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

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In press at Journal of Public Policy & Marketing. Please cite accordingly.

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Abstract
Recovery from societal and market catastrophe is a daunting process requiring multi-function, systemic, and long-term efforts. Humanitarian aid and donor assistance rarely are sufficient. Trade and other forms of direct investment in devastated markets offer another kind of recovery-assistance. Risks encountered in recovering economies however can deter firms wishing to invest. A real options framework is applied to examine the financial feasibility of trading with recovering economies; the framework is applied to the countries of the war-disintegrated, former Yugoslavia. The real options framework considers the value of managerial flexibility in the presence of risks. Implications for policy, marketing management and export development, and ultimately economic and societal recovery in a number of contexts are discussed.
Risk, Trade, Recovery, and the Consideration of Real Options: The Imperative Coordination of Policy, Marketing, and Finance in the Wake of Catastrophe

Tsunamis, hurricanes, earthquakes, mudslides, 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 nations, and institutions such as the Red Cross, Red Crescent, and UNHCR. Aid and assistance however are inadequate for large-scale market reconstruction, full societal recovery and long-term welfare. Resource-strapped agencies are unable to meet all 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 seen with reconstruction efforts vis-à-vis 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). Other mechanisms for market and society reconstruction therefore must be implemented.

Full or optimal recovery requires long-term commitments and coordinated orchestration by numerous institutions, including governments, NGOs, businesses / 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. *The Economist* (2005, pp. 51-52), referring to recovery efforts in the wake of the recent tsunami, noted 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 often neglect important infrastructure projects such as roads, ports, and sewage. Conditions generally deter private sector investment, vital for enterprise-creation, jobs, and socio-economic development. Devastated areas that would most benefit usually are seen as too risky by potential investors interested in important infrastructure projects and other forms of engagement. This is especially true in war-ravaged and politically volatile areas, where catastrophe can exacerbate tensions, often making them even less inviting. Since further conflict is possible, and still more destruction and suffering subsequently 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. Recovery from catastrophe therefore requires a skillful melding of policy, market understanding and risk assessment, financial services and markets, and marketing practices, if we are to rebuild sustainable marketing systems as evinced by prosperous and peaceful societies.

In this paper, 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 CFP for this special issue, principally 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 2005). We contend, perhaps counter-intuitively, there are some inherent advantages to risk and instability, if there is flexibility to respond to this uncertainty. Risk and instability therefore actually can expedite domestic or foreign direct investment (FDI), to the benefit of marketing firms as well as 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 also are rebuilding economies are risky markets. There is considerably more risk endemic to the process of marketing to/with/in these markets and to managing value chains, from source to consumer, than in markets not recovering from war (Kwok and Reeb 2000). Risk interestingly has been revisited as a scholarly focal point for marketing and public policy, though largely studied toward a consumer’s perspective (e.g., Johnson 2004). We expand the perspective by taking a cross-disciplinary tack; that is, we look at 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, the human element that causes and sustains them, and accordingly because they likely are the most difficult catastrophes from which to recover. Other catastrophes, moreover and as hinted earlier, can slip into armed conflict and other forms of violence, resulting in more death and destruction. This possibility was/is true of Banda Aceh, Sri Lanka (both devastated by a 2004 tsunami), and even New Orleans (more recently damaged by Hurricane Katrina). Strategies, tactics and solutions for war-recovery thus likely can be leveraged to provide relief and recovery efforts from other catastrophes.
More specifically, we examine the amalgam of factors affecting risk and recovery in Bosnia-Herzegovina, Croatia, 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 (Miller, 1992; Kwok and Reeb, 2000),\(^1\) which in turn will affect pace and scope of recovery. Despite compelling reasons to enter such markets -- e.g., pent-up consumer demand, market size, and 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 levels of risk are unacceptable.\(^2\) While commercial country risk measures are generally helpful in providing broad insights into political and economic conditions, they have been found to have little power in actually predicting periods of intense instability or unique opportunity (e.g., Oetzel, Bettis, and Zenner 2000).

Though 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 a number of strategies that companies may employ when 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 first believed. Real options analysis, also known as contingent

\(^1\) These are just a few risks to which exporters and other international marketers may be exposed. See Miller (1992), Kwok and Reeb (2000), and Flynn, et al. (1994), and Reeb, Kwok, and Baek (1998) for a further delineation and classification of risks faced by firms doing business in international/foreign markets.

\(^2\) This conclusion is based on a series of depth interviews (McCracken 1988) by the authors, over a twelve year period, with members of the food value chain, government authorities, trade associations and NGOs, throughout the region, in the US and in the EU. We add, however, that exports and other forms of trade and investment should not be limited to food.
claims analysis, is a framework that can be used to value managerial flexibility in the presence of uncertainty (e.g., Dixit and Pindyck 1994; Copeland and Keenan 1998), and has been suggested for valuing marketing strategy (Ward and Ryals 2001; Dias and Ryals 2002). 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 US food enterprises intend to invest in more markets replete with more risks, then they need a way to evaluate more appropriately marketing relationships in the presence of uncertainty – uncertainty that at times may be unruly (Thomas 2001). This is particularly true when considering an export venture to FYR and other recovering economies. While all export ventures are exposed to uncertainty, the lingering perception of instability and war in these countries may be the largest 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, then they may be more inclined to engage these countries despite considerable uncertainty. Engagement, in turn, 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 an export venture to the region may also stimulate policies that help promote trade with the region, and trade with recovering economies more generally, thus expediting recovery.

