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A GUIDE TO USING EVENT STUDY METHODS IN MULTI-COUNTRY SETTINGS

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While the event study method has made significant contributions to strategic management research, most event study research published in management journals has analyzed the financial implications of corporate announcements in a single country. This study discusses solutions to methodological challenges that emerge when applying the event study method to multiple countries. Specifically, this study develops the world market model, illustrating how to simultaneously assess the financial impact of strategic actions in multiple countries. These challenges and solutions are illustrated by an example of a multi-country event study analyzing 241 international alliance announcements of 23 firms in 16 countries. The findings show that the use of the single country market model in a multi-country event study is likely to overestimate changes in firm value, demonstrating the need for this world market model. Copyright © 2004 John Wiley & Sons, Ltd.

The event study method has significantly contributed to strategic management research by examining the financial impact of various corporate announcements. The event is often a release of information to market participants through the news media about corporate or governmental actions. Event studies assess whether specific events create abnormal stock returns. Abnormal returns are the differences between the observed returns and the estimated returns derived from a particular stock return model (Brown and Warner, 1985; Campbell, Lo, and MacKinlay, 1997; Peterson, 1989). However, over the last two decades, most event studies published in management journals have analyzed corporate announcements in a single country, limiting academic attention to the event studies that simultaneously analyze firms in multiple countries (multi-country event studies). For example, 28 of the 30 event studies published in the *Strategic Management Journal* have limited the scope of their analyses to firms in a single country, usually the United States (with a few exceptions; see Table 1).

A primary explanation for the paucity of multi-country event studies is that previous event studies relied on the strong assumption that financial markets are not integrated across countries, and simply used the typical market model as a valid representation of stock return models for foreign countries (e.g., Lee, 1997; Seth, Song, and Pettit, 2002). However, as early as the 1970s, the international finance literature had identified international stock market movements as another major factor affecting stock returns due to active international trade and foreign direct investments (e.g., Agmon and Lessard, 1977; Lessard, 1974; Solnik, 1974). These studies showed that stock returns for firms significantly involved in international business can be

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Table 1. A summary of recent event studies published in the *Strategic Management Journal*, sorted by year

Studies	Nature of event(s)	Stock return models	Number of announcements	Firms and countries analyzed
Seth, Song, and Pettit (2002)	Cross-border acquisitions	Market model	100	Firms in 11 countries
Hayward (2002)	Corporate acquisitions	Market model	278	100 U.S. firms
Davidson, Nemec, and Worrell (2001)	Changes in executive titles	Market model	421	332 U.S. firms
Lee (2001)	Corporate name change	Market model	59	59 U.S. firms
Reuer (2001)	Joint venture (JV) partner buyouts	Market model	139	U.S. firms
Anand and Khanna (2000)	Joint venture and licensing contracts	Market model	1976	U.S. firms
Merchant and Schendel (2000)	International joint ventures	Market model	101	U.S. firms
Narayanan, Pinches, Kelm, & Lander (2000)	Voluntary release of qualitative information on R&D projects	Market model	501	U.S. firms
Reuer and Koza (2000)	Joint ventures	Market model	297	U.S. firms
Tang and Tikoo (1999)	Earnings announcements	Market model	589	589 U.S. firms
Lee (1997)	Lay-off announcements	Market model	358	U.S. and Japanese firms
Holl and Kyriazis (1997)	Resistance to takeover bids	Market model	178	U.K. firms
Kabir, Cantrijn, and Jeunink (1997)	Takeover defenses	Market and Market-adjusted models	44	44 Dutch firms
Reuer and Miller (1997)	Internationalization of international JVs	Market model	73	U.S. firms
Sundaramurthy, Mahoney, and Mahoney (1997)	Antitakeover announcements	Market model	486	261 U.S. firms
Worrell, Nemec, and Davidson (1997)	Consolidations of executive titles	Market model	522	438 U.S. firms
Wright and Ferris (1997)	Business divestments	Market model	31	31 U.S. firms
Nayyar (1995)	Customer service changes	Market model	324	106 U.S. firms
Mahoney and Mahoney (1993)	Antitakeover amendments	Market model	409	409 U.S. firms
Chatterjee, *et al.* (1992)	Mergers and acquisitions	Market model	30	30 U.S. firms
Nayyar (1993)	Diversification moves	Market model	163	80 U.S. firms
Davidson and Worrell (1992)	Product recall announcements	Market model	133	U.S. firms
Seth (1990)	Corporate acquisitions	Market model	104	U.S. firms
Bromiley and Marcus (1989)	Product recall announcements	Market model	91	4 U.S. firms
Shelton (1988)	Corporate acquisitions	Market model	218	U.S. firms
Beatty and Zajac (1987)	CEO succession announcements	Market model	209	209 U.S. firms
Bettis and Weeks (1987)	Competitive interactions	Market model	55	2 U.S. firms
Lubatkin (1987)	Mergers	Market model	340	257 U.S. firms
Singh and Montgomery (1987)	Corporate acquisitions	Market model	77	U.S. firms
Chatterjee (1986)	Corporate acquisitions	Market model	25	U.S. firms

estimated using international capital asset pricing models. As the effects of globalization continue to become ubiquitous, many recent studies have demonstrated that stock prices in most countries are affected by both domestic and global influences such as stock market movements in other countries, clearly indicating the global integration of equity markets (e.g., Beckers, Connor, and Curds,

