Information Sharing Alliances in the Airline Industry: An Examination of Code Sharing Agreements

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This paper addresses the issue of inter-organizational information-sharing alliances and their impacts on firm values from the perspective of inter-organizational coordination between partners in the airline industry setting. We investigate the shareholder wealth effects of inter-organizational information-sharing alliance arrangements, using 131 code sharing agreements in the airline industry between 1984-1997. Employing event study methodology, we find that the information-sharing alliances between similar partners did create positive value in terms of stock returns at the time of alliance announcements to major US airlines. However, alliances between dissimilar partners resulted in significant losses of shareholder value to the major airlines. These results strongly support our main hypotheses, that information-sharing alliances are successful and the benefits of such alliances are realized only when coordination difficulties can be effectively dealt with.

Keywords: inter-organizational information sharing alliances, event studies, code sharing, coordination

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I. INTRODUCTION

A notable trend in industry in recent years is a persistent growth of alliances between competitors. Information technology often plays a strategic role in such alliance arrangements. Information-sharing generated from the IT that mediates such alliances becomes the core asset for these types of alliances. However, researchers have scarcely looked at the role of information sharing in creating strategic advantages to the partners (Christiaanse 1994). Moreover, no consistent patterns have been found when it comes to interorganizational information-sharing alliances and their impacts on firm values. We address this issue from the perspective of inter-organizational coordination between partners in the airline industry setting.

In an effort to create competitive prowess, airlines often engage in information-sharing agreements by sharing airline codes (referred to as 'code sharing') in the computer reservation systems. Code sharing in airlines, often referred to as an "IT-enabled leading edge solution," occurs when one airline places a flight code onto a service operated by another airline (Kao, Brown, and Tornbohm 2000). With this context in mind, we focus particularly on the following questions: Do information-sharing alliances add value to alliance partners? Under what conditions do such alliances create value, and when do they not? Even when it is clear that some alliance arrangements may not create value for the partners, why do firms engage in alliance arrangements?

We argue that the structural dimensions of inter-firm coordination between partners have significant roles in determining the direction of stock market responses. Our study shows that code sharing agreements between 'major' and 'regional' airlines are often considered in the stock market to be potentially damaging to the future value of the participating major airlines, showing a negative response to the events. We argue that such results might be the consequence of the 'coordination trap,' an anomaly where coordination difficulties of the alliance exceed the potential benefits. In particular, we posit that both coordination complexity and coordination dependency affect the coordination of the arrangements, impacting the stock market performance of partners. We use the event study methodology to investigate abnormal stock returns created by information-sharing alliances effected by code sharing agreements in the airline industry.

The paper is organized as follows. Code-sharing agreements in the airline industry are first introduced. The subsequent section discusses the evaluation of an alliance in terms of stock market returns. Finally, two different types of information-sharing agreements in the airline industry, code sharing among major-regional alliances and major-international alliances,¹ are investigated, along with other variables. The study focuses on the stock market responses for major US airlines following code sharing announcements, since they are the owners of Computer Reservation Systems (CRS) and often the initiators of the alliance arrangements.

II. INFORMATION-SHARING ALLIANCES AND THEIR PERFORMANCE IMPACTS

1. Computer Reservation Systems and Code Sharing Agreements

Airlines have used various types of IT in order to gain control over their revenue flows (Copeland and McKenney 1988; McFarlan 1984). Notable types include revenue management systems (RMS), computer reservation systems (CRS), distribution support systems (DSS), and other auxiliary systems. As shown in Figure 1, these systems are centered on CRS, either supporting the roles of CRS (e.g., DSS) or utilizing the information derived from CRS (e.g., RMS). Airlines use CRS for customer booking, routing, and other services. CRSs are often connected to hotel reservation systems and car rental systems, making it possible for travel agents to provide a comprehensive set of travel services. In a CRS, each member airline is assigned a unique code for booking and routing purposes.

FIGURE 1. INFORMATION SYSTEMS IN THE AIRLINE INDUSTRY

Since each airline offers services for a set of routes, the strategic market posture of each airline has been limited to coverage of air travel routes. Airlines have overcome this limitation by way of special information-sharing arrangements (code sharing) with other airlines, in which air travel routes of one or more airlines become available to each alliance partner by sharing airline codes in CRSs.² International expansion of the trend for code sharing agreements has been rapid. According to *Airline Business* magazine, there were 389 alliances among airlines worldwide in 1997, a 40% jump since 1994.

2. Inter-organizational Alliances and Stock Market Responses

In inter-organizational alliances, two or more autonomous organizations cooperate

to pursue joint achievement of their goals using their collective pool of resources (Contractor & Lorange 1988; Parkhe 1993).³ One popular type of alliance other than the information-sharing alliance is the marketing alliance. Such alliances are typically formed between partners producing complements in the market place (Bucklin and Sengupta 1993; Das, Sen and Sengupta 1998) and require sharing of information, though focused on downstream activities such as sales and customer service (Hagedoorn 1993).

Despite alleged potential benefits, inter-organizational alliances often suffer from unexpected consequences – about 55% of all alliances fall apart within three years and only 23% of these recover the costs of dissolution (Larraine 1999). In the recent past, a few studies have focused on the implication of alliance arrangements on the firm value of partners (e.g., Das, Sen and Sengupta 1998; Lorange and Roos 1991; Parkhe 1993). However, the results are mixed. Koh and Venkatraman (1991) found statistically insignificant positive market reactions to announcements of strategic alliances. Das, Sen, and Sengupta (1998) reported weak negative (statistically insignificant) market reactions to announcements of marketing strategic alliances.

