Institutional Determinants of International Technological Diffusion: The Case of Electronic Ticketing among Airlines

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ABSTRACT

This paper investigates the institutional factors that affect the international diffusion of beneficial technological innovations across firms. The propensity to invest in an unknown technology is strongly influenced by state governance through four institutional mechanisms: contract enforcement, property rights, uncertainty, and ownership. The absence of clear contract enforcement processes and well-defined property rights discourages investments in technology, due to the difficulty in allocating the residual surplus gained from productive assets and to the risk of their later expropriation. Institution-driven uncertainty increases the challenge of avoiding contractual hazards, requiring greater experience and learning when undertaking investment decisions. State ownership encourages multiple and often competing firm goals that diminish the incentive to promote technological improvements.

To better understand this relationship, I utilize the case of electronic ticketing among airlines. Electronic ticketing is a critical tool for cutting costs in the airline industry, potentially saving the industry approximately US$3 billion annually; yet despite the myriad gains provided to individual firms, the pace at which this technology was adopted occurred unevenly across the world. For airline e-ticketing implementation, state contract enforcement is particularly relevant given that e-tickets depend on contracts that involve no physical paper documents as proof of agreement between parties. In essence, e-ticket contracts are bound by “click-wrap” agreements wherein mere indications by the buying party to assent to the terms offered by the seller are sufficient to conclude a contract, with no need for paper exchanges or signatures. On top of this, the enforcement of such contracts in cases of dispute is made more complex by issues of legal jurisdiction and the need to modify customer behavior.

Using a unique dataset consisting of more than 180 airlines operating in 120 different countries, my analyses indicate that controlling for firm- and industry-specific factors, state governance characteristics - especially government effectiveness - have a significant impact on the pace at which individual airlines adapt the e-ticketing technology. However, I find that state ownership of firms does not significantly affect the pace of technological diffusion. Moreover, my results suggest that the diffusion of technology operates not on a global scale but along regional lines, alluding to the need to also focus supra-national institutions to properly understand global processes.

Keywords:

International technology diffusion, institutions, airlines

INTRODUCTION

With increased globalization pressures, firms are hard-pressed to find avenues for maintaining long-term competitive advantage. Among the key drivers for sustaining competitive advantage is the ability to innovate and absorb innovations rapidly from different sources (Greve, 2009). Firms that continuously adopt new technologies generate an improved ability to recognize the value of other innovations, creating more absorptive capacity for further technological advancement (Cohen & Levinthal, 1990).

For many countries, foreign sources of technology account more than 90 percent of domestic productivity growth, indicating that the pattern of global technological change is determined mainly by international technology diffusion (Keller, 2004). For certain technologies, like information technology, the increased migration of firms towards such electronic platforms not only provide productivity gains for the adopting firm (Zhu, Kraemer, & Xu, 2006b), but due to network effects, these gains also spread substantially throughout the industry as the innovations are widely adopted (Katz & Shapiro, 1985; Zhu, Kraemer, Gurbaxani, & Xu, 2006a). Hence, the ability of domestic firms to absorb technology from abroad advances firm productivity nationwide (Eaton & Kortum, 1999), playing a key role in determining the level of economic development of each country (Easterly & Levine, 2001; Rosenberg & Birdzell, 1986).

For the airline industry, electronic ticketing is arguably the most critical innovative technology aimed at cutting rising costs in the industry (Abeyratne, 2005). Although electronic tickets, which contain information previously held on a paper ticket in an electronic form (Chen, 2007), require airlines to invest in new databases integrated with the firm’s passenger service systems, these investment costs can be made up for by major cost savings. For instance, each paper ticket costs US$10 to process, while an e-ticket will only cost US$1 to process; thus saving the entire industry approximately US$3 billion annually (IATA, 2009). Besides the significant cost savings that e-tickets offer, they also ensure easier handling of itinerary changes and last-minute travel decisions; obviate the danger and inconvenience associated with lost tickets; and provide airlines with the ability to make effective use of the internet (Abeyratne, 2005).

Yet, despite the myriad gains provided to individual airlines in the use of e-ticketing systems, the pace in which this beneficial innovation diffused across firms has been uneven. In August 1994, Southwest Airlines became the first airline to issue e-tickets, followed shortly that November by United Airlines. Though the technology spread quickly throughout the United States; a decade later, only 20% of all airline tickets globally issued were electronic (IATA, 2009). This prompted the industry's governing body, the International Air Transport Association (IATA) in June 2004, to set an industry target of 100% e-ticketing by the end of 2007. Difficulties encountered by certain airlines forced IATA to extend its self-imposed deadline by a few months (Roy, 2007). Remarkably, on June 2008, the industry moved to 100% electronic ticketing among its members (IATA, 2009), albeit a few non-member airlines still issue only paper tickets.