In light of the preceding text, an objective of this research is to evaluate the real options value of potential investment 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 where scant data are actually 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 which capitalize on maintaining managerial flexibility in the presence of risk. We specifically examine the case of an enterprise evaluating the feasibility of entering the recovering countries of Bosnia-Herzegovina, Croatia, and Slovenia. These three countries are examined given the likely differences in both real and perceived risks of doing business throughout the FYR.

While 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 itself in profound disruption of infrastructure, production, and distribution capabilities – as well as further exacerbating 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 EU trading partners. Furthermore, this research presents a framework that can be adapted by managers not only considering export ventures to FYR, but also to other recovering countries. In this spirit, it is hoped that managers and policy makers will appreciate the options value of these potential investments, leading to additional trade in recovering economies, and ultimately win-win incentives to sustain peace and prosperity through mutually beneficial commerce.
The remainder of our paper is organized as follows. First, we examine the recent literature on applications of real options, and apply a methodology for crafting a real options problem allowing for 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 from doing business in Slovenia, Croatia, and Bosnia-Herzegovina. Third, we estimate and present the real options value of doing business in each of these countries using general assumptions, and then 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 and recommendations into 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 how the value of these real options adds considerable information to the decision and policy making process when considering risky export ventures.

Real Options Analysis

Discounted cash flow analysis is the standard tool for evaluating financial feasibility of real investments (Brigham and Houston 2002). If the discounted future cash flows from a project are greater than the initial investment, the net present value (NPV) is positive suggesting that economic gains to the firm would be realized if the project or investment were adopted. While the risk of the project is typically accounted for by using 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, or over, a specified time 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 time 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 value 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 driving 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; Merton 1973; Hull 2000). For example, the longer the time that one can invoke the option, the greater the option value; the more volatile the underlying asset, the more valuable the option. Indeed, as shown 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.

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\(^3\) 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). While this research has helped foster the multi-billion dollar financial derivatives industry, it also has allowed both scholars and practitioners to apply similar option pricing methods in valuing real options – the option value inherent in real investment decisions (Dixit and Pindyck 1994).
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 Copeland and Antikarov 2001; Amram and Kulatilaka 1999; 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 considering a new venture into a recovering economy. Richards and Patterson (2002) furthermore demonstrate that the uncertainty related to marketing commodity exports can have significant value.

Real options analysis indeed provides an ideal framework for considering risky investment decisions, such as the decision whether to trade with a recovering economy. Instead of viewing uncertainty as a “bad,” real options analysis views the ability to deal with uncertainty as a “good.” The value of managerial flexibility, such as the option to expand or contract marketing efforts once the investment is initiated, must be considered in addition to the net present value (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, the specific case of a food company considering investment in a trading venture with the recovering economies of Slovenia, Croatia, and Bosnia-Herzegovina is developed.
Methodology

Similarly to other marketers (e.g., Franses 2005; Wittink 2005), we see some utility in modeling to assist marketing and policy decision making. Development and articulation of our model, and subsequent applications follow.

Crafting and Valuing Real Options

In considering the financial feasibility of entering an export venture to a recovering economy, managers are likely to rely on discounted cash flow analysis, namely Net Present Value analysis (NPV). The NPV is calculated as:

\[
NPV = \frac{-INVEST}{(1+i)^1} + \frac{CF_1}{(1+i)^2} + \cdots + \frac{CF_n}{(1+i)^n},
\]

where \(-INVEST\) is the initial investment in the project, \(CF_t\) is the incremental cash flow at time period \(t\) (\(t = 1 \text{ through } n\)) and \(i\) is the risk-adjusted discount rate.\(^6\) The appropriate risk-adjusted discount rate used by a firm is dependent on many factors, including the firm’s cost of capital, debt structure, market risk, as well as the perceived risks of the project examined.\(^7\) That is, adjusting discount rates for risk reduces the present value of future cash flows, providing a more conservative NPV assessment. While 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

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\(^6\) The use of risk-adjusted discount rates for international projects is consistent with the findings of Reeb, Kwok, and Baek who suggest that despite reductions in systematic risk from diversification, risk-adjusted discount rates are justified for international projects.