One difficult consideration in studying performance in alliances is measuring performance itself. Given the multi-faceted nature of partner objectives, performance can be difficult to measure in financial terms. Many successful alliances terminate because they are pre-programmed as such; some free-riders may consider a short-lived alliance successful as far as their intended objective (e.g., technology transfer) is achieved (Gulari 1998). The event study method provides valuable information in measuring the strategic values of alliance arrangements (Dos Santos, Peffer and Mauer 1993; Im et. Al. 2001; Subramani and Walden 2001). In an efficient capital market, investors should recognize all the expected additions (or deductions) in future cash flows resulting from an alliance arrangement when it is publicly announced.⁴ Unfortunately, even in event study analyses, alliances do not seem to produce positive responses all the time (Koh and Venkatraman 1991; Das, Sen and Sengupta 1998).

3. Coordination Dependency and Requirements in Information-Sharing Alliances

The current paper primarily focuses on a very specific type of information-sharing alliance: code sharing agreements in the airline industry. The paper argues that coordination dependencies between partners significantly affect ex-post costs of coordination and restructuring, thereby influencing the risk of default and prospective income streams. We argue that task complexity and dependency (Malone and Crowston 1994) and information dependency (Milgrom and Roberts 1987; Rao, Chaudhury and Chakka 1995) can create a 'coordination trap,' where ex-post costs of coordination and restructuring outweigh benefits of alliances.

When coordination dependencies are high, organizations need to bring together more coordination mechanisms and structural elements to control information and resource flow between partners. When tasks and subtasks between partners are complex

and highly inter-dependent, more control and coordination mechanisms are required and, as a result, coordination difficulties increase. This is likely to lead to increasing information-processing costs (Galbraith 1977) and possibly a decline in performance (Pondy 1970).

When high dependency requires tight coordination, partners tend to prefer more hierarchical governance mechanisms, such as joint venture or equity positions⁵, rather than using simple contractual forms of alliance. When hierarchical elements are introduced to respond to complex coordination requirements, this may entail a substantial investment in structural elements (Gulati and Singh 1998). Often-times, however, one or both of the parties involved in the alliance are required to go through extensive restructuring because of task and subtask complexities and dependencies (Crowston and Kammerer 1998). When this happens, inter-organizational pooling of resources draws more or less into the hierarchical boundary of a partner. Moreover, the alliance could be translated later into complete hierarchical arrangements, such as vertical integration or acquisitions (Putzger 1996).

We argue that when this type of conversion happens, the stock market perceives the risks associated with such changes and firm risks and future income streams are considered from that perspective. In this coordination trap phenomenon, there is a trade-off between coordination/restructuring requirements and benefits of alliance arrangements. The major and regional alliances in the domestic airline industry are good examples. Issues of task complexity and resource dependency, especially in terms of asymmetric information dependency, often require major partners to invest heavily in coordination/restructuring efforts, which may outweigh the benefits of the alliance arrangements.

III. HYPOTHESES ON CODE SHARING ALLIANCE PERFORMANCE

In the airline industry, code sharing agreements are the foundation of information-sharing alliances. Two types of alliance arrangements are important in the domestic airline industry: 1) between major airlines and international airlines; and 2) between majors and regionals. Although these two alliances use the same basic tool, i.e., code sharing, for alliance formation, the nature of coordination in these two types of alliances varies considerably.

The major-international alliances are characterized by horizontal alliances in which the partners have comparable objectives, market scope, and operational principles. The Northwest-KLM alliance arrangements clearly reveal the benefits of such alliance arrangements as is explained by a Northwest executive: "80 percent of our strategies are very similar. We recently signed a transfer pricing agreement; we want to get better access to each other's capacity" (Putzger 1996). Both airlines are able to partially internalize its partner airline's flight information resources and offer broader service options without incurring substantial investment risk, and thus financial distress.

Economies of scale and scope economies are high compared to the size of the operational risks and investment requirement, which is minimal. As such, investment in a partner's equity is not typical, although some alliances have later developed into mergers and acquisitions. In contrast with major-regional alliances, in which many have later converted into mergers and acquisitions, major-international alliances are largely simple alliances without equity ties.

Major-regional alliances, on the other hand, represent vertical alliances in which hub operations (upstream activities in value chain) of major airlines are interconnected with the spoke operations (downstream activities) of regional partners. The two have very different objectives in strategy, market scope, and operation. The objective of major airlines is to establish a secure foothold in the local market by controlling regional competition. On the other hand, regional airlines' objective is to draw on market power of the major partner in serving in the regional market (Oster and Pickrell 1986). Major airlines face fierce competition from other major airlines and international carriers, whereas most regionals have only a few competitors in their serving markets (Philips 1996). Due to differences in market strategy and operational concerns, it is the major airlines that are responsible for the alliance to work. Information imbalances and task imbalances are problematic, as the entire operation depends heavily on the major partners. After the alliances, regional partners often need to be revamped in order to streamline the daily operations of major partners (Philips 1996).

TABLE 1. COORDINATION DIFFERENTIALS IN TWO TYPES OF INFORMATION-SHARING ALLIANCES

Coordination attributes	Major-regional alliances	Major-international alliances
A. Alliance Characteristics <ul style="list-style-type: none"> Objectives (Oster and Pickrell, 1986) Major drivers of alliance (Philips, 1996) Governance struct. (Gulati & Singh, 1998) 	<ul style="list-style-type: none"> Market penetration Cost Joint venture or equity position involved 	<ul style="list-style-type: none"> Market Expansion Profit Simple alliances, equity position rarely involved
B. Market scope and operation <ul style="list-style-type: none"> Economies of scope (Clemons et al., 1993) Competitive pressure (Philips, 1996) Operating principle (Clemons et al., 1993) 	<ul style="list-style-type: none"> Limited High for major, low for regional Highly dissimilar 	<ul style="list-style-type: none"> Very high High for both Almost identical
C. Coordination dependency <ul style="list-style-type: none"> Task dependency (Malone & Crowston, 1991; Malone et al., 1999) Information dependency (Crawford, 1982; Ellis, et al., 1991) Power imbalance (Boris & Jemison, 1989) 	<ul style="list-style-type: none"> Unbalanced Unbalanced Unbalanced 	<ul style="list-style-type: none"> Balanced Balanced Balanced
D. Coordination Requirements <ul style="list-style-type: none"> Organizational restructuring needs (Gulati & Singh, 1998) Managerial restructuring needs (Gulati & Singh, 1998; Rao et al., 1995) 	<ul style="list-style-type: none"> High and imposed on the major High and imposed on the major 	<ul style="list-style-type: none"> Medium or low High, but mutually responsible