This paper seeks to analyze the factors that affect the speed by which beneficial technologies diffuse across firms internationally. This paper provides a two-fold contribution to the institutional economics literature. First, the paper looks at the international diffusion of a single technology investment across comparable firms. In the economics of diffusion literature, models of technology diffusion have suffered from the empirical problem posed by the lack of good measures of the concept of technology (Keller, 2004; Santacreu, 2009). In the management field, papers that analyze the international diffusion of innovations across firms have utilized survey-level data on a limited set of countries that similarly fail to adequately verify the precise equivalence of the technology being adopted worldwide (e.g. Gooderham, Nordhaug, & Ringdal, 1999; Zhu et al., 2006b). This paper uses a unique dataset of electronic ticketing adoption among more than 180 airlines operating in 115 different countries, providing sufficient firm and institutional variability for understanding the impact of these different factors on international technological diffusion. The phenomenon itself resolves most of the technological comparability issues given that electronic ticketing is a technology whose utility precisely requires universal compatibility across airlines. Moreover, airlines generally have straightforward business models – the transport of passengers and freight by air – that are sufficiently equivalent across firms globally. Airlines have also been shown to be early adopters of information technology (Buhalis, 2004), which makes the understanding of this particular phenomenon more pertinent for less technology-savvy industries.

Second, the paper analyzes the issue of the institutional determinants of international technological diffusion while controlling for the industrial and firm-based factors that affect firm strategic processes. Given how bulk of the firm diffusion literature has analyzed the adoption of innovations only within a single country (e.g. Fiss & Zajac, 2004; Greve, 1996; Sanders & Tuschke, 2007), these innovation studies capture mainly the impact of firm- or industry-level factors on the diffusion process and fail to consider the significant effects of institutional differences across countries. On the other hand, studies that have been conducted on international technological diffusion have been analyzed mainly at the country level (e.g. Albuquerque, Bronnenberg, & Corbett, 2007; Caselli & Coleman, 2001; Guler, Guillen, & Macpherson, 2002), especially in the marketing literature (e.g. Gatignon, Eliashberg, & Robertson, 1989; Kumar & Krishnan, 2002); these studies do not adequately analyze industry- or firm-level effects.

The paper will be organized as follows. The first part of the paper provides a brief review of the literature to explain the impact that institutional factors have on the diffusion of technologies across firms internationally. The second part of the paper describes the electronic ticketing process and the global airline industry to highlight the value of studying this phenomenon. The third section explains the data and methods used to generate empirical support for the theoretical propositions. The fourth section enumerates the empirical results. The final section discusses the implications of the research outcome and provides insights on issues needing further research.

DETERMINANTS OF INTERNATIONAL TECHNOLOGICAL DIFFUSION

The diffusion of technology has been widely studied in the management and economics literature, given the importance of rapid adoption of technology in explaining firm competitive advantage (Cohen et al., 1990; Greve, 2009) and economic development (Easterly et al., 2001; Eaton et al., 1999; Rosenberg et al., 1986). Studies in the management literature have made much leeway in explaining the pace of the transfer of innovations across firms (e.g. Fiss & Zajac, 2004; Greve, 1996; Sanders & Tuschke, 2007), pointing to numerous firm- and industry-specific characteristics, such as firm size (Gooderham et al., 1999), network position (Greve, 2009), strategic orientation (Vilaseca-Requena, Torrent-Sellens, Meseguer-Artola, & Rodríguez-Ardura, 2007), among others, that affect this process. However, many of these studies fail to adequately specify the role of institutions, regulations or the stage of economic development in the technology diffusion process.

On the other hand, bulk of the economic literature on international diffusion have pinpointed numerous drivers of technological diffusion at the national level, such as human capital endowments (Caselli et al., 2001), trade relations (Comin & Hobijn, 2004; Keller, 2004), international networks (Guler et al., 2002), and geographic proximity (Albuquerque et al., 2007). Similarly, these economic studies fail to mention the firm-specific characteristics that affect the technology adoption process.