\(^7\) See Brigham and Houston (2004) for discussion and methods for estimating risk-adjusted discount rates in capital budgeting.
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, providing the business, in theory, with an instantaneous increase in wealth through the adoption of the venture. Even in situations where NPV is projected to be positive, management may still be reluctant to engage in an export venture to a country that is recovering from war, due to 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 regarding the true value of this potential investment. Considering the real options value of the investment, in conjunction with the standard NPV, not only provides 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:

\[ NPV + \text{Real Options Value} \]

Slovenia, Croatia, and Bosnia-Herzegovina are considered to illustrate the differences in real options value. For example, the Slovenian economy is very robust; strong enough to join the European Union in 2004. This is mainly due to the fact that 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. While there are conceivably numerous options that can be valued in the context of a firm considering an export venture to these countries, the specific real options problem examined and applied here is that of the option to
choose among various courses of action once the venture is initiated, 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.8 While 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) to be six years. While undoubtedly management would 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 examined.9 Another important consideration for real options value, especially when considering an export venture to a country recovering from devastation, is that flexibility in managing the venture be 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 which promote flexibility and risk taking (e.g., export credit guarantees). If managers do not have flexibility to respond to risk, then real options value essentially disappears.

Given the complex nature of a chooser option, a binomial option pricing model using risk-neutral probabilities is used (Cox, Ross, and Rubinstein 1979). For complex options such as the one outlined here, binomial methods are more flexible, They are more intuitive and easier to convey to management and other decision makers relative to closed form solutions and differential equation methods (Dixit and Pindyck 1994; Mun 2002; Richards and Patterson

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

9 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.
When using binomial methods 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 (S₀), 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).

The binomial lattice for the underlying asset, S₀, is shown in Figure 1 and is developed following the specification presented by Hull (2000). Here, the underlying asset S₀ 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 defined as:

\[ u = e^{\sigma \sqrt{\Delta t}} , \quad d = e^{-\sigma \sqrt{\Delta t}} = \frac{1}{u} \]

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. Assuming only one time step per year, Δt = 1.\(^{11}\) Note that the down factor, d, is also the inverse of the up factor \((\frac{1}{u})\). Thus, the underlying lattice in Figure 1 illustrates how S₀ 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 presented in Figure 1, to find the real options value. Following the

\(^{10}\) Hull, as well as Mun, shows that binomial methods should provide very similar real options to closed form solutions (e.g., Black-Scholes pricing methods). In fact, in the limit, binomial and closed form methods should equal (Hull).
procedures of Mun (2002), the end nodes of the equity lattice reflects 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:

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

where $\Phi_1$ through $\Phi_4$ reflect the net value to each of the options considered. For $\Phi_1$, the net value of the option is simply the salvage value that would be obtained from abandonment. That is, it is assumed that the firm can recover at least a portion of its yearly variable production and marketing costs. For the value of the expansion option, $\Phi_2$, the value is:

(5) $\Phi_2 = \alpha_{\eta_i} - c$

where $\alpha$ is the amount that sales are expected to expand (e.g., $\alpha = 2$ would indicate a doubling of sales), $\eta_i$ 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, $\Phi_3$ can be expressed as:

(6) $\Phi_3 = \beta_{\eta_i} + s$

where $\beta$ is the amount that sales are expected to contract from the scaling back efforts (e.g., 0.5 would indicate a reduction of sales by 50%), and $s$ represents the cost savings from reducing

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11 The term $\sqrt{\Delta t}$ is an adjustment to annualize the standard deviation, $\sigma$. 

14
marketing efforts. Finally, the option to stay the course, $\Phi_4$, is merely the value in the corresponding node of the underlying lattice ($\eta_i$).

After the end nodes of the equity lattice are calculated, backward induction is used 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, the calculation of risk-neutralized probabilities is necessary. Using both the up and down factors examined in equation (3), the probability of an up movement on the binomial lattice is equal to:

\[
(7) \quad p = \frac{e^{\Delta r} - d}{u - d}
\]

where $e$ is the exponential function, $r$ is the risk-free interest rate, $\Delta t$ 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 $1 - p$. Using these risk-neutralized probabilities and backward induction, each of the intermediate nodes can be expressed as:

\[
(8) \quad \text{Max}[\Phi_1, \Phi_2, \Phi_3, \Phi_4, \Omega]
\]

where $\Phi_1, \Phi_2, \Phi_3, \Phi_4$ are defined as before, and $\Omega$ is:

\[
(9) \quad \Omega = e^{-r\Delta t} \left[ pV_u + (1 - p)V_d \right]
\]
where $e$ again 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 considering 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, $V_0$, and the static present value of the future cash flow stream, $S_0 (V_0 - S_0 = \text{Real Options Value})$.\(^{12}\)

Indeed, it is $\sigma$ that ultimately drives the real options result. From options pricing theory, a positive relationship is known to exist between volatility ($\sigma$) and the value of an option. While at first glance this suggests that highly risky projects imply greater real options value, this is not the case. Ex ante real options value only exists if there is flexibility in the project design itself such that management can respond to uncertainty. If this flexibility does not exist, then the option value is essentially zero. Real options value ex post (after the project is engaged) furthermore 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 $\sigma$, usually based on historical data, are also needed to adequately assess real options value. However, deriving estimates of $\sigma$ associated with the cash flows of a new export venture to a recovering country is difficult given there is likely no history of similar transactions, and an overall paucity of publicly available, high quality data to derive

\(^{12}\) Binomial option pricing methods incorporate re-combining lattices (Cox, Ross, Rubinstein 1997; Hull 2000). Therefore, it is important to not confuse the binomial option pricing method shown here, which is explicitly used to
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 utilized to robustly capture the likely risks associated with an export venture to FYR in an estimate of $\sigma$.