Compared to major-international alliances, major-regional alliances are generally characterized by comparatively higher coordination dependency in the task and sub-task environment, higher restructuring costs, and more vertical governance arrangements. Table 1 shows the two types of alliances representing two different types of information-sharing ties, one (major-regional case) being vertical ties later being developed into mergers, and the other (major-international case) being horizontal ties without equity positions. We argue that such differences in coordination mechanisms will be reflected in performance measures, and stock market responses to the alliance announcements will differ.

H1: Code sharing agreements between US majors and foreign internationals will differ in stock market responses from those between US majors and regional airlines.

1. Code Sharing Agreements between Major Airlines and Foreign Internationals

As international air travel becomes the heart of competitive battle in the airline industry, strategic alliances are viewed as a low-risk strategy leading to international expansion. Information and resources of two airlines are pooled together in order to create a synergy in which market accessibility of the partners is greatly expanded without incurring extra financial costs. According to Northwest, partner compatibility is the salient factor in the success of US major-foreign international alliances (Putgzer 1996). Organizational goals and operational structure are similar, thereby reducing partner opportunism and ex-post coordination costs of information and resource sharing. Thus, post-alliance coordination is primarily an information system/technology issue (Putgzer 1996). Compatibility between partners also minimizes the risk of uneven informational flow in terms of controlling information unfairly by a partner. Therefore, US major and foreign international alliances have low anticipated coordination dependency as well as low ex-post restructuring requirements. As each alliance is carefully woven into the international web of alliances, these alliances are known to create ex-post values to the partners. As such, positive stock market responses are expected. Therefore:

H2-a: Code sharing agreements between US majors and foreign internationals will produce positive abnormal returns in the stock market

We also expect that, in general, the magnitude of an alliance would effect an information alliance and have an impact on the future values of the partners (Rao et al. 1995). There are two important variables that may represent the magnitude of alliances that would impact alliance performance: 1) the presence of multiple routes (vs. single route) covered in the agreement; and 2) the presence of other marketing contracts (vs. no other contract) involved in the code sharing agreement. Because of the similarities in operation principles, market strategies, and market scope, coordination requirements do not seem to increase substantially in tandem with the number

of routes involved. Rather, the presence of multiple routes covered in the contract may indicate the degree of involvement and acceptance of the agreement, which in turn may have an impact on the success of the partnership (Rao et al. 1995). Therefore, we anticipate that the presence of multiple routes covered in the code sharing agreement is likely to amplify the relative impact on the stock price of the code sharing participants. Alliance arrangements containing other marketing contracts may indicate strategic intent of the partners, showing clearly their seriousness and readiness for the alliance arrangements. Other marketing contracts include frequent flier mile programs, co-use of airport facilities, advertising campaigns and so forth.

While these arrangements might increase coordination requirements between partners with similar operation principles and strategies, they are not likely to be translated into major restructuring or ex-post task coordination. We expect that the stock market will react positively to the news that there are other marketing arrangements involved along with code sharing agreements. An introduction of new code sharing agreements represents a quantum change for airline partners. In contrast, an extension of, or an addition to existing agreements is only an incremental change for the airline partners. Therefore, we anticipate that stock market responses will be more positive to *new* code sharing agreements than to the extension of, or addition to existing ones. These amplifications would occur because we expect the variables to moderate the relationship between US major-international code sharing agreements and stock market performance. Therefore:

- H2-b: *The presence of multiple routes will amplify the effects of code sharing agreements between US majors and foreign internationals on abnormal stock returns at the announcement.*
- H2-c: *The existence of other contracts will amplify the effects of code sharing agreements between US majors and foreign internationals on abnormal stock returns at the announcement.*
- H2-d: *The effects of code sharing agreements between US majors and foreign internationals on abnormal stock returns at the announcement will be amplified if the agreements are new, rather than extensions of existing ones.*

2. Code Sharing Agreements between Major Airlines and Regional Airlines

Code sharing agreements between major airlines and regionals are often problematic because partners have substantial differences regarding firm objectives, market scope, operating principles, and value chain activities as a whole. Regionals traditionally competed only in niche markets, while the major airlines have national and international presence. Accordingly, coordination dependency and ex-post costs of restructuring are likely to be high in this type of alliance. Negative aspects of regional alliances lie also in the need for seamless but flexible operation, and thus smooth logistical collaboration between the partners.

Unlike major-international alliances, which are usually hub and hub-operational contracts, major-regional alliances involve fine-tuning between hub operations and

spoke operations. Therefore, the alliance partners must share day-to-day operational details in the region so as to respond to shifting market demand promptly.⁶ Such requirements create an enormous operational headache, which cannot be easily resolved unless tight operational relationships concerning information-sharing of daily activities are established.

No matter how detailed the contracts are, it is often difficult to achieve such a level of operational ties without bringing all the resources under one governance structure (that is, vertical consolidation through mergers or acquisitions). The default risk of alliances is high, and to contain the coordination problems, major airlines introduce more hierarchical elements and governance forms into the contract. A preliminary analysis of code sharing agreements between major and regional found that in a substantial number of regional airlines, the major airlines either took an equity position or subsequently acquired the alliance partners within a few years (Putzger 1996). It is also observed that about half of the regionals that had entered into code sharing agreements with major airlines and had not been subsequently acquired by the majors went out of business in the 1980s (Putzger 1996). In order to protect their regional presence and partnership, the majors had to make a substantial investment in hierarchical elements and even internalize their investment through equity position or acquisition. Therefore, it is likely that many of the major-regional alliances have fallen into the coordination trap, where anticipated coordination and restructuring difficulties outweigh the benefits of alliances and, as a result, market elements of the alliances are eliminated subsequently.