1996; Chaumeton, Connor, and Curds, 1998; Conn and Connell, 1990; Darbar and Deb, 1997; Chan, Karolyi, and Stulz, 1992; Harvey, 1991; Karolyi and Stulz, 1996). Other studies have also reported that equity markets in most countries continuously readjust stock prices in response to simultaneous or lagged movements of foreign exchange rates (Bartov and Bodnar, 1994; Bodnar and Gentry, 1993; Jorion, 1991; Miller and Reuer, 1998; Wasserfallen, 1989; Yang, Wansley, and Lane, 1985). Thus, applying the same market model used for a single-country event study to studies in multiple countries is likely to create biases in analysis results. Another reason may be that while McWilliams and Siegel (1997) provided valuable guidance for event studies in the single-country context, management scholars do not have clear guidance about how to expand the event study to multiple countries. For example, in multi-country settings, researchers need to deal with selection of stock return models, lack of synchronism in stock market trading hours, and unique institutional environments across countries. Therefore, to conduct an event study in a multi-country setting, researchers must make sure that the methodology keeps pace with current changes in the real business fields to ensure rigorous assessment of events.

This paper is meant to serve as a guide for researchers who are reasonably familiar with the event study methodology, but know little about applying that methodology to multiple countries. Following the typical event study procedure, I discuss the challenges and solutions for event studies in multi-country settings. As a stock return estimation model for multi-country event studies, I present the world market model that enables researchers to simultaneously calculate stock price reactions to corporate announcements in multiple countries. To illustrate how all of these issues should be considered in multi-country settings, I provide an example that investigates the impact of international alliance announcements on changes in firm value for 23 international airline companies in 16 countries.

METHODOLOGICAL ISSUES AND SOLUTIONS IN MULTI-COUNTRY EVENT STUDIES

Among the issues that researchers may need to consider for an event study, I specifically focus on the major challenges and solutions pertaining to the use of the event study method in multi-country settings. These major challenges include development of a stock return model, lack of synchronism in stock market trading hours, and differences in institutional environments between countries. For other issues that also pertain to typical single-country event studies, such as event selection, adjusting length of estimation windows, controls for confounding events, and explaining abnormal returns, I will briefly highlight the differences that researchers should take into account in multi-country event studies. Researchers can obtain more detailed guidance about the issues of single-country event studies from previous research (e.g., Brown and Warner, 1985; MacKinlay, 1997; McWilliams and Siegel, 1997; Peterson, 1989).

Selection of the event

The initial task of conducting an event study is to define the event of interest. Selecting an event of interest in multiple countries requires more caution than in single-country settings. Since the institutional environments of stock exchanges differ significantly across countries, researchers need to make sure that the selected event is comparable and available in all sample countries. For example, unlike the United States, where the Securities and Exchange Commission requires quarterly earnings announcements of publicly traded companies, other countries require only annual earnings reports. Thus, a comparative study investigating the effect of earnings announcements in multiple countries is likely to distort the findings when researchers are not aware of such institutional differences. Furthermore, certain events may be very rare in some foreign countries. For example, a study that examines the effects of external CEO succession may not find a significant number of events of that type in Japan or Korea. In those two countries, CEOs are more likely to be replaced by internal directors or existing executive members due to unique ownership structures, such as *keiretsu* or *chaebol*. To ensure the comparability and availability of the event across all countries, researchers may implement interviews with experts about the selected countries or conduct a pilot study. Another option is to study events that encompass firms from multiple countries, such as international joint ventures, international alliances, and international mergers and acquisitions (M&A).

Furthermore, unlike single-country event studies that can collect announcements of events from a few domestic newspapers, researchers may need to expand sources of news media to collect comprehensive event announcements in multiple countries. For example, researchers may use the *Dow Jones* newswire, the *Bloomberg* news, and the *LexisNexis* database.

Estimation of abnormal return: world market model

The next step is to develop a stock return model, which poses especially daunting methodological challenges in multi-country settings. To illustrate this procedure step by step, I first introduce the stock return model in a single-country event study and then present a world market model for multi-country settings. To estimate the expected stock return in a single country, researchers have typically used the market model. This model takes into account a specific security's past performance and its sensitivity to general market movements reflected by the individual countries' stock market indexes (e.g., the Center for Research in Security Prices (CRSP), value-weighted or equally weighted indexes or Dow Jones Industrial Average). The market model can be developed as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} and R_{mt} are the day t returns on firm i and the market portfolio, respectively, and ε_{it} is a disturbance term. α_i, β_i, and ε_{it} are the parameters of the market model with $E[\varepsilon_{it}] = 0$ and $\mathrm{Var}[\varepsilon_{it}] = \sigma_i^2$. Using the parameter estimates from the ordinary least squares regression (OLS), researchers calculate abnormal returns (AR_{it}) for every security on a specific date as follows:

$$\mathrm{AR}_{it} = R_{it} - \mathrm{a_i} - \mathrm{b_i} R_{mt} \quad (2)$$

where a_i and b_i are OLS estimates of α_i and β_i respectively from the market model in Equation 1.