The binomial option pricing model presented above 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 traditional decision tree analysis often used in project valuation. While binomial option pricing and decision tree analysis appear similar, they are quite 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 and benefits and probabilities associated with each outcome and each node of a decision tree lattice provide critical information to the decision maker. In fact, 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 (as shown above) can be used to value certain real options that may be available at different decision nodes in a comprehensive project design.$^{13}$ It is important to remember,

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$^{13}$ Mun (pp. 242 – 245) 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 for conducting complex project decision and decision analysis.
however, the differences between relating options pricing as described above to actual project design and implementation.

**Monte Carlo Simulation for Estimating Risk**

In the context of international trade, there are numerous factors that are likely to create variability in the project’s cash flow stream. Researchers have suggested many alternative ways to classify these risks (Miller 1992; Flynn, et al. 1994; Reeb, Kwok, and Baek 1998). For instance, Miller (1992) takes a general management view towards risks, developing three major categories of interrelated uncertainties – general environmental uncertainties, industry uncertainties, and firm uncertainties.\(^{14}\) General environmental uncertainties focus on factors affecting 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, he develops sub-classifications reflecting risk factors specific to the industry that the firm operates - namely uncertainties arising from the input market, 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 relate to the numerous risk factors that are firm-specific including delays in payment, culture-based misunderstandings, unreliable third parties, transportation bottlenecks, problems with customs brokers, or other issues which may disrupt product flow and payment.

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\(^{14}\) Flynn et al. (1994) and Reeb, Kwok, and Baek (1998) provide alternative classifications of risk, but are similar in concept to the taxonomy of risks provided by Miller (1992).
Interestingly, Flynn, et al. (1994) note that many view the general environmental uncertainties presented by Miller (1992) to be the most important drivers of volatility, encompassing many if not most of the risks described above. In fact, it is likely these risks that most managers immediately consider when evaluating the decision to introduce a new product to a recovering region. While numerous commercial rating services provide political risk assessments and related information designed for exporters, which attempt to gauge these risks (e.g., Dun and Bradstreet), according to Oetzel, Bettis, and Zenner (2000), these country risk measures, while generally informative, provide little value in predicting periods of major instability in a country. While it is clear that numerous risks drive the variability of cash flows, these risks are difficult to quantify and predict with any precision. For instance, what is the probability of war breaking out again in Bosnia-Herzegovina, the chance 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?

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, \( \sigma \), to use in the valuation of real options; they suggest that only three to four key risk drivers 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 drive 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 they will charge for their product, the quantity of the product that they anticipate selling, and the costs associated with producing and marketing the product. These factors are unique depending 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 such that it can be used to estimate the variability of cash flows ($\sigma$) for any export venture to a developing or emerging economy.  

The following baseline assumptions are made in the Monte Carlo simulation, and then the risk factors examined in the next section are applied to this base case depending on the country examined. First, both price and quantity are assumed to be one, such that revenue (price x quantity) is also one. Variable costs to the export venture are assumed to be a fixed 80% of total sales. Since fixed costs do not vary with the quantity of sales, fixed costs are not explicitly modeled. Therefore, the cash flows to the project for each year are assumed to be the revenue – costs. The initial life of the export venture under consideration is also assumed to be six years. The Monte Carlo simulation is conducted using 10,000 iterations, therefore almost every

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

16 Since $\sigma$ 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 $\sigma$. The assumption that both price and quantity equal 1 allows for simplicity in modeling.

17 Accounting revenue arguably does not equal cash flow. Non-cash expenses such as depreciation are routinely added back to net income in determining the relevant cash flows to an investment project. However, the focus of this model is to focus on the variability of cash flows from the exporting venture. Cash flows that are unique
conceivable scenario will be incorporated, providing a robust simulation of the discounted cash flows. Hence, with each draw in the simulation, new values for the cash flows for periods one through six (\(CF_1\) through \(CF_6\)) of the project are estimated, and these cash flows are discounted using a risk adjusted discount rate of 15%.\(^{18}\) From this simulated discounted cash flow stream, \(\sigma\) is estimated as the standard deviation of \(r\) defined as:

\[
(10) \quad r = \ln\left(\frac{PV_1 + CF_1}{PV_0}\right)
\]

where \(PV_1\) is the present value of future cash flows in time period 1, \(CF_1\) is the cash flow (not discounted) at year 1, and \(PV_0\) is the present value of discounted cash flows at year 0. As suggested by Munn (2002) only \(PV_1\) and \(CF_1\) are stochastic in equation (4), while \(PV_0\) 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 the standard deviation of this distribution, \(\sigma\), is used in the binomial option pricing model. Given this baseline model, the following major risk factors are incorporated considering export ventures to Slovenia, Croatia, and Bosnia-Herzegovina; they are price, quantity sold, major disruptions, and foreign exchange risks. How these factors are modeled is described in the following sections.