This study highlights the importance of integrating these disparate literatures in explaining the variation in firm decisions to absorb new technologies globally. Reflecting a current line of theorization among scholars of international business (Makino, Isobe, & Chan, 2004; Peng, Wang, & Jiang, 2008), this study incorporates the national-, industry- and firm-based aspects of firm behavior to explain the organization's decision to internally adopt a beneficial technology that provides substantial benefits. In particular, this paper seeks to direct attention to the impact of country-effects on the process of technology diffusion, which has not been as widely studied in the management literature (Makino et al., 2004; Peng, 2002) although it has been the staple in the economics of diffusion literature.

In and of themselves, national factors play a significant role in explaining the international diffusion of technology. There is much evidence pointing to the fact that technology diffusion occurs faster within countries than between countries (Branstetter, 2001; Eaton et al., 1999). Firms within each country generally share the same geographic space, language, government regulations, among others, which all play a part in lowering transaction, search and information costs, and make the transfer of technology across firms more feasible. Subsequently, three general theoretical streams have been utilized to explain the country effect on diffusion: geography, macroeconomics and institutions.

Geographic proximity decreases the costs of transportation and communication, which promotes greater interaction, trade and exchange; and which increases the propensity of the firms to benefit from innovations developed in neighboring countries (Eaton & Kortum, 2002; Keller, 2002). This may be partially explained by the increasing costliness of transferring tacit aspects of new knowledge as distance increases (Audretsch & Feldman, 1996). Thus, geographic proximity enhances the firm's ability to share formal (strategic alliances, supply contracts) and informal (shared suppliers, transferring employees) channels that facilitate the transfer of information across firms (McCann & Folta, 2008; Porter, 1990; Singh, 2005). At the same time, close contacts resolve the uncertainty of understanding the value of an innovation by providing information on costs and benefits of adoption at a greater level of timeliness, detail and persuasiveness than other information sources (Adler & Kwon, 2002; Brass, Galaskiewicz, Greve, & Tsai, 2004).

Studies have also shown how shared language significantly reduces the impact of geographic distance and facilitates greater technology transfer (Eaton et al., 2002; Keller, 2002). Shared language not only facilitates communication and obviates the need to make costly or problematic translations, it also generally embodies shared mechanisms of culture such as socialization (Schieffelin & Ochs, 1986) and social identity (Anderson, 1991). Shared language is similarly important given how cultural similarity between source and recipient countries promotes international diffusion (Albuquerque et al., 2007; Kedia & Bhagat, 1988).

Macroeconomic variables have also been used to explain the impact of country characteristics on innovation and adoption. Countries with higher levels of economic development have been shown to have higher rates of innovation and adoption, as higher income levels generally translate to more demanding consumers, as well as the provision of greater firm incentives for labor saving innovations (Comin et al., 2004; Shane, 1993). Hand-in-hand with economic development is the presence of human capital in developed economies, which similarly spurs technology adoption, especially of information technology, because of the skillrequirements, professional personnel and predecessor technologies that facilitate the utility of these new technologies (Caselli et al., 2001; Guler et al., 2002).

It must be noted that there are similar theories that point to how human capital and the presence of other technologies may retard firm technological adoption. This vintage human capital theory talks about how built-in experience in technological use reduces the incentive to update to new technologies, given how firms have more to lose from switching to a new technology platform (Brezis, Krugman, & Tsiddon, 1993). However, studies indicate that the benefits of a strong human capital base trumps the vintage human capital effect (Comin et al., 2004).

The propensity to invest in technology is also strongly influenced by the institutions in the host country where the firm generally operates. Institutions are defined as the rules of the game in an economy, including both 'formal' and 'informal' rules that define legitimate behavior (North, 1990). Institutional frameworks interact with organizations by signaling which choices are acceptable and supportable, lowering the costs of transactions (Peng, 2002).

The quality of state institutions affect firm decision strategies through three institutional mechanisms: uncertainty, contract enforcement and property rights (Williamson, 1991). Most certainly, states play a key role in maintaining political and social order whose absence causes substantial macroeconomic disturbances that affect the profitability of existing enterprises throughout the economy. In addition, this institution-driven uncertainty increases the challenge of avoiding contract disputes, requiring greater experience and learning when undertaking investment decisions (Luo & Peng, 1999). Certain state regulations can also lower transactional uncertainty by providing information and production standards that make the evaluation of technologies less costly (Ménard, 2005).

