the real-options value of any venture in the wake of catastrophe may help convince policy makers to provide incentives for marketing companies to trade with and conduct business in recovering economies. Increased commercial activity will create more uniform and effective systems, enhance efficiencies, and more broadly lead to win–win outcomes for investing firms, as well as the suffering consumers and marketing firms in the countries and areas recovering from catastrophe.

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