We expect that the risks associated with high ex-post coordination and restructuring requirements will be reflected negatively in the stock prices of the alliance partners, and also that when an equity position is involved, the stock market views it as a traditional hierarchical consolidation and responds to it accordingly (Gulari and Singh 1998). Therefore, we anticipate a non-positive stock response for major partner airlines at the time of alliance announcements.

H3-a: Code sharing agreements between US majors and regional airlines will produce non-positive stock market responses.

In addition to the expectation that the stock market response at the time of code sharing announcements between major-regional airlines will be negative, we anticipate that the presence of multiple routes covered and the existence of other contracts will adversely influence the abnormal stock returns of announcement dates. This expectation is related to the previous hypotheses (H2-b, c) in that the general magnitude of code sharing agreements, such as the presence of multiple routes covered and the existence of other contracts, will have an amplifying impact on the already presumed negative stock price response in the financial market. This would occur because we expect the variables to moderate the relationship between major-regional code sharing agreements and stock market performance.

For example, implementing and coordinating code sharing agreements with multiple

routes are more difficult than those with only a single route in terms of achieving efficiency and seamless operation. Investors will respond more negatively in the case of code sharing agreements with the presence of multiple routes. We also expect that the stock market will respond more negatively to *new* major-regional code sharing agreements than to the extension or addition of existing ones, because new agreements will create a greater perturbation in the stock market than existing ones (which are already common knowledge). Therefore:

H3-b: The presence of multiple routes will amplify the effects of code sharing agreements between US majors and foreign internationals on abnormal stock returns at the announcement.

H3-c: The existence of other contracts will amplify the effects of code sharing agreements between US majors and foreign internationals on abnormal stock returns at the announcement.

H3-d: The effects of code sharing agreements between US majors and foreign internationals on abnormal stock returns at the announcement will be amplified if the agreements are new, rather than extensions of existing ones.

Figure 2 summarizes our hypotheses and research model.

FIGURE 2. CONCEPTUAL FRAMEWORK FOR GENERAL LINEAR MODEL.

V. DATA AND ANALYSIS

The data was gathered by tracing all the code sharing agreements made in the airline industry and announced in *Aviation Daily* between January 1984 - December 1997. We used *Aviation Daily* because it is the only comprehensive daily in the airline industry and is commonly used as a data source (all announcements regarding

aviation are first announcements).

Data gathering involved the content-analytic technique, using key words such as "code sharing," "code share," "information-sharing agreement," and so on. More than 400 alliances among airlines worldwide were found, of which 170 cases included contracts in which major US airlines were involved. Of these, only 131 cases had all the required data.⁷ We had eighty-seven cases for major-international airlines code sharing agreements, thirty-five cases for major-regional agreements, and nine cases for other type of agreements (major-major agreements).

In the data, eighty-seven agreements turn out to have more than one contract; thirty-six cases have other marketing agreements along with the code sharing agreements; and 101 cases are found to be new initiatives.

TABLE 2. CODE SHARING AGREEMENT PARTNERS IN THE SAMPLE

International airline partners	Major airlines	National/Regional airline partners
Quantas; BWIA; Lufthansa; Canadian Air; Cathay Pacific; Singapore Airlines; South African; El Al Airlines; Transwede; China Air; Kuwait Airlines	American	Metro Airlines Lone Star Airlines Command Airways
Aero Mexico	America West	Mesa Airlines
SAS; Air Ontario; Ansett Air; TACA; China Air; Air France; CSA Czech Air; World Air; Al Italia	Continental	City Express; GP Express Skywest; Gull Air
Sabena; TAPA-Portugal; Swiss Air; Singapore; Austrian Air; Air Lingus; Korean Air; Air France	Delta	Ransom Airlines
	Eastern	Bar Harbor Airlines; Precision Valley Aviation
KLM; China Air; Ansett; Air UK; Eurowings	Northwest	Precision Air; Transstate Air; Statewest; Northwest Express; Alaska Air; Mahalo; Mesaba
Malibu-Hungarian Airlines; Adria Airlines	Pan Am	
	Piedmont	Brockway Air
China Air; Malibu-Hungary Airline; Royal Jordanian Air; Philippine Air; Air Canada	TWA	Jet Express; Statewest; Pocono Gull Air; West Air; Alpha Air
British Air; Ansett; USAfrica; ALM Antilean; Air New Zealand; National Air of Chile; Lufthansa; Thai Airways; Air India	United	Great Lakes Airlines; Gulf Stream; Cayman Airlines
All Nippon Airlines; British Airways; Quantas	USAir	CC Air; Cayman; Jet Express; Hawaiian Airlines

Only the data that had US Airline involvement could be utilized because of the non-availability of international stock price data, as well as non-availability of stock

prices for smaller US regionals because of their non-public status. Consequently, code sharing agreements such as international-international, international-US regional, international-foreign regional, etc., were excluded.

To test hypothesis 1, which asserts that stock market responses on the code sharing announcements between US majors/foreign internationals and US majors/regionals will be significantly different, we calculated the cumulative abnormal stock returns of each type of code sharing alliance for the day before and on the announcement day (i.e., combined abnormal returns for two days [-1,0]). Table 3 shows descriptive statistics for each type of alliance.