State contract enforcement facilitates cross-party investments by providing penalties against parties acting in bad faith (Goldberg, 1976) and subsidizes the monitoring and disciplining costs incurred by the contracting parties (Walsh & Seward, 1990). The absence of clearly defined property rights discourages investments in technology, due to the difficulty in allocating the residual surplus gained from productive assets (Grossman & Hart, 1986) and to the possibility of their later expropriation (Williamson, 1991). It must be noted that the appropriability of returns from assets between parties in an exchange requires both contract enforcement and property protection (Oxley, 1999) because all interparty disputes assets involve aspects of both property and contractual rights (Arruñada, 2003). As such, much economic analyses have lumped these concepts together (e.g. Barzel, 1989).

Contract enforcement is particularly important for air travel given how the issuance of a ticket, be it a paper or an electronic ticket, hinges upon the notion of a contract to ensure certainty of intent among the parties (Abeyratne, 2005). For e-tickets, these contracts are bound by "click-wrap" agreements wherein mere indications by the buying party to assent to the terms offered by the seller is sufficient to conclude a contract, with no need for paper exchange or nor signature. On top of this, the enforcement of such contracts in cases of dispute is made more complex by issues of jurisdiction and the need to modify customer behavior (Abeyratne, 2005; Chen, 2007).

Firm-Specific Resources

The resource-based view of the firm suggests that firm-specific differences drive the strategy and performance of organizations (Barney, 1991). Inherent disparities in the assets, organizational processes, and other resources possessed by individual firms lead to differences in the strategic decisions these firms should optimally make in order to maintain their competitive advantage.

Each firm makes the decision on whether or not to invest in a particular technology based on the costs and the expected returns to be generated by the investments. However, investments in new technologies are associated with firm-specific payoff uncertainties, which help explain the slower than expected process of diffusion of technology across firms (Greve, 2009). Much of the investments in information technology have yet to produce the expected organizational performance gains (Barua, Sophie Lee, & Whinston, 1996) and such payoff uncertainty is worsened by temporal factors, since returns to investments in information technology are not realized instantaneously, but occur only after a certain period of time (Devaraj & Kohli, 2003).

Larger firms are more likely to adopt innovations earlier than their smaller counterparts (Greve, 2009) not only because larger firms generally face higher potential returns from technological investments, but also because larger firms have greater capacity to hire more specialized personnel and absorb the financial risks entailed by committing to new processes (Dewar & Dutton, 1986). The same reasoning holds true for firms with greater profitability, which also provides them with more capital availability for investing in new technologies.

At the same time, much of the disparity between investment and expected gains can be explained by other specific factors, such as the lack of sufficient synergistic alignment between the new technology and the firm's business value chain, which affects the payoffs stemming from the new technology (Barua et al., 1996; Sethi & King, 1994). Hence, the decision to adopt new technologies is also driven by the business model utilized by each firm. For example, low-cost no-frills airlines, with their singular focus on minimizing operational expenses, have been shown to be more pioneering in the use of technology in lowering costs, in comparison with their traditional counterparts (Buhalis, 2004; Doganis, 2001). Airlines primarily operating on a non-scheduled or chartered basis use differing distribution mechanisms for selling tickets (Buhalis, 2004) and will not likely achieve similar cost-savings as scheduled airlines. Firms catering mainly to the domestic market are not expected to adopt technologies rapidly, not only because they are walled off against the onslaught of international competition, but also because they are less likely to be exposed to foreign ideas and technologies (Osterman, 1994).

State ownership produces firms that are owned collectively by political communities instead of shareholders, funded mainly by taxation rather than fees paid by clients and controlled by political forces more than markets (Niskanen, 1971; Walmsley & Zald, 1973). These characteristic differences have begotten public enterprises that are generally more bureaucratically complex; prone to be affected by external events; less subject to competitive pressures; concerned with multiple, often contrasting objectives; and more constrained by limited funding than their private counterparts (Boyne, 2002; Rainey, Backoff, & Levine, 1976). Given how costs and benefits of improved organizational performance are diffused to a high number of stakeholders, state-owned firms have limited incentives for adopting new innovations (Caselli et al., 2001; D'Aunno, Succi, & Alexander, 2000).

Industry Specific Drivers

The industry-based view of strategy argues that industry structure plays a major role in determining firm strategy and performance (Porter, 1980). This paradigm suggests that firm decisions are an implicit result of industry structure. As such, certain structural characteristics of industries, such as the degree of rivalry between firms, strongly affect the performance of firms and lead to different outcomes across industries.