Following previous studies on stock return modeling research (e.g., Brown, 1989; Chang, 1991; Fama, 1996, 1998a), I rely on three guidelines to develop the stock return model in multiple countries: (i) assuming that financial markets are globally integrated; (ii) developing a stock return model primarily for using daily data; and (iii) factors estimating stock returns should have a significant and stable impact on stock returns. First, the stock return model in multi-country settings has to control for the influence of global stock markets. The influence of global stock markets was initially identified by studies investigating stock returns in a small number of countries (Agmon and Lessard, 1977; Conn and Connell, 1990; Jorion and Schwartz, 1986; Lessard, 1974; Yang *et al.*, 1985). These studies suggested that the international market model that expanded the typical market model by adding a world market factor should be applied to foreign equity returns. In particular, Yang *et al.* (1985) showed that the greater the foreign involvement of a firm, the more its rates of stock returns depend on international market factors. More recent studies have shown that global stock market movements significantly affect equity returns in most foreign countries even after controlling for other macro-economic factors (e.g., Beckers *et al.*, 1996; Chaumeton *et al.*, 1998; Darbar and Deb, 1997; Dumas and Solnik, 1995; Ferson and Harvey, 1994). Beckers *et al.* (1996) showed that the influences of the global and domestic stock markets are of roughly equal importance in explaining changes in equity returns in 19 countries. In particular, they further found that the global market factor is more important than local country factors within the eight European Union countries, suggesting that the European Union financial markets are more integrated than the rest of the world in general. Chaumeton *et al.* (1998) also found that the global market movements have a strong influence on movements of local stock returns in 13 countries. Other studies showed that capital markets are becoming increasingly integrated internationally, reinforcing the role of global market movements (Bekaert and Harvey, 1995; Chan *et al.*, 1992; Karolyi and Stulz, 1996).

Second, another factor that has been confirmed to have a significant and stable impact on stock returns is foreign currency exchange rates (Bartov and Bodnar, 1994; Bodnar and Gentry, 1993; Darbar and Deb, 1997; Dumas and Solnik, 1995; Ferson and Harvey, 1994; Malliaropulos, 1998; Miller and Reuer, 1998; Richards, 1997; Roll, 1992). Roll (1992) found that nominal exchange rates can explain a significant portion of common currency denominated national index returns across 24 countries from 1988 to 1991. Bodnar and Gentry

(1993) confirmed that the impact of exchange rate movements on stock returns is significant, and the exchange rate has a greater impact on both smaller and more internationally oriented economies. In particular, Miller and Reuer (1998) showed that stock returns of individual firms are significantly influenced by multiple currency exchange rates. Malliaropulos (1998) showed that real foreign exchange rates also have a significant impact on stock returns in G5 countries.

While previous studies also investigated other macro-economic factors, such as inflation, interest rate, oil price, consumption, and industry production (Chang, 1991; Chen, Roll, and Ross, 1986; Dumas and Solnik, 1995; Ferson and Harvey, 1994; Flannery, Hameed, and Harjes, 1997; Garcia and Ghysels, 1998; Wasserfallen, 1989), it remains to be confirmed whether most of these factors have significant and stable effects on stock returns. For example, empirical studies reported that interest rates (Chang, 1991; Ferson and Harvey, 1994; Roll, 1992; Wasserfallen, 1989), inflation (Ferson and Harvey, 1994; Garcia and Ghysels, 1998; Roll, 1992), and industry production (Chen *et al.*, 1986; Ferson and Harvey, 1994) have a marginal or insignificant impact on stock returns. Furthermore, data availability tends to limit the effects of these economic factors especially for event studies examining daily stock returns, since most economic data are available on a monthly rather than daily basis. For example, for event studies examining a 3-day event window, there will be no volatility for either interest rate or inflation during the event window. Thus, I develop the world market model as follows:

$$R_{ijt} = \alpha_i + \beta_i R_{mjt} + \gamma_i R_{wmt} + \delta_i X_{jt} + \varepsilon_{ijt} \quad (3)$$

where R_{ijt} is firm i's stock return in its home country j on day t, R_{mjt} is the market index return in country j on day t, R_{wmt} is the world market index return on day t, and X_{jt} is the change in the foreign currency exchange rates in country j on day t. α_i, β_i, γ_i, and δ_i are firm-specific parameters, and ε_{ijt} is a random-error term with $E[\varepsilon_{ijt}] = 0$ and $\mathrm{Var}[\varepsilon_{ijt}] = \sigma_{ij}{}^2$.

Researchers can use several indexes to capture global market movements. While early studies developed their own global market indexes by combining stock returns of a few countries (e.g., Jorion and Schwartz, 1986; Solnik, 1974) or used equally weighted global market indexes (Lessard, 1974), most recent studies have used several readily available market value weighted indexes, such as the S&P 500 (e.g., Chan *et al.*, 1992; Karolyi and Stulz, 1996), the Morgan Stanley Capital International EAFE index (e.g., Harvey, 1991; Ferson and Harvey, 1994), or the Financial Times Stock Exchange World Index[1] (e.g., Beckers *et al.*, 1996). Previous studies reported that the choice between equal-weighted and value-weighted global market factors do not create significant differences (Yang *et al.*, 1985; Chen *et al.*, 1986). When using these ready-made global market indexes, researchers need to take into account one more issue. If a domestic portfolio of a country is included in one of these global market indexes, then researchers need to make the global market index orthogonal to the domestic market index by subtracting the influence of the local market index from the global market index. If these two factors are not orthogonal by design, the regression coefficients for the global market factor may be biased downward since the aggregate world market factor may include some factors that are related to the domestic components of total rates of returns (Ferson and Harvey, 1994).