Based on the normality of distributions of two abnormal stock returns, the null and alternative hypotheses and test statistic are as follows:

$$H_0: \mu_x = \mu_y; H_1: \mu_x \neq \mu_y$$

$$T = \{(X_m - Y_m) - (\mu_x - \mu_y)\} / \sigma * \sqrt{1/n_1 + 1/n_2}$$

Where, T = Test statistic

X_m = Mean of abnormal stock returns for the US_INT alliances during [-1, 0]

Y_m = Mean of abnormal stock returns for the MAJ_REG alliances during [-1, 0]

μ_x = Expected mean of X_m ; μ_y = Expected mean of Y_m

sqrt = Square root; $\sigma = \sqrt{\{(n_1-1)s_1^2 + (n_2-1)s_2^2\} / (n_1 + n_2 - 2)}$

s_1^2 = Variance of abnormal stock returns for the US_INT alliances

s_2^2 = Variance of abnormal stock returns for the MAJ_REG alliances

n_1 = Number of alliances between US major and international airlines, i.e. US_INT

n_2 = Number of alliances between US major and US regional airlines, i.e. MAJ_REG

TABLE 3. DESCRIPTIVE STATISTICS OF ABNORMAL STOCK RETURNS (TEST WINDOW: [-1,0])

	US_INT	MAJ_REG
Number of Samples	87	35
Average Abnormal Stock Returns	1.501%	-0.979%
% of Negative Abnormal Returns	55.33%	65.71%
Highest Abnormal Returns	20.56%	17.07%
Lowest Abnormal Returns	9.63%	-12.76%

Following Cody and Smith (1991), the General Linear Model (GLM) method was used to analyze the data and test hypotheses 2 and 3 (Murphy and Myers 1999; Elia 2000). This was preferred to OLS, since the independent variables were dichotomous. The dependent variable is the "net abnormal market returns" of each airline, which is obtained using the Market Model.⁸ This is then used in our GLM model – the dependent variable that represents the net abnormal return for the designated i^{th} period is denoted by the symbol RET _{i} . The event study methodology is based on the assumption of efficient capital market theory (Fama 1972), i.e., the market value of firms as reflected in their security prices fully reflect available information. As

a result, whenever new information is made available to the market, the market adjusts the firm's value to reflect the changes in the present value of the cash flows and profits (Subramani and Walden 2001; Im, Dow and Grover 2001; Chatterjee, Richardson and Zmud 2001). For example, the stock market reacts positively to the announcements of environment performance awards (Klassen and McLaughlin 1996) and quality awards (Hendricks and Singhal 1996). Here, the new information is the announcement of code sharing between US major vs. international and regional airlines.

Event study methodology is common in finance and strategy literature (Patell 1976; Brown and Warner 1985) in inspecting the one day before-announcement and announcement day effects for the calculation of abnormal stock market returns (i.e., $[-1, 0]$). Dos Santos, Peffer, and Mauer (1993) also adopted the two-day announcement effect in their empirical examination of the effects of announcements of IT investments on announcing firms' common stock prices. In addition to this return period, we also included in our analysis before and after-announcement periods (i.e., $[-20, -2]$ and $[+1, +20]$) to see if the announcement day effects can be isolated to the code sharing agreement events.⁹

The following variables indicated: the types of agreement (CS-US_INT and MAJ_REG), presence of multiple routes covered by the contract (ROUTE), the existence of other contracts made along with the code-sharing agreement (CONTRACT), and whether the agreement was new or not (NEW). All the main variables are indicator variables. We used the coding scheme of 1, -1, and 0 to designate the indicator variables of US_INT, MAJ_REG and others such as MAJ_MAJ and REG_REG (Neter, Kutner, Nachtsheim and Wasserman 1996).¹⁰ US_INT was coded as 1 if the code sharing agreement was made between a US major airline and a foreign airline. MAJ_REG was coded as -1 if the code sharing agreement was made between a US major airline and a regional airline. 0 was assigned if the code sharing agreement was between US major airlines or between US regional airlines (i.e., MAJ_MAJ or REG_REG). The types of agreement variables were considered along with the interaction variables between the types of code sharing agreements and the presence of multiple routes covered, the existence of other contracts, and whether the agreement was new or not, respectively. ROUTE, CONTRACT, and NEW variables were included to see if these variables independently had any effect on the abnormal stock returns around the time of the code sharing announcements. The ROUTE variable was coded 0 if the code sharing agreement covered only one route (single route), and 1 if it covered more than one routes (multiple routes).¹¹ The CONTRACT variable was coded 1 if a code sharing agreement had other arrangements, and 0 if not. The NEW variable was coded 1 if an airline company did not have an alliance with the particular airline before, and 0 if the code sharing agreement was the extension of, or addition to the existing code sharing contract between these airlines.

To verify hypotheses H2-b, c. and d and H3-b, c. and d, we included interaction variables (I1 through I3). The GLM model is specified as follows:

$$RET_i = f(CS, ROUTE, CONTRACT, NEW, I1, I2, I3)$$

where RET_i = Net abnormal return for the period i

CS = 1 if code sharing agreement is made between US and foreign airline,
 -1 if code sharing agreement is made between US major and a regional
 airline
 0 if code sharing agreement is made between US major or between US
 regional airlines.

$ROUTE$ = 1 if there were multiple routes covered in the code sharing agreement.

$CONTRACT$ = 1 if there exist other contracts made along with the code-sharing
 agreement

NEW = 1 if the contract is made first time (not expansion of existing contracts).

$I1 = (CS \times ROUTE)$; $I2 = (CS \times CONTRACT)$; $I3 = (CS \times NEW)$

We also performed multiple comparison tests (LSD and Scheffe test; see Table 5) in order to determine the direction of significance for the independent variables and interaction variables that are shown to be statistically significant.

VI. RESULTS

We found that hypothesis 1 was strongly supported by the analysis shown in the previous section. The test statistic was 2.50, which is statistically significant at 95% confidence level. This means that stock market responses on the code sharing announcements between US majors/foreign internationals and US majors/regional airlines, which were measured by the abnormal stock returns during the day before and the day of announcement, were significantly different. That is, the average abnormal returns for the US_INT alliances at the time of code sharing announcements were significantly greater than those for the MAJ_REG alliances.