**Price**

Price is designated as a stochastic input variable in the Monte Carlo simulation. For each country modeled, the initial export selling price of $1.00 is assumed to grow 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

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relative to firm’s accounting practices, such as depreciation, are firm specific and are not likely influenced by risks inherent in exporting to an emerging market.

\(^{18}\) To focus on the primary factors that drive the variability of the cash flows from the export venture only, the risk adjusted discount rate is assumed fixed at 15%. This risk-adjusted discount rate is used for illustrative purposes. A
and importing country. However, a distribution around the trend inflation rate of 4% is established to account for uncertainty in this price point over time. The distribution around the price trend is assumed to be lognormal, with the mean of the distribution set at the previous period’s price, and the standard deviation of the distribution being the standard deviation of historical exchange rate returns of the specific importing country (foreign currency / U.S. $) for the period 1995 to 2003 (13% for Slovenia, 12% for Croatia, and 8.8% for Bosnia-Herzegovina). The distribution around the trend is assumed to be lognormal since (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. While it is 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 a variety of factors, namely exchange rate volatility. In fact, 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 their invoice price to the importer to keep prices in the importing country stable. As well, it is likely that over time the exporter will need to adjust prices to account for changes in

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firm’s unique risk adjusted discount rate is a function of their cost of capital, capital structure, market risk, and project risks.
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 a number of factors.

**Quantity Sold**

Quantity sold is also designated as stochastic in the Monte Carlo simulation. It is likely to fluctuate greatly over time due to a number of 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, etc. Large currency devaluations in the importing country moreover may cause local demand for the product to fall greatly, thus reducing the quantity of 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.

Starting with the quantity sold as one (1), quantity sold through time is allowed 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. These growth trends are assumed for each of the countries examined. For rapid growth, the growth rate is designated as a uniform distribution where 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 –10% to -1% for declining growth. So, 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. While

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19 Prior to 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
there may be instances where management has information or past experiences suggesting that
the distribution of potential growth rates are not uniform, a range of growth rates with equal
probability of occurrence picks up the considerable uncertainty surrounding the quantity of
goods likely to be sold into a market that is recovering from devastation. Furthermore, a
distribution is placed around the growth trend to account for variability in the trend over time.
This distribution is assumed normal, with the mean being the previous year’s quantity sold, and
standard deviation being 2% for year 1, then increasing 1% annually for years 2 through 6.
Thus, the uncertainty around the trend quantity sold increases as the time horizon increases.
Because there is really 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. While the assumptions regarding the distribution around the trend are
subjective, they do 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 presented 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. Costs, which fluctuate with the quantity of product sold (e.g., variable costs), are also
considered, and are fixed 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 to a recovering economy, management is
likely to consider the worst scenarios. Namely, they are likely to be concerned with major
disruptions to the ongoing export venture that could eventually bring harm to the venture itself,

standard deviation of Euro/$ exchange rate returns from the launch of the Euro in 2002 through 2003.
as well as the entire firm and its stakeholders. In a Monte Carlo simulation framework, these major disruptions are likely to be events not captured by the normal stochastic modeling of price and quantity described in the previous two sections. For example, delays in payment, or even default in payment by an import customer, likely would 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 are also concerns. For a perishable food product, lapses in proper product handing could create a food safety scare that may damage brand reputation to the point where consumer demand for the product is effectively reduced to zero. Furthermore, local and national governmental controls may make it difficult to successfully complete an international business transaction, or 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 non-systematic in nature and likely not captured by exchange rate fluctuations. Indeed, major disruptions are likely to represent unique shocks to the cash flow stream that likely create considerable variability of discounted cash flows, and 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 any recovering region for that matter, data of this nature do not exist. Therefore, we explicitly model major disruptions, in the Monte Carlo simulation.