To incorporate foreign currency exchange rates, researchers can use the exchange rate between the U.S. dollar and the local currencies (e.g., Roll, 1992), multiple exchange rates (e.g., Dumas and

[1] *The EAFE Index*: The Europe, Australia, and Far East Index provided by Morgan Stanley Capital International is a market value weighted index designed to measure the overall condition of overseas markets. This index is designed to measure developed market equity performance, excluding the United States and Canada. As of 2002 the EAFE Index consisted of the following 21 developed market country indices: Australia, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom. As of December 2002, this index tracks a total value of about $200 billion equities in the world, compared to about $700 billion equities in the S&P 500.

The FTSE World Indices: The Financial Times Stock Exchange World Index aims to capture 82–90 percent of the investable equity market capitalization available in any country. Approximately 5000 indices are calculated daily for the FTSE World Indices. In addition to the overall World Index, the range of indices includes a number of regional, country, economic, and sector indices covering 29 markets and various regions worldwide. The FTSE World Indices were launched in 1986. Markets covered: Australia, Austria, Belgium/Luxembourg, Brazil, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States. As of September 18, 2000, Israel, Korea and Taiwan were added to the World Index, while Indonesia, Thailand, and the Philippines were removed.

Solnik, 1995; Miller and Reuer, 1998; Wasserfallen, 1989), and the trade-weighted or the multilateral exchange rate model (MERM)-weighted effective exchange rates (e.g., Ferson and Harvey, 1994; Bartov and Bodnar, 1994; Bodnar and Gentry, 1993; Jorion, 1991; Miller and Reuer, 1998; Richards, 1997; Yang *et al.*, 1985). MERM was developed by the International Monetary Fund. The procedure for computing the MERM weights is detailed in Artus and McGuirk (1981). Most studies have used either trade-weighted or MERM-weighted exchange rates. While a few studies used real exchange rates (Malliaropulos, 1998; Miller and Reuer, 1998), researchers can generally use nominal exchange rates, for the following reasons. First, the choice between nominal and real exchange rates is not crucial because the available evidence indicates that real exchange rates behave similarly (Wasserfallen, 1990). The reason is that the variance of nominal exchange rates is much higher than the variance of the inflation rate. For example, using the consumer price indices, Bodnar and Gentry (1993) showed that the correlations between monthly changes in the nominal and real G-7 trade-weighted exchange rates from 1978 to 1989 are 0.97 for the United States, 0.95 for Canada, and 0.98 for Japan. Second, using the real exchange rate would assume that financial markets instantaneously observe the inflation rates that are necessary for calculating the real exchange rate. While nominal exchange rates are readily observable on a daily basis, inflation rates are available mostly on a monthly basis for most countries. Thus, most event studies investigating daily stock returns used nominal exchange rates rather than real exchange rates adjusted either monthly or quarterly.

After estimating Equation 3, the daily abnormal returns for a multi-country event study are calculated as follows:

$$AR_{ijt} = R_{ijt} - (a_i + b_i R_{mjt} + g_i R_{wmt} + d_i X_{jt}) \quad (4)$$

where AR_{ijt} are the daily abnormal returns for firm i in country j on day t, and a_i, b_i, g_i, and d_i are the firm-specific OLS parameter estimates from Equation 3. Thus, abnormal returns derived from the world market model are adjusted for domestic market movements, global market movements, and changes in foreign currency exchange rates.

Estimation window

After developing a stock return model, researchers need to estimate the parameters of the model using a subset of the data known as the estimation window. However, if these estimation windows contain unusual market movements, such as 'the Black Monday Crash of 1987' when the Dow Jones Industrial Average lost 22.6 percent of its total value, it is very likely that those movements significantly influence the parameter estimation procedure (for a general guide about unusual market movements; see Campbell *et al.*, 1997; McWilliams and Siegel, 1997). In multi-country event studies, it is more likely that these estimation windows contain country-specific unusual events, such as terrorist attacks, sudden political crises, and/or natural disasters. Thus, it is necessary for researchers to investigate whether their estimation windows contain these unusual market movements through interviews, researching secondary data, or checking historical developments. However, checking unusual market movements of all stock exchanges often requires demanding effort especially when investigating a long observation period in a large number of countries. For example, a study that examines 15 years of equity trading in twenty countries, checking all unusual market movements tends to be both time- and cost-intensive work. As an alternative, researchers may employ longer estimation windows in multi-country event studies to reduce the impact of those unusual market movements. When returns are estimated over longer horizons, an unusual market movement for a few days tends to be only a small portion of the entire estimation period.