The impact of rivalry on innovation is partially explained by cluster theory, which posits that geographic proximity to the source of innovation would allow for the faster spread of the innovation (Greve, 2009; Porter, 2000). This is because organizations that provide similar products and are located in close proximity to each will face relatively stronger competition, as they are all trying to attract the same limited pool of consumers. Greater competition pressure encourages firms to innovate and adopt new technologies in order to survive, whereas the lack of competition makes such investments less necessary (D'Aunno et al., 2000; Osterman, 1994).

Related to this is the size of the domestic market faced by airlines. In essence, companies operating in larger domestic markets can be protected from intense international competition by government regulation of the local market where they maintain jurisdiction. For most countries, domestic routes are traditionally served solely by home-nation airlines (Pustay, 1992) through legal restrictions termed as cabotage. Cabotage provides airlines with some level of protection by allowing firms the ability to rent shift between the domestic and international markets (Clougherty, 2001). Cabotage is not only a function of population size, but also geographic size as geographically small states, where flying is infeasible, do not have the option of utilizing cabotage as a means for protecting their domestic airlines.

ELECTRONIC TICKETING AMONG AIRLINES

It has been argued that electronic ticketing has revolutionized the airline marketplace in numerous ways (Abeyratne, 2005). Electronic tickets are airline tickets that have converted the information previously held on a paper ticket into an electronic form (Chen, 2007). Though the electronic system require airlines to invest in new databases integrated with the firm's passenger service systems, these investment costs are made up for by major cost savings. For instance, each paper ticket costs US$10 to process, while an e-ticket will only cost US$1 to process; thus saving the entire industry approximately US$3 billion annually (IATA, 2009). Besides the significant cost savings that electronic tickets offer, they also ensure easier handling of itinerary changes and last-minute travel decisions; and obviate the danger and inconvenience associated with lost tickets.

Most significantly, electronic tickets facilitate e-commerce sales, which in turn provides the possibility of bypassing both third-party travel agents and manned reservations desks, implementing an e-ticketing program provides numerous avenues for further cost reductions (Belobaba, Swelbar, & Barnhart, 2009; Doganis, 2001). These cost savings are equally substantial as distribution costs have increased to 24 percent of total costs (Hoosain & Khan, 2000), ranking even higher than airline fuel costs. Notably, travel agent commissions account for roughly half of these airline distribution cots (Abeyratne, 2005). The successful adoption of electronic ticketing by certain airlines allowed the airline industry to dominate the e-commerce platform, making travel the number one product purchased online by 1997 (Hoosain et al., 2000).

The benefits of electronic ticketing have not always been evident. There were initial problems with the technology related to the verification of customers, threat of fraud and complications resulting from human or system errors (Hoosain et al., 2000). The system was initially utilized only by travelers with simple itineraries due to the difficulties of making changes and of using an e-ticket issued by one airline for travel on another airline. However, these obstacles have now been overcome through various e-ticket data exchange agreements as the technology has improved (Belobaba et al., 2009).

Yet, despite the myriad gains provided to individual airlines in the use of e-ticketing systems, the pace by which this beneficial innovation diffused across firms has been uneven. In August 1994, Southwest Airlines became the first airline to issue e-tickets, followed shortly that

November by United Airlines. Though the technology spread quickly throughout the United States; however, a decade later, only 20% of all airline tickets globally issued were electronic (IATA, 2009). This prompted the industry's governing body, the International Air Transport Association (IATA) in June 2004 to set an industry target of 100% e-ticketing by the end of 2007. Difficulties encountered by certain airlines forced IATA to extend its self-imposed deadline by a few months (Roy, 2007). Remarkably, on June 2008, the industry moved to 100% electronic ticketing among its members (IATA, 2009), albeit a few non-member airlines still issue only paper tickets.

Airlines provide the optimal context for conducting the analysis of the international diffusion of technology because airlines are particularly subject to globalization pressures (Clougherty, 2001). Airlines tend to have similar business models across countries, supplying easy comparability across firms by controlling only a few variables. Most countries have at least one airline, providing scope for including numerous countries in the analysis and obtaining sufficient variation for the institutional variables. Airlines are required to declare their national origin for regulatory purposes, making it relatively simple to ascertain which institutional variables are appropriate for each firm.