The *Dun and Bradstreet Exporters’ Encyclopedia* (2001) publishes information useful for exporters, including information on credit and payment conditions such as local delays and foreign exchange (FX) 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 their local bank. FX delays reflect the average time between deposit of funds in a local (foreign) bank and receipt of funds by the exporter. Both measures provide at least some information regarding the non-systematic risks discussed above – namely risks that affect payment. For Croatia, local delays ranged from 1-3 months, and FX delays also ranged from 1-3 months. Furthermore, D&B 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 0-2 months, and FX delays from 0-1 month. Local and FX delays were not reported for Bosnia-Herzegovina, but local delays and FX delays for Ukraine were reported at 4-5 months, with letters of credit recommended for all customers both new and established. Though Ukraine is not one of the FYR, and has not recently suffered the atrocities of civil war, it does represent a transitioning economy recovering from marked political upheaval, and is rated as a very high risk country by D&B (Dun & Bradstreet 2002). Thus, the information for Ukraine is likely similar to that of Bosnia-Herzegovina, though the utter absence of such data from B-H hint at even greater risk. Based on local delays, FX delays, and the fact that Slovenia is now part of the E.U. and suffered little damage during the Yugoslav wars of the 1990’s, Slovenia is likely to have the smallest probability of a major disruption; Bosnia-Herzegovina is likely to have the largest.
In the Monte Carlo simulation, it is assumed that if a major disruption occurs, a considerable reduction in top-line revenue will be realized. While many exporters are likely to use some form of product payment insurance, a major disruption likely will cause serious problems, such as the severing of a customer relationship that will 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 is likely to be much less severe and temporary, relative to, say, Bosnia-Herzegovina. Therefore, reduction in revenue is modeled using a uniform distribution, ranging between -1% to -10% for Slovenia, -2% to -20% for Croatia, and -5% to -50% for Bosnia-Herzegovina. The uniform distribution is appropriate when modeling ranges where values within the ranges are assumed to have an equal probability of occurrence. So, 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, subjective probabilities are used incorporating the D&B local delay and FX delay measures as guides. For Slovenia, it is assumed that there is a 95% chance of no major disruption and a 5% chance that a major disruption would occur. For Croatia, it is assumed that there is a 70% chance of no major disruption and a 30% chance that a major disruption will occur. Finally, for Bosnia, it is assumed that there is a 60% chance of a major disruption, with a 40% chance of no major disruption.

While 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, etc. Hence, 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 is likely to be considerably less for a more developed nation such as Slovenia relative to Bosnia–Herzegovina. As described above, variable costs are assumed 80% of revenue; but increase by 1% to 10% for Slovenia, 2% to 25% for Croatia, and 5% to 30% for Bosnia-Herzegovina in the case of a major disruption, with the ranges for the cost increase represented by a uniform distribution. Again using Bosnia-Herzegovina as an example, if a major disruption were to occur costs would increase anywhere between the range of 5% and 30% with 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. $) 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 macro economic and political factors. It is difficult to explicitly model changes in value arising due to 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 using a variety of risk management approaches (e.g., Jacque 1981; Henley and Sanders 1994; Butler 2004).

While routine exchange rate fluctuations are captured 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
described above is consistent with the standard deviation of relative historical exchange rate changes for the countries examined, but does not consider explicit shocks to the exchange rate regimes (e.g., Oanda Corporation 2003). Bosnia-Herzegovina moreover 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 B-H consumers. Indeed, major devaluations seen in recent years, for instance the devaluation of the Argentine Peso, greatly increased the price of American goods and services in Argentina; we revisit this comparison, below.

The potential for exchange rate shocks are specified in the Monte Carlo simulation. From 1995 to 2003, year-to-year exchange rate returns did not exceed 20% for Slovenia; therefore, exchange rate shocks are not modeled 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, historical exchange rate data for the Argentine Peso (1995 – 2003) is used 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 1/8th chance of devaluation occurring (that is, from 1995 through 2003, one major devaluation occurred) in both the Croatian Kuna and the Bosnian Mark, relative to the U.S. dollar. If at any iteration of the Monte Carlo simulation a major devaluation occurs, revenues are assumed to be reduced by 20% to 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 since a range of values is established, and all percentages between these ranges are assumed to have an equal probability of occurrence if a major devaluation is realized. While 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 $\sigma$ for Slovenia (0.369 or 36.9%), Croatia (0.419 or 41.9%), and Bosnia-Herzegovina (0.719 or 71.9%). Not surprisingly, Bosnia-Herzegovina has the highest standard deviation of annual discounted cash flows. Indeed, while any export venture is risky, most exporters would view a 72% annual standard deviation in discounted cash flows to be 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, the following assumptions for the chooser option defined earlier are made. First, 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, the salvage value is assumed to be $50,000. So, if management deems a pullout to be necessary over the six year initial life of the venture, they will be able to recover or save $50,000 from their actions. In considering the option to expand, the expansion factor $\alpha$ in equation (5) is assumed to be 2 and expansion costs, $c$, are $50,000 such that expansion efforts will realize a two-fold increase in
sales, but cost the firm an additional $50,000. Similarly, in considering the option to reduce or contract marketing efforts, $\beta$ in equation (6) is 0.5 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. Clearly, each individual exporting firm will have their own costs and unique assumptions for the chooser option depending on the specific design for the project determined prior to engaging in the venture. But, the general assumptions presented here, with the estimates of $\sigma$ presented in Table 1 for Slovenia, Croatia, and Bosnia-Herzegovina, provide baseline real options values which can be further examined.