Table 4 shows that the type of alliance was a statistically important variable in determining the abnormal stock returns at the time of code sharing announcements. Further, the difference in means between US_INT and MAJ_REG was statistically significant and was the most critical factor among the three types of alliances. The mean difference between MAJ_REG and other types of alliances, i.e., MAJ_MAJ and REG_REG combined was also statistically significant, but this difference cannot be considered valid due to the lack of samples (there were only nine combined code sharing cases in our sample for the MAJ_MAJ and REG_REG alliances).

Hypotheses 2-a and 3-a are strongly supported, as the cumulative average abnormal returns (CARs) for the US major-international type of alliance were positive (1.501%) for the period [-1,0] and statistically significant at $p < 0.1$ level, and the CARs for the US major-regional alliance were negative (-0.979%) at $p < 0.05$ level. This shows that code sharing agreements were not always considered value-creating strategic decisions by investors. In fact, it seems that investors penalized alliances between major and regional airlines by responding negatively to the code sharing agreement

news in the stock market. It is noteworthy that the abnormal returns of major airlines for the test periods $[-20, 2]$ and $[-1, +20]$ for both US major- international and US major and regional code sharing agreements were not statistically significant. This means that the strong test results of abnormal stock returns at the code sharing announcements for the test period $[-1, 0]$ are primarily due to the announcements of code sharing agreement event, and that these results around the announcement dates are further substantiated by the weak results of twenty days before and after the announcement day.

The results of Least Significant Difference (LSD) test and Scheffe test show that all the signs for the coefficients of abnormal returns around the announcement date are as expected (see Table 5). For these, we separated major-regional alliances from major-international ones in order to highlight the variance differences between the two. The code sharing agreement between US major and international airlines yielded consistently positive abnormal returns while that between US major and regional airlines generated consistently negative abnormal returns for the return period of $[-1, 0]$. This means that code sharing agreements between US major and international airlines were considered to be good news by investors. On the other hand, as we hypothesized in H3-a, we found that code sharing agreements between US major airlines and regional airlines resulted in significantly negative abnormal returns for all of the dependent variables.

As far as other explanatory variables are concerned, we found an interesting pattern. ROUTE and NEW variables combined with the US major-regional variable had a statistically strong relationship with abnormal returns during $[-1, 0]$. According to LSD and Scheffe test results, the means of abnormal returns were negative. This indicates that the code sharing agreements between US major and regional produced strong negative abnormal returns at the 0.05 level when they covered multiple routes in their contracts. If the code sharing agreement was new, rather than an extension of an existing contract, this negatively influenced (at $p < 0.1$ level) stock returns of major airlines that went into the code sharing arrangements with regional airlines. These results support our hypotheses, H3-b and d. However, ROUTE, CONTRACT, and NEW variables did not have a statistically significant impact on the abnormal stock returns when they were combined with major-international alliances, even though the direction of their impact was positive according to the LSD and Scheffe tests. This result shows that hypotheses H2-b, c, and d were not supported by the test results, and the ROUTE, CONTRACT, and NEW variables did not amplify the abnormal stock returns of major airlines at the time of code sharing announcements with international airlines (unsupported results are not shown in Table 5).

Event studies in prior literature have consistently shown that there are some market imperfection effects regarding investors' reactions to strategically meaningful announcements due to pre-announcement information spill-outs. Our study also has some implications with respect to this market efficiency issue – common stock investors reacted quickly on the announcement of code sharing agreements. The results also

imply that there was little evidence of information spill-out shortly before or after the announcements (see the results of test periods $\{-20, -2\}$ and $\{+1, +20\}$). This strongly supports the argument for market efficiency, which states that the stock price reflects all the information that is available to the public.

TABLE 4. GENERAL LINEAR MODEL (GLM) RESULTS FOR THE IMPACTS OF CODE SHARING AGREEMENTS ON THE STOCK MARKET RETURNS

Variable Names	Days -20 to -2		Days -1, 0		Days +1 to +20	
	F-Value	Pr<F	F-Value	Pr<F	F-Value	Pr<F
Intercept	0.92	0.3385	4.67*	0.0328	1.63	0.2039
CS	1.32	0.2509	3.94*	0.0221	0.03	0.9672
ROUTE	0.36	0.5472	5.15*	0.0250	1.58	0.2106
CONTRACT	0.63	0.4279	0.13	0.7161	0.32	0.5744
NEW	0.31	0.5812	0.17	0.6773	1.45	0.2306
CS*ROUTE	0.06	0.5183	2.78*	0.0661	0.83	0.4403
CS*CONTRACT	0.94	0.3952	1.47	0.2345	0.19	0.8350
CS*NEW	0.27	0.7609	3.31*	0.0399	0.01	0.9892
Model	0.70	0.7377	2.59**	0.0056	0.50	0.9021
R-square	0.0607		0.1929		0.0439	
No. of Obs.	131		131		131	

* p-value < 0.1 one-tailed; * p-value < 0.05 one-tailed; ** p-value < 0.01 one-tailed;

Legend:

- CS = 1 if code sharing agreement is made between US airline and foreign airline,
 -1 if code sharing agreement is made between US major airline and regional airline, and
 0 if code sharing agreement is made between US major airlines or between U. S. regional airlines
 ROUTE = 1 if there were multiple routes covered in the code sharing agreement.
 CONTRACT = 1 if there exist other contracts made along with the code-sharing agreement
 NEW = 1 if the contract is made first time (not expansion of existing contracts)
 CS*ROUTE = Interaction variable between CS and ROUTE
 CS*CONTRACT = Interaction variable between CS and CONTRACT
 CS*NEW = Interaction variable between CS and NEW

TABLE 5. RESULTS OF LEAST SIGNIFICANT DIFFERENCE (LSD) TEST AND SCHEFFE TEST

Variable Names	LSD Test	Scheffe Test
	Days -1, 0	Days -1, 0
US_INT	-	-
MAJ_REG	-	-
ROUTE	-	-
MAJ_REG*ROUTE	-	-
MAJ_REG*NEW	-	-

NOTES: 1. The signs + or - indicate that the group mean is positive (+) or negative (-).
 2. Only the significant results are included in Table 5.