Lack of synchronism in stock market trading hours

When using daily data, multi-country event studies have to deal with the lack of synchronism in stock market trading hours between countries. There is a difference of about 5 or 6 hours between American and European countries and between European and most Asian countries, which allows trading hours of those countries to be overlapped. The issue becomes even more serious for the comparison between Asian and American countries that have about a 12-hour difference with no overlap of stock trading hours. This large time lag between countries prevents potential investors from simultaneously responding to major announcements. Thus,

when a study includes Asian and American countries, researchers need to lag stock and local market return data by 1 day for firms from Asia or Australia/Oceania (e.g., Chan *et al.*, 1992).

Country-specific occasions, such as national holidays, political crises, and regional wars also create a problem in multi-country event studies because stock and local market return data will be unavailable for foreign companies during the estimation and/or the event periods. There are several techniques to deal with the missing returns. First, researchers can remove firms with missing returns from the sample, as is frequently done for single-country event studies. However, in multi-country event studies, this technique can significantly reduce the number of available observations due to inherent differences between countries (Eades, Hess, and Kim, 1985). Second, researchers can utilize stock return data on succeeding days to replace the missing days' returns. They can average the succeeding period returns over the missing and the succeeding periods. Since the succeeding day's returns spread over the missing days, this technique tends to mask single-day effects and renders it impossible to identify stock returns for individual days. However, when missing only 1- or 2-day returns, it is possible to minimize the loss of observations. Third, researchers can use only available data, removing the missing period and the succeeding day from the analysis. This alternative, also used by Brown and Warner (1985), is desirable particularly when a missing period is just a few days.

Confounding events

Controlling for confounding corporate events is also a critical issue in multi-country event studies. Multi-country event studies are more likely to contain confounding events due to the more heterogeneous characteristics of firms and their domestic environments (for a general guide about confounding events, see McWilliams and Siegel, 1997; Meznar, Nigh, and Kwok, 1998). Foster (1980) suggested four methods to control for confounding events: (1) excluding firms with confounding events from the sample; (2) partitioning the sample by grouping firms with the same confounding events; (3) excluding firms from the sample on the day of the confounding event; and (4) subtracting the financial impact of the confounding event when estimating the sample's abnormal returns. In multi-country event studies, especially when investigating a small sample, the first method may reduce sample size so much as to significantly decrease the power of statistical tests, if not eliminate all observations (MacKinlay, 1997). The second and fourth alternatives may encounter methodological challenges when the events in a sample contain many different kinds of confounding events, which are more likely in multi-country event studies. In particular, estimating the financial impact of these confounding events becomes more challenging when the institutional environments of stock exchanges are not similar among the countries of interest. Thus, in multi-country event studies, the third alternative may be more appropriate as it can both control for confounding events and minimize the consequential loss of announcements.

Explanation of abnormal returns

The final stage of multi-country event studies, if necessary, will be to explain the magnitude of abnormal returns with a set of predicting variables. However, in multi-country event studies, it is possible that the market sensitivity to specific announcements may differ significantly across countries due to differences in regulatory oversight of accounting and reporting practices (e.g., Morck, Yeung, and Yu, 2000). If some equity markets are 'noisier' and incorporate firm-specific news less promptly, such as studies analyzing firms from both highly regulated and relatively less regulated countries, this market sensitivity may have significant influence on analysis outcomes. One way to cope with potential market sensitivity is to assume that the direction of the stock price reaction, either positive or negative, should remain consistent across countries if the announcements contain the same information, such as changes in market share, lay-offs, and new technology developments. Researchers may investigate whether a specific announcement creates more positive rather than negative returns across countries (e.g., Park and Martin, 2001). To further explain the variance in abnormal returns across countries, researchers may run logistic regressions with country-fixed effects where the dependent variable is a binary variable. This specification explains only the direction of the abnormal returns, which would be less sensitive to stock market heterogeneity between countries.

AN EXAMPLE OF A MULTI-COUNTRY EVENT STUDY

In this section I present an example to illustrate the multi-country event study method. The sample study investigates the research question of whether firms can increase their value by establishing international alliances. The sample includes data on 23 international airlines in 16 countries from 1986 to 1998. I examine stock price reactions surrounding 241 international codesharing alliance announcements. International codesharing alliances are arrangements through which airlines share existing flights to serve partners' customers, thereby increasing the frequency and scope of available flights without a concomitant increase in costs.

The multi-country event study method provides an ideal tool to test the above research question in 16 different countries. As the first step, to check the availability and comparability of the event I conducted interviews with senior executives from six international airlines (two U.S., one Asian, and three European airline companies), numerous airline industry consultants, and academic scholars. These interviews confirmed that due to active alliance formations among major airline companies in most countries over the last two decades, enough international codesharing alliance announcements were available across countries for analysis. I also learned that most airline companies tended to rely on a fairly standard contract format for their international codesharing alliances, which helped maintain the comparability of the event in 16 countries. To identify the event and announcement dates, I comprehensively examined 76 newspapers and 14 industry magazines in the *LexisNexis* database. To increase the comparability of the event, I excluded some international codesharing alliances that contained other alliance activities, such as equity investments, executive exchanges, combining sales offices, and integrating computer reservation systems. For each announcement, I collected daily data for stock returns, local market returns, world market returns, and daily foreign currency exchange rates from the *Datastream* and the *Factset* databases.