Table 2 presents the real options values for export ventures to Slovenia, Croatia, and Bosnia-Herzegovina based on the above 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 lattice and equity lattice for the case of Bosnia-Herzegovina, with the real options value of $96,707 being 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 1997; Hull 2000), the larger $\sigma$, the larger the real options value holding all other factors constant. These results confirm this theory, and show that the export venture with the highest estimate of $\sigma$ (Bosnia-Herzegovina), holding all other assumptions constant, has the highest real options value while Slovenia, the least risky venture, has the lowest. The results moreover 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 those projects with fewer built-in options. This is value not considered by traditional static NPV
analysis. Intuitively, riskier projects have larger real options value since management has the flexibility to respond to this risk. It is important therefore to remember a true definition of risk – variability of outcomes. Risk accordingly can be valuable, since upside risks results in positive outcomes to the firm and its customers, and management may indeed be able to weather downside risks through proper risk management and their flexibility to respond.

Considering Bosnia-Herzegovina for example, if an exporter determined the Net Present Value of an export venture to Bosnia-Herzegovina to be $100,000, then the true value of the project considering the combined options to abandon, expand, contract, or stay the course really makes the project more valuable than previously considered ($96,707 dollars more under these baseline assumptions). Similarly, if the project were deemed to have a negative NPV, say a negative NPV of $50,000, the true value of the project would be a positive $46,707 considering the real options value, 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 to an export transaction to 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 unruly risks are likely to find these ex ante real options values compelling. Similarly, those exporters that are highly educated on the business and marketing practices of the region are likely to better maneuver through the myriad risks associated with exporting to a country like Bosnia-Herzegovina (and implicitly other recovering economies), and thus will likely find the ex ante real options value of the project an extra incentive to actually begin an export venture to the country. The existence of this ex ante real options value, however, is conditioned on the premise that flexibility in responding to risk does indeed exist and is ensured.
While 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 defining the chooser option. Table 3 presents the baseline real option value for Bosnia-Herzegovina ($96,707), and then considers how the real options value would change given changes in real options assumptions *ceteris paribus*. Considering the abandonment option, there is a positive relationship between the money saved from abandoning the export venture and the real options value. For instance, if the savings from abandonment were $100,000, the real options value would be $123,124. If there is no value from abandoning the export venture once engaged, then the real options value would still be substantial at $88,473 considering the chooser option despite the fact that 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. In fact, 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 2 times sales to 3 times sales raises the real options value to $189,900 – almost doubling the real options value. At the other extreme, if no additional sales are realized when additional marketing efforts, and additional marketing costs, are undertaken, then the real options value declines dramatically to $17,772. If market share expands by 50% due to these increased efforts, then 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 the real options value holding 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 where $50,000 in additional marketing costs are assumed – an increase of $13,913 in real options value. Furthermore, if expansion costs are assumed $100,000, then the real options value declines to $83,140, a difference of -$13,567 from the baseline. When considering the factors underlying the expansion portion of the chooser option (the option to expand marketing efforts), the assumption related to additional market share drives the bulk of the real options value.

Perhaps the most interesting result, however, is to consider how the real options value changes due to the changes in the assumptions underlying the option to contract or scale back marketing efforts. Interestingly, the real options value does not change as the contraction factor varies from 0 to 1, 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 quite substantial to illicit a change in the real options value. Under the presented assumptions, the cost savings from scaling back marketing efforts needs 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 increases, 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. In fact, even at a fairly extreme contraction of sales, 0.25, 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 very risky markets in which to invest; yet investment in them is vital for recovery. Policy makers and marketers therefore must find and
use tools to better understand investment-risk and stimulate investment, 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 based on traditional evaluation metrics, decision makers likely would not support such a venture. The real as well as perceived risks of doing business in a recovering economy may overshadow any potential opportunity; management is likely to view the project as “just too risky”. These factors and the subsequent choice not to invest in markets ravaged by catastrophe clearly will retard societal recovery, resulting in additional hardships and suffering. However, considering real options value when evaluating the financial feasibility of an export venture should provide an additional incentive 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 insight to marketers considering similar ventures, and also provides guidance to policy makers charged with assisting recovering economies.

Key to understanding the real options value of any export or foreign direct investment project to a recovering economy is 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. The realities of donor fatigue, resource scarcity, and the probability of future catastrophes, however 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 -- pressed
for time and forced to make decisions in the absence of data -- likely will not opt for this labor intensive and time consuming method. We submit that deterrents to extensive field work or the lack of data to make volatility estimates need not be obstacles to the estimation and consideration of real options value. The framework 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, to the benefit of marketers, policy makers, and citizen-stakeholders of the devastated country or region.

Market environments with high levels of risk do 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, 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 that 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 foreign direct investment should reward flexibility and readiness to respond to both good and bad outcomes that may arise during the course of doing
business in a recovering economy. Investments – and investment incentives invoked by policy makers-- moreover 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 socio-economic recovery. A commonality among them, aside from demonstrable impact on consumer and societal value: 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, once initiated, contributes most to the value of a chooser option. As described in the previous section and Table 3, real options value increases commensurate with the assumption on 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 actually foster a certain level of business risk taking (e.g., export guarantee programs designed to foster trade and development) in recovering economies.