VII. DISCUSSION AND CONCLUSION

This paper investigated the shareholder wealth effects of inter-organizational information-sharing alliance arrangements, using code sharing agreements in the airline industry between: 1) US major airlines and international airlines; and 2) US major airlines and regional airlines. We hypothesized that the alliance between equally-balanced partners in terms of organizational size and information flow will create more value to the investors than the alliance between unbalanced partners. Our hypotheses were primarily based on the differences in coordination difficulties between alliances of balanced partners and that of unbalanced ones in terms of task dependency, information dependency, and power imbalance.

Previous studies have revealed that alliances might not always create positive stock market returns to the partners. The researchers, however, did not explore this anomaly, although studies suggest a strong possibility that alliances may represent bad news for the investors (Koh and Venkatraman 1991; Das, Sen and Sengupta 1998). The current study is an effort to investigate this question. It finds that: 1) information-sharing alliances such as code sharing agreements do create positive abnormal returns when costs of coordinating equally-balanced partners that engage in alliance contracts are relatively low; and 2) when partners possess differential levels of market power, size, and information control, alliances seem to fail to create positive values to the larger, major partners, due to coordination and restructuring difficulties.

1. Marketing Alliances: A Losing Game?

It seems that coordination difficulties caused mainly by market scope and information asymmetry between partners impede synergistic effects of information-sharing alliances in creating positive values to the partners. Das, Sen and Sengupta (1998) note that alliances are frequently observed in mature or declining industries where alliances might signal the troubles that partners experience. In addition, our findings suggest that partner asymmetry in terms of size and information control foreshadows a negative abnormal return.

Then the question is: Why would firms engage in information-sharing alliance contracts, even when adverse stock market responses are expected? One of the reasons might lie in the nature of changes brought into the industry. For example, in the airline industry, information-sharing (through code sharing) agreements were the by-products of the on-going restructuring of the domestic as well as international airline industries. The industry-wide shake-out was so extensive that four major airlines (Easeterm, Braniff, Piedmont, and PanAm Airlines) went bankrupt; more than 50% of regionals either went bankrupt or were acquired by other (usually major) airlines (Sterling 1986). By the end of the 1980s, most of the surviving regionals entered into code sharing agreements (Foros 1990).¹² Airlines plunged into alliance arrangements in order to contain competition and instability, not exactly knowing the impacts of

alliances on the bottom line. Due to the instability that has characterized the airline industry, airlines tended to replicate what industry leaders were doing (DiMaggio and Powell 1983).¹³ In fact, many major airlines used strategic alliances as a stepping-stone to subsequent acquisitions; in some cases, major airlines acquired the partnering regionals partially at the time of agreements. We found that the stock market penalized such alliances. This is consistent with some studies that reveal that certain strategic actions result in negative stock returns at the time of their announcements (Kim, Hwang and Burgers 1993). Sirower (1997) described this phenomenon as the “synergy trap.”

Why can't firms learn from others' mistakes? If every firm is capable of learning from others' mistakes, there should be no corporate decisions that yield negative returns at the time of announcements, especially when the firms have had the time to watch what other firms behaved and performed. However, we are witnessing many corporate strategic decisions that consistently produce, on average, significantly negative returns. Some researchers ascribe this phenomenon to managers' hubris – their belief that even though others failed, they are able to do better (Roll 1986; Sirower 1997). Are all the managers that decide to employ the above-mentioned strategies irrational? The results of these event studies are only saying that these events will, on average, produce negative response from the stock market, and there are some companies that have positive abnormal returns at the announcements. Information-sharing agreements in this study need to be understood in a similar context.¹⁴

2. Implications

The findings bear important implications for information alliance research in general, and for the literature on coordination problems between dissimilar partners in particular. First, earlier theories on alliance performance may not be applicable to contracts with unequally-balanced partners. Assuming that an alliance contract is an inter-firm cooperative arrangement wherein rival firms cooperate to achieve joint maximization of firm values, researchers have emphasized the importance of goal congruence among alliance partners and clear hierarchical arrangements for effective alliance management (Burgers et al. 1993; Parkhe 1993). Special emphasis has been placed on promoting effective cooperation between two partners (Hamel 1991; Harrigan 1987; Osborn and Baughn 1990; Parkhe 1991, 1993). We find that this traditional perspective of alliances – seeing alliances as a cooperative mechanism between partners – may be too narrow a perspective. In cases of major-regional alliances in the airline industry, goal incongruence is visible and the relationship is not of cooperation, but of hierarchical dominance.

Second, our findings imply that alliances characterized by high coordination dependency and information asymmetry may be penalized by the market due to high risks of coordination and reorganization. Strategic differences in terms of market scope and operating principles often spells for differences in structure and strategy, while the asymmetry in information contents often requires partners to undergo major restructuring

for seamless flow of information resources. Under such circumstances, while alliances are arranged in order to buffer the uncertainties in the environment and contain the competition, internal risks prompted mainly by coordination problems between unequal partners might dominate the possible benefits of the alliances.

Third, as explained by Das, Sen and Sengupta (1998), when information-sharing alliances occur in a maturing market or during the industry shake-out, stock market does not always see an alliance arrangement as good news. It may see it as a sign of trouble, a prelude before a major shake-out. In fact, major and regionals alike used code sharing agreements as a way to overcome maturing market conditions, i.e., ever increasing competition, decreasing load factor and profitability, market instability due to deregulation, etc. Under such circumstances, firms turn into unproven measures. Weak competitors would be forced out and casualties are inevitable. Alliances with or among such partners do not buffer environmental uncertainties and could be detrimental to the major partners that must bear such risks. In summary, when information-sharing alliances cannot function as a boundary-spanning, buffering mechanism (which is the original design of such inter-organizational arrangements), they do more harm than good to the major partners. Internal risks associated with such alliances become salient. Stock market responses to such alliances are accordingly negative to those that should bear internal risks, i.e., the major airlines in the current study.