The airlines have been early adopters of information technology. They have a long history of technological innovation and have incorporated a dependency on IT for their operational and strategic management (Buhalis, 2004). Many of these innovations, such as customer reservation systems, have provided early adopters with tremendous operational advantages, making these technological investment decisions necessary for the survival of late adopters. Despite these factors, studies of technology investments among airlines remain relatively rare (Shon, Chen, & Chang, 2003).

Electronic tickets are commercial contracts between consumers and the airlines, previously provided on paper tickets, now converted into electronic form. Although e-tickets provide the potential for increased internet commerce, the spread of this technology does not require the capability of the airline to provide sales via the web. Historically, sales of airline tickets via the internet have lagged far behind the spread of e-tickets worldwide (Doganis, 2001). This issue is significant because unlike electronic ticketing per se, electronic commerce requires more significant state institutional support, as well as the development of auxiliary services, such as credit card payment facilities, in order to materialize (Oxley & Yeung, 2001).

SCOPE AND METHODS

The database on e-ticketing implementation was obtained from IATA, as part of their program to implement 100% e-ticketing among member airlines. This dataset contained the month-year at which each airline issued their first electronic ticket for around 160 IATA member airlines. Supplemental data for another 200 airlines not contained on this database was obtained through the websites of the individual airlines. This final database includes airlines from more than 140 countries, which provides substantial variance among the institutional variables.

Institutional-Level Variables

Institutional data that affect the speed of technological adoption were collected from different data sources. Geographic proximity and shared language were measured by the proximity of the country to the source of the innovation. A geographic distance variable was generated to measure the recipient airline's distance from the origin of the innovation, the United States and was calculated based on the number of kilometers separating Dallas, Texas, the headquarters of Southwest Airlines to the capital of the country where the other airlines are based. For airlines from the United States, the geographic proximity variable was coded as zero.

A dummy variable for English was created for all countries where English is considered an official language.

Measurements of human capital and the presence of a predecessor technology were proxied by the level of economic development and internet penetration rates. The logarithm of the gross domestic product per capita was obtained from the International Monitory Fund and is used as a measure of the level of economic development. The number of internet users per capita was collected also from Euromonitor and controls for the ability and familiarity of the general consumer population to the use of electronic commerce, which enhances the potential productivity of electronic ticketing.

Other more traditional measures of human capital, such as adult literacy levels, percentage of population with a secondary degree, as well as other technologies such as computers use and mobile phones per capita, were all gathered but limited data on all these measures materially reduced the sample size. Regressions were run including these other measures. But given how none of these other variables displayed statistical significance or materially changed the results of the empirical analyses, these measures were dropped in the final regressions.

To measure quality of governance, two variables were obtained from the World Bank Governance Indicators project. These World Bank governance indicators have been widely used in the management literature as measures of institutional quality (e.g. Cuervo-Cazurra & Genc, 2008; Weitzel & Berns, 2006). These indicators consist of six dimensions of governance, namely Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. For the purposes of this study, only two variables were utilized: Political Stability and Government Effectiveness.

Political Stability measures the likelihood of government overthrow, violence and terrorism and proxies for the level of uncertainty in the country. Government Effectiveness focuses on the quality of public service and civil service independence and proxies for the level of contract enforcement and public property protection.

Firm-Level Variables

Firm-level data on the airlines were obtained from the International Civil Aviation Organization (ICAO) through their Commercial Air Carriers – Traffic database. This database contains operational, traffic and capacity statistics of both international and domestic scheduled airlines, as well as for non-scheduled operators on an annual basis, and has been used previously in international management studies on the airline industry (e.g. Clougherty, 2001). The ICAO-sourced variables incorporated general financial and economic measures that proxy for the different firm-specific characteristics of each airline. In accordance with previous international airline studies (e.g. Lazzarini, 2007), I focus on the use of operational data due to comparability and availability issues related to financial data. Only 180 airlines from the ICAO database had data from the 1994 to 2008 period and matched with the electronic ticketing adoption dataset, which limited our sample to this above figure.

The variable on the number of passengers carried annually provided an apt proxy for the size of the airline. The statistic on the passenger load factor – measured by how much of an airline's passenger carrying capacity is used – is the main measure of capacity utilization and is the optimal indicator for airline operational efficiency and performance (Behn & Riley, 1999; Davila & Venkatachalam, 2004). With airlines being frequently capital intensive entities suffering from heavy fixed costs, the efficiency of asset utilization is a crucially important indicator of profitability. It must be noted that this is not a precise indicator of profitability since it fails to consider the pricing policies of the airline. Although, actual revenue data were available from a separate ICAO database, this was only for a small subset of airlines, fatally diminishing our sample size. Nonetheless, previous studies do indicate that passenger load factor is a highly significant predictor of airline profitability (Antoniou, 1992; Behn et al., 1999).