Calculating abnormal returns is the next step. As described above, I first use the world market model, Equation 3, to estimate firm-specific parameters by using data over an estimation window of 250 trading days ending 10 days before each announcement date. For the local market returns, I use the market indexes that list airline companies in their own countries. These indexes are often the oldest in their local markets and most widely quoted in the international news media (Brown and Warner, 1980). For example, I use the Nikkei Average Index (225) for Japan, and the DAX Index for Germany. However, I use the CRSP value-weighted index for the U.S. market, which is employed by most event studies in the United States. For the world market returns, I use daily returns of the Morgan Stanley Capital International EAFE index that I adjusted to be orthogonal to the local market indexes of all 16 countries. For the robustness check, I also use other world market indexes, such as the Financial Times Goldman Sachs World Index and the S&P 500 index. For the foreign currency exchange rate, following previous studies (e.g., Ferson and Harvey, 1994; Jorion, 1991), I use the trade-weighted U.S. dollar price of foreign currencies by using quarterly trade data for the top 10 largest trading partner countries of each country. Thus, a positive change in X_{jt} indicates dollar depreciation. I use a single aggregate measure as a parsimonious alternative to the approach of using multiple exchange rates (e.g., Dumas and Solnik, 1995; Miller and Reuer, 1998). While some limitations of using a single aggregate measure were identified (Miller and Reuer, 1998), previous studies that included multiple currency exchange rates in their stock return models often found that, except for the primary exchange rate, the effect of the second or third exchange rates is usually marginal and varies significantly across countries. To adjust for the time differences between countries, I lag stock returns, market returns, and changes in currency exchange rates by 1 day for firms from Australia, Japan, Korea, Malaysia, New Zealand, Singapore, and Thailand. For missing data due to country-specific events such as national holidays, I use only the available data, removing the missing period and the succeeding day from the analysis, since most country-specific events were missing just a few days of data.

After estimating Equation 3, the daily abnormal returns for the 3 days surrounding each alliance announcement date are calculated using Equation 4. In this study, I define the event window as a period of 3 trading days centered on the event day (day 0). Day 0 is defined as the first day the local

markets could respond to the news of an international codesharing alliance. In cases where the announcement was made after the close of trading, I adjust day 0 accordingly. When multiple announcements appeared for a single alliance, the earliest announcement date was used for day 0. Finally, I measure the change in firm value by aggregating abnormal returns over 3 days (e.g., McWilliams and Siegel, 1997). For the 3 days of the event window, I checked the existence of potential confounding events for all alliance announcements in 16 countries, to minimize the potential for noise in the dependent variable.

To better illustrate the methodological issues of the multi-country event study, I present the empirical results in several ways. First, I report the abnormal returns from both the market model and the world market model, comparing the effects of the two estimation models. Second, I report the abnormal returns that are derived from the world market model using different lengths of estimation windows. Third, I illustrate the effect of confounding events in a multi-country event study by reporting the abnormal returns both before and after controlling for confounding events. Fourth, I show the abnormal returns for U.S. and foreign firms, checking for the existence of significant differences between the U.S. and foreign countries. The main focus of this study is to demonstrate how to calculate abnormal returns in multi-country event studies, not to test hypotheses about the magnitude of abnormal returns with a set of predicting variables. Therefore, I do not report the regression analysis outcomes in this study, although such regression analyses may be a final step for hypothesis testing event studies.

Table 2 reports the daily abnormal returns averaged across 241 international alliance announcements and the aggregated cumulative abnormal returns over 3 trading days, as derived from both the market model and the world market model. The average abnormal return on the event day 0 (AR_0) from the world market model (+0.77%) is significantly smaller than AR_0 from the market model (+0.92%). There are similar patterns for the abnormal return on the event day −1 (AR_{-1}) and +1 (AR_{+1}), while the differences are not significant. The cumulative abnormal returns from day −1 to day +1 ($CAR_{-1\text{ to }+1}$) from the world market model is 1.10 percent, which is 23 percent smaller than $CAR_{-1\text{ to }+1}$ from the market model. $CAR_{-1\text{ to }+1}$ of 1.10 percent is similar in magnitude to previous alliance studies in single-country settings (Das, Sen, and Sengupta, 1998; Koh and Venkataraman, 1991; Woolridge and Snow, 1990). The difference of $CAR_{-1\text{ to }+1}$ between two models remains significant when I replicated the same analysis for U.S. and foreign companies respectively. These findings show that international codesharing alliance announcements significantly increase the financial value of international airlines. To check the robustness of the findings, I used the Financial Times Goldman Sachs World Index and the S&P 500 index for the world market returns and confirmed similar findings. Overall, Table 2 shows that the market model, compared to the world market model, overestimates changes in firm value when applied to a multi-country event study.