While an option to expand contributes greatly to the value of the chooser option, an option to completely abandon the export venture also could be valuable; this is particularly true the higher the cost saving or cost recovery realized from abandonment. This result suggests strong benefits from policies that focus on attracting initial investment relative to policies that encourage large scale capital investments in the recovering region. The aforementioned sectors
again 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. On the other hand, marketing ventures that rely more on leasing arrangements, strategic alliances with local partners, and other strategies, which are variable cost intensive versus fixed cost intensive, potentially provide greater value to the option to abandon in the context of the chooser option. While the option to abandon contributes to the overall value of the chooser option, the impact of the option to merely scale back marketing efforts is the least valuable. In fact, the option to scale back marketing efforts is only valuable if the cost savings from doing so is very 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.

We finally reemphasize this framework can be applied to a number of 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 to convince policy makers to provide incentives for marketing companies to trade with and to do 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 businesses in the countries and areas recovering from catastrophe.
References


The Economist (2005), Asia’s Tsunami: Relief, but little rebuilding, December 25th, 51-52.


Table 1. Estimates of $\sigma$ from Monte Carlo Simulation for Slovenia, Croatia, and Bosnia-Herzegovina

<table>
<thead>
<tr>
<th></th>
<th>$\sigma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slovenia</td>
<td>0.369</td>
</tr>
<tr>
<td>Croatia</td>
<td>0.419</td>
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<tr>
<td>Bosnia-Herzegovina</td>
<td>0.716</td>
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</table>
Table 2. Estimated Real Options Values for Slovenia, Croatia, and Bosnia-Herzegovina

<table>
<thead>
<tr>
<th>Country</th>
<th>Real Options Value</th>
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<tbody>
<tr>
<td>Slovenia</td>
<td>$70,090</td>
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<tr>
<td>Croatia</td>
<td>$74,010</td>
</tr>
<tr>
<td>Bosnia-Herzegovina</td>
<td>$96,707</td>
</tr>
</tbody>
</table>

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: $50,000
- Expansion factor ($\alpha$): 2.00
- Cost savings from option to scale back marketing efforts: $25,000
- Contraction factor ($\beta$): 0.50
Table 3. Changes in Real Options Value (Chooser Option) for an Export Venture to Bosnia-Herzegovina Resulting from Changes in Baseline Real Options Assumptions

<table>
<thead>
<tr>
<th>Cost savings from option to abandon:</th>
<th>$0</th>
<th>$25,000</th>
<th>$50,000</th>
<th>$75,000</th>
<th>$100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real options value:</td>
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<td>$87,944</td>
<td>$96,707</td>
<td>$109,342</td>
<td>$122,237</td>
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<td>Increased costs from option to expand marketing efforts:</td>
<td>$0</td>
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<td>$50,000</td>
<td>$75,000</td>
<td>$100,000</td>
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<tr>
<td>Real options value:</td>
<td>$110,620</td>
<td>$103,664</td>
<td>$96,707</td>
<td>$89,869</td>
<td>$83,140</td>
</tr>
<tr>
<td>Expansion factor ($\alpha$):</td>
<td>0.00</td>
<td>1.00</td>
<td>1.50</td>
<td>2.00</td>
<td>2.50</td>
</tr>
<tr>
<td>Real options value:</td>
<td>$17,772</td>
<td>$17,772</td>
<td>$50,456</td>
<td>$96,707</td>
<td>$143,304</td>
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<tr>
<td>Cost savings from option to scale back marketing efforts:</td>
<td>$0</td>
<td>$25,000</td>
<td>$50,000</td>
<td>$75,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Real options value:</td>
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<td>$96,707</td>
<td>$100,456</td>
<td>$113,655</td>
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<tr>
<td>Contraction factor ($\beta$):</td>
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<td>0.25</td>
<td>0.50</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td>Real options value:</td>
<td>$96,707</td>
<td>$96,707</td>
<td>$96,707</td>
<td>$96,707</td>
<td>$96,707</td>
</tr>
</tbody>
</table>
Figure 1. Binomial Lattice of Underlying Variable - Present Value of Cash Flows ($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

$\sigma$ = standard deviation of discounted cash flows

$\sqrt{\Delta t}$ = time factor
Each end node $= \text{Max}[\Phi_1, \Phi_2, \Phi_3, \Phi_4]$ where $\Phi_1$ is the value of the abandonment option, $\Phi_2$ is the value of the expansion option, $\Phi_3$ is the value of the contraction option, and $\Phi_4$ reflects staying with the original course of action.

Each intermediate node $= \text{Max}[\Phi_1, \Phi_2, \Phi_3, \Phi_4, \Omega]$ where $\Phi_1$ through $\Phi_4$ are defined as above. $\Omega = e^{-r\Delta t} \left[ pV_u + (1-p)V_d \right]$ 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.
Figure 3. Underlying Lattice and Equity Lattice Using Baseline Assumptions – Bosnia