At the same time, the airline industry produces service outputs of a heterogeneous nature depending on the business model, including different classes of scheduled, chartered, international and domestic service. Two business model variables were sourced from the ICAO dataset, calculating the percentage of domestic passengers and the percentage of scheduled passengers, to ascertain the dependence of the airline on domestic ticket sales and non-chartered (scheduled) flights. Additional dummy variables were also generated for airlines that were more than 50% owned by the state and those utilizing a low-cost business model. For certain airlines, state-ownership changed drastically throughout the period of study and as such, the state-owned dummy variable also varies across time and indicates a one value only during years when the state-ownership is more than 50% at the end of that calendar year.

Industry-Level Variables

Domestic competition variables are designed measure the level of competition faced by each firm in its home market, as domestic routes are traditionally served solely by home-nation airlines (Pustay, 1992). This restriction, termed as cabotage, provides a barrier against global competition and allows firms to rent shifting opportunities between the domestic and international markets (Clougherty, 2001). Domestic market competition provides a proxy mechanism for analyzing the effective competition faced by the airline in its home region.

Given the limited of availability of market share data for all 115 countries, the domestic competition variable was operationalized utilizing three indicators: country size, total national airline passenger traffic per capita and number of airlines per country per capita. The country's geographic size as measured on a square kilometers basis provides a measure of the potential domestic market for transporting persons nationwide, as people living in a country the size of Russia would require more domestic flights than those from smaller states like Luxembourg or Singapore. Data on total passenger traffic is calculated as the total number of passenger kilometers flown per country and measures the actual size of the domestic market; this dataset was obtained from the Euromonitor International's Global Market Information Database which has been used extensively in the management literature (see Kotabe, 2002; Kshetri, Williamson, & Schiopu, 2007).

Finally, the number of airlines per country was collected manually on a country-by-country basis and divided by the country population. This variable was obtained as a single observation per country as of 2008, due to having no data available on the yearly entry and exit of airlines throughout the time period. I realize that the lack of data at the fleet, revenue or traffic level of each airline prevents me from adequately assessing the precise level of market concentration and therefore understanding the true level of domestic competition; however this measure remains the most feasible proxy for the ascertaining the domestic competition of each country's airline system given the data limitations.

Two additional control variables were added for the regressions. The decision by IATA to implement the 100% e-ticketing target was modeled utilizing a structural break dummy that divides the dataset into two periods before and after June 2004 decision. To confirm the reasonableness of this date, robustness tests on the stability of the hazard function over this period was attempted by modifying the date of the structural break to different months throughout the 2004 to 2005 period. Moving the dates around did not materially affect the results of the regression and the regressions with the highest explanatory power are those with the dummy variable centered on the June 2004 period. In addition, regional dummy variables were created for each geographic region to capture any unobservable regional effects that which have previously been demonstrated to impact airline performance (O'Hanlon, 2007).

The IATA and the regional dummies were used in all regressions but are not reported in the final tables for reasons of clarity and brevity. The list of variables is located in Table 1.

Insert Table 1 about here

Model Estimation

Given the nature of the data, I estimate the model using a parametric regression survival-time models to analyze which among the institutional, firm-level or industry specific factors are the most significant predictors of the time at which the execution of the e-ticketing program is made (Allison, 2001). Survival models or hazard models are models which estimate the length of time spent in a given state before the occurrence of an event. The dependent variable is recalibrated as a time-to-event indicator by summing the total month-years from August 1994 that it took the each airline to adopt the electronic ticketing technology. There are no instances of censoring with this dataset as all airlines in the sample implement electronic ticketing before the end of the investigation period.

Hazard regressions were run assuming a hazard function with a log-logistic distribution, whose mathematical properties have been shown to be more tractable than other similar distributions, particularly since it does not contain strict assumptions on the monotonicity of the hazard function (Bennett, 1983). Nonetheless, as a method of comparison, I ran several other parametric regressions utilizing alternative hazard function distributions, such as Weibull, exponential and log-normal distributions, as well as semiparametric hazard regressions like the Cox model, all of which displayed lower instances of goodness of fit as measured by the of logarithm of the likelihood function criterion.