Table 3 shows the abnormal returns calculated with four different estimation periods, specifically 250, 200, 150, and 100 days. Regardless of the estimation period length, the world market model produces fairly similar abnormal returns on event day −1, 0, and +1. $CAR_{-1\text{ to }+1}$ with four different estimation periods are of similar magnitude. Additional mean-difference tests did not find any significant differences in abnormal returns. It is possible that the airline industry in this study is

Table 2. The impact of international alliance announcements: abnormal returns derived from the market model and the world market model[a]

Event day	Abnormal returns from market model $n = 241$	Abnormal returns from world market model $n = 241$	Mean difference tests t-tests[b]
−1	0.2108	0.1430	1.51
	(1.24)	(0.84)	
0	0.9216**	0.7660**	2.27*
	(3.47)	(3.31)	
+1	0.2943	0.1952	1.75
	(1.32)	(1.01)	
$CAR_{-1\text{ to }+1}$[c]	1.4267**	1.1042**	3.01**
	(3.14)	(2.92)	

[a] $N = 241$ international codesharing alliances announcements. Numbers in parentheses represent z-statistics testing the null hypothesis that the mean of abnormal returns is zero.
[b] The reported statistic is the value of t for a difference-of-means test between the world market model and the market model.
[c] $CAR_{-1\text{ to }+1}$ represents the cumulative abnormal returns from day −1 to day +1.
* $p < 0.05$;
** $p < 0.01$

Table 3. Abnormal returns derived from different lengths of the estimation window[a]

Event day	Abnormal returns with estimation window of 250 days $n = 241$	Abnormal returns with estimation window of 200 days $n = 241$	Abnormal returns with estimation window of 150 days $n = 241$	Abnormal returns with estimation window of 100 days $n = 241$
−1	0.1430	0.1350	0.1265	0.1329
	(0.84)	(0.71)	(0.66)	(0.69)
0	0.7660**	0.7599**	0.7437**	0.7526**
	(3.31)	(3.08)	(2.99)	(3.01)
+1	0.1952	0.1793	0.1759	0.1829
	(1.01)	(0.92)	(0.89)	(0.97)
$CAR_{-1\ to\ +1}$[b]	1.1042**	1.0742**	1.0461**	1.0684**
	(2.87)	(2.74)	(2.69)	(2.72)

[a] Numbers in parentheses represent z-statistics testing the null hypothesis that the mean of abnormal returns is zero.
[b] $CAR_{-1\ to\ +1}$ represents the cumulative abnormal returns from day −1 to day +1.
* $p < 0.05$;
** $p < 0.01$

such a mature, non-volatile sector that researchers can obtain a reliable estimation with a relatively short estimation period. However, in a technology sector characterized by rapid changes in frontier technologies and by continuous innovations, the length of the estimation window may have a significant influence on the magnitudes of abnormal returns in multi-country event studies.

Table 4 shows the effect of confounding events. Following the guidelines from previous studies (e.g., Foster, 1980; McWilliams and Siegel, 1997), I excluded 38 international alliance announcements that contained various confounding events during the 3-day event window. AR_0 that includes the 38 announcements with these confounding events (+0.62%) is significantly smaller than AR_0 without the confounding events (+0.77%). This pattern is the same for AR_{-1} and AR_{+1}, although the differences are not significant. Similarly, $CAR_{-1\ to\ +1}$ with these confounding events (0.88%) is significantly smaller than $CAR_{-1\ to\ +1}$ without the confounding events (+1.10%). These findings show that the outcomes of multi-country event studies can be significantly affected by confounding events. In particular, when researchers investigate highly diversified multinational corporations across many countries, it is more likely that confounding events will affect results.

Table 5 reports the difference of abnormal returns between U.S. and foreign companies. The average abnormal returns of the U.S. firms are significantly greater than those of the foreign firms, indicating that the U.S. stock exchanges respond

Table 4. Abnormal returns after and before controlling for confounding effects[a]

Event day	Abnormal returns without confounding effects $n = 241$	Abnormal returns with confounding effects $n = 279$	Mean difference tests t-tests[b]
−1	0.1430	0.1078	0.79
	(0.84)	(0.63)	
0	0.7660**	0.6194**	2.44*
	(3.31)	(2.80)	
+1	0.1952	0.1567	0.91
	(1.01)	(0.71)	
$CAR_{-1\ to\ +1}$[c]	1.1042**	0.8839**	2.34*
	(2.87)	(2.95)	

[a] Numbers in parentheses represent z-statistics testing the null hypothesis that the mean of abnormal returns is zero.
[b] The reported statistic is the value of t for a difference-of-means test between abnormal returns with confounding events and abnormal returns without confounding events.
[c] $CAR_{-1\ to\ +1}$ represents the cumulative abnormal returns from day −1 to day +1.
* $p < 0.05$;
** $p < 0.01$

to international alliance announcements more positively than foreign stock exchanges. In magnitude, $CAR_{-1\ to\ +1}$ of the U.S. firms (1.89%) is about two and half times greater than that of the foreign firms (0.74%). Regression analyses with random-firm effects and other control variables (number of routes accessed through an alliance, partner's market share at its hub airports, number of competing hubs, number of competing airlines in neighboring countries, previous alliances, firm size, and

Table 5. Comparison of abnormal returns derived from the world market model between U.S. and foreign firms[a]

Event day	Abnormal returns of the U.S. firms from world market model $n = 79$	Abnormal returns of foreign firms from world market model $n = 162$	Mean difference tests t-tests[b]
−1	0.4398	−0.0017	2.81**
	(1.26)	(−0.24)	
0	1.0394**	0.6327**	2.69**
	(4.15)	(3.61)	
+1	0.4071	0.0919	2.24*
	(1.34)	(0.58)	
$CAR_{-1\ to\ +1}$[c]	1.8863**	0.7363**	2.94**
	(3.64)	(2.74)	

[a] Numbers in parentheses represent z-statistics testing the null hypothesis that the mean of abnormal returns is zero.
[b] The reported statistic is the value of t for a difference-of-means test between U.S. and foreign firms.
[c] $CAR_{-1\ to\ +1}$ represents the cumulative abnormal returns from day −1 to day +1.
* $p < 0.05$;
** $p < 0.01$

amount of equity exchanged between partners), while not presented here, show that the difference between U.S. and foreign airlines remains significant. Additional analyses with country-fixed effects also show that country dummy variables have significant influence on changes in firm value across 16 countries. This confirms the importance of controlling for country effects in multi-country event studies when researchers need to explain variance of abnormal returns across countries.