There are certain limitations in our study. First, we looked only at the airline industry, with its own distinctive features - this can influence the scope of our theory. Investigations on other industries should definitely help in terms of confirming the results we have in this study. Second, to enhance external validity of the study, it would be most useful if the stock prices of international airline companies at the time of code sharing agreement announcements were available. Our belief is that the announcement of code sharing agreements with major US airlines should cause a positive impact on the market value of the corresponding international carriers. Another limitation is the difficulty of controlling for other factors. This problem also exists for other event studies, which investigate information effects of major event announcements on the value of firms. In general, major external changes in the environment should be controlled in the model as abnormal stock returns are calculated in terms of the difference between individual stock returns and market returns. However, it is inherently difficult to consider all other major events that are firm-specific in the event studies.¹⁵

In summary, we believe that this study is among the initial attempts at addressing why inter-organizational information-sharing alliance announcements may produce negative abnormal returns in the stock market to the major partners.¹⁶ Much of the previous research has assumed that alliance announcements produce positive abnormal returns. However, this study of the airline industry has found that information-sharing alliances between unbalanced partners could be bad news to the partnering major airlines.

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ENDNOTES

¹ According to the Department of Transportation, airlines in the US are classified as 'major' when their annual revenue is over \$100 million. We treated other airlines whose annual revenue falls below \$100 million as 'regionals'.

² In the US the CRSs are owned by major airlines (Sabre by American; Apollo by United, USAir and Air Canada; Galileo by United, USAir, British Airways, etc. and Systems One by Continental, etc), and they are often the initiators of the deals. For relatively minimal expense, airlines can significantly expand

their presence by sharing information about their activities. In essence, major airlines aim at achieving strategic advantages by leveraging crucial CRS information technology.

- ⁵ Alliance arrangements are considered to be inherently unstable due to goal discrepancy among alliance partners, uncertainty with respect to future behaviors, and a lack of clear hierarchical arrangements for effective alliance management (Burgers et al. 1993; Paréche, 1993). Also, there exists the inherent problem of information asymmetry and resultant moral hazard between partners when firms contract to share firm-specific information through market arrangements (Williamson, 1975, 1981).
- ⁶ This does not mean that investors can predict the real cash flows of the future. It rather means that stock returns represent an unbiased, *ex ante* estimate of the future cash flows.
- ⁷ Equity positions are frequently taken by a larger or powerful partner in order to reduce partner opportunism and to gain more control over the activities of smaller partners.
- ⁸ It is known that in the regional market, there exist around 15 pricing levels over the same route, depending on demand patterns, timing of purchase, flight schedules, etc. Such sophisticated pricing scheme is possible only when the airline has complete and accurate market and operation information.
- ⁹ We could not use all of the 130 cases where US major airlines were involved because some of the announcements did not contain information about certain variables.
- ¹⁰ See Loderer & Mauer (1992) for detailed procedures for obtaining abnormal stock returns using Market Model.
- ¹¹ Only two announcement dates of code sharing agreement overlapped in our sample, but both of them were the agreements between US major and international. Therefore, the possible problem about independence of stock returns used as the dependent variable (as in our GLM model) would not be an issue here.
- ¹² Personal correspondence with Prof. Neter (Prof. Emeritus, Univ. Of Georgia) and Prof. Nachesheim (Univ. of Minnesota).
- ¹³ It is possible that in some cases, the presence of more routes does not indicate the magnitude of impact since some routes are more popular than others and can have a bigger impact. However, we utilized the presence of multiple routes as a proxy for the impact since popularity of routes is not available in the Aviation Daily and other sources.
- ¹⁴ In 1990, only 5 out of the top 50 regional airlines did not have code sharing agreements; about 41% of the regionals were wholly owned by major or international carriers (Fotos, 1991).
- ¹⁵ The explanation of negative returns for major airlines who announced their code sharing with regional airlines using DiMaggio and Powell's (1984) argument is not necessarily contradictory to the basic tenets of market efficiency. Market efficiency depends on the assumption that all public information is available to the decision makers and the information available contains either positive or negative attributes. However, if high levels of uncertainty and ambiguity are involved, such as in the airline industry of 1980's and early 1990's, we cannot really say that market efficiency was violated in the major airline's alliance with regionals despite the expected (and persistent) negative returns for the majors at the announcement. One of DiMaggio and Powell's hypotheses states that the more uncertain the relationship between means and ends, or the more ambiguous the goals of an organization, the greater the extent to which an organization will model itself after organizations it perceives to be successful.
- ¹⁶ Another possible explanation of the stock market response on the code sharing announcements can be made from the viewpoint of transaction cost economics, as a firm has many ways of coordinating with another, ranging from outright acquisition or merger to a loose alliance. It would be a good theoretical thrust if we can have the *ex ante* estimates of transaction costs of the two organizational forms. In code sharing cases, however, it is difficult to assess what market predicted before the code sharing announcement occurred. Due largely to the difficulty in establishing the pre-announcement expectations, drawing upon transaction costs to support our theoretical basis may not be able to provide a more robust explanation for the code sharing behavior observed. We suggest that the level of difficulty in coordinating two airline firms should be the major factor in explaining the relationship between the type of code sharing agreements and abnormal stock returns.
- ¹⁷ Other firm-specific events can include earnings announcement, changes in top management, mergers and acquisitions, etc. We checked above-mentioned events whether they coincided with code sharing agreements and we did not find any.
- ¹⁸ A recent study by Das et al. (1998) showed that marketing alliances had negative market reactions, although not significantly different from zero.