Given a single time-to-event observation for each airline, I converted all of the time-varying independent variables into averages and transformed the entire calculation into a cross-sectional analysis. This cross-sectional analysis works inline with our earlier theoretization which indicates that much of the difference in the propensity for technological adoption across firms internationally should be motivated by inter-airline, inter-industry and inter-country differences between. Many of these variables, particularly those at the national level, such as human capital or institutional quality, do not vary tremendously across time. I include the summary statistics of the data in Table 2.

Insert Table 2 about here

As a robustness test, I also ran separate regressions allowing for each independent variable to be time-dependent or to vary each year across the 1994 to 2008 time period to potentially capture the effects of changes across time. However, this time-varying analysis diminishes my sample size to 107 airlines, as certain airlines did not provide complete firm-level data for all years. For this time-varying analysis, I use the Cox regression method, which is a semiparametric method that estimates the influence of the explanatory variables without needing to specify the parametric form for the precise time to failure (Cox & Oakes, 1984) and allows for the incorporation of time-dependent covariates (Allison, 2001).

In order to use the Cox regression with time, I modify the dependent variable of month-year electronic ticketing into a discrete year-dummy variable, wherein years prior to the adoption of electronic ticketing are recorded as zero, the year wherein the firm adopts the technology is recorded as one and all subsequent years after the adoption are dropped. The rest of the independent variables or covariates are now included in the model at the annual level, given the lack of availability of monthly data at the firm or country level. I note that this method assumes that all electronic ticketing events occurred at the precise same time every year, preventing us from the fine-toothed analysis at the monthly level.

RESULTS

Detailed results of the model estimation are presented in Table 3 below. The results of the duration model estimation may be interpreted as the effect of the independent variables on the expected value of the number of months until the airline decides to electronic ticket. It must be noted for interpretation's sake that the coefficient signs of the log-logistic model and the Cox model are reversed; a positive sign in the coefficients estimated in the log-logistic model and a negative sign in the Cox model are interpreted as an increase in the time to event. Given the desirability in this particular case of survival analysis of a lower time to event, meaning a faster diffusion rate, the Cox regression results provide a more intuitive sign to effect relationship: indicating that a positive coefficient in the covariate signifies a faster diffusion rate. As such, I report all log-logistic regression coefficients with their opposite signs, in order to minimize reader confusion for the subsequent analysis.

Insert Table 3 about here

There is significant empirical support alluding to the impact of institutional factors on international technology diffusion. Sharing the English language has a positive effect on technological diffusion, at least in the time-invariant regressions in Model 1.   These differences can be quite substantial, with hazard mean calculations estimating a 3.5 year difference in mean adoption of technology between English and non-English speaking airlines. However, pure distance from the United States is not shown to have a significant effect on technological diffusion. This result, coupled with anecdotal evidence and the significance of many of the regional variables point to the fact that diffusion does not spread on a purely global basis, but may travel instead from region to region.

The level of internet penetration shows a positive effect on technology diffusion only in Model 2. At the same time, GDP measurements show a significant relationship to diffusion only in Model 1, with the sign being the opposite of what was earlier predicted. This negative relationship between economic development and technology adoption may be pointing to the validity of vintage human capital theory in explaining some aspects of diffusion. This result may provide some credence to the leapfrogging literature which shows that countries with a limited technological base face fewer vested interests and thus fewer barriers for faster firm technological adoption.

There is significant empirical support on the impact of the quality of state governance on the adoption of technology by firms. The regressions show a consistently significant relationship indicating that countries with states having greater government effectiveness are more likely to have airlines that adopt technologies faster than poorly-run countries. However, no similarly significant results were obtained from the political stability variable. This result suggests that among the theorized impact of state institutions on technology investments, the role of contract enforcement and private property protection has the stronger impact on firm investment-decisions, as compared with uncertainty.

Briefly touching the firm-level variables, I show that firm size is among the most significant drivers of international technological diffusion. As expected, airlines that carry more passengers are more likely to adopt the electronic ticketing faster than their smaller counterparts, a result that is highly significant and consistent throughout all four regression models. However, profitability, as measured by passenger load factor, is not a solid predictor of technological diffusion in any of the regressions. This may signify that the significant cost savings inherent in electronic ticketing, particularly for larger firms, provides equal motivation for adoption either for companies that are profitable enough to afford the technological investment, or for companies that are unprofitable and require such cost-saving measures to regain