DISCUSSION

The example in the above section illustrates that the use of the market model in a multi-country event study, instead of the world market model, may overestimate changes in firm value. The findings further show that considering several research design issues is critical to the proper implementation of multi-country event studies. Researchers need to consider global market movements, currency exchange rate issues, country-specific occasions, lack of synchronism in stock market trading hours, and market sensitivity to firm-specific information between countries. Like some previous studies that indicated the impact of confounding effects in the single-country event study (e.g., McWilliams and Siegel, 1997), this study also confirms that confounding events can create a significant difference in the magnitude of abnormal returns in multi-country settings. While the length of the estimation windows did not change the magnitude of abnormal returns in the airline industry significantly, researchers may need to consider the estimation period issue more carefully in volatile sectors such as computers, e-commerce, and other hi-tech industries. There is a significant difference between abnormal returns of U.S. and foreign firms when those firms are involved in international alliances (see more generally Morck *et al.*, 2000).

Considering all of the above issues, I outline appropriate procedures for future multi-country event studies. The first step is to determine whether the event of interest is available and comparable across all the countries included in a study. Researchers need to be aware that heterogeneous institutional environments can easily make a specific event unavailable or incomparable in some countries. The second step is to identify the dates when selected firms experienced the event of interest. Researchers need to expect more difficulties in finding accurate announcement dates in multi-country event studies due to time lag, language barriers, and difference of institutional environments. To deal with this challenge, researchers need to expand the number of news media used to collect announcement information in multi-country event studies. For example, I had to comprehensively review 76 newspapers for the example study. The third step is to develop a stock return model taking into account global market movements and currency exchange rate issues. While the primary selection criteria between the market and world market models should be research questions and the main research assumptions about world equity markets—whether world equity markets are integrated across countries or not—researchers may prefer to employ the world market model for the following cases: (1) studies to compare simultaneous stock returns of research phenomena in multiple countries, such as international alliances or mergers and acquisitions across borders; (2) research investigating firms involving various international businesses (Lessard, 1974) or ones in the very global industries (Agmon and Lessard, 1977; Conn and Connell, 1990; Yang *et al.*, 1985); (3) studies analyzing firms mainly in developed countries (Bekaert and Harvey, 1995;

Garcia and Ghysels, 1998); and (4) empirical works to examine stock returns at macro-level such as national index returns or industry index changes in multiple countries (Dumas and Solnik, 1995).

While the world market model can be applied to most countries, some studies reported that the effect of global market movements is not stable and consistent for a number of emerging countries, such as Colombia, Jordan, Nigeria, and Zimbabwe (Bekaert and Harvey, 1995; Garcia and Ghysels, 1998). Other studies suggested that event studies investigating long-term stock returns in foreign countries still need to check issues about both the market efficiency and the integration of financial markets (e.g., Chan, Gup, and Pan, 1997), while event studies investigating short event windows such as a few days produce very robust outcomes in both domestic and international settings (Fama, 1998b; Lee *et al.*, 1998; McWilliams and Siegel, 1997). Another limitation of this study is focusing on multi-country event studies using daily stock returns data. Multi-country event studies using monthly returns data may be able to avoid a few possible challenges, such as lack of synchronism in stock market trading hours and data availabilities. However, they may face their own unique challenges like stronger influence of macro-economic variables such as interest rates, inflation, and/or oil price. Thus, the influence of the world market factor in some emerging countries or on long-term stock returns in foreign countries may remain as a potential candidate for further investigation.

The fourth step is to choose an appropriate estimation window. While this study did not find that the length of the estimation windows significantly changed the magnitude of abnormal returns, researchers need to consider that country-specific and firm-specific unusual movements are more likely to create noise in shorter estimation windows. The fifth step is to examine whether a specific announcement is affected by other financially relevant confounding events. Researchers need to recognize that multi-country event studies are more likely to be affected by confounding events due to the greater heterogeneity of firms and country environments. Once they find confounding events, as discussed in an earlier section, researchers need to select the option best suited to the situation (e.g., Foster, 1980; Meznar *et al.*, 1998). The final step is to compute the daily abnormal returns accrued during the selected event window, using the world market model and Equation 4 described earlier. The abnormal returns can be further investigated using various parametric and non-parametric statistical methods for hypothesis testing research.

Over the last few decades, the event study method has been used frequently in strategic management research. Given the increasing global interdependence of financial markets and the tendency toward globalization, applying this technique to multiple countries simultaneously would definitely increase the research scope in the strategic management field. I hope that the solutions discussed in this paper will help researchers understand and overcome methodological challenges, creating more opportunities to apply the multi-country event study method to strategic management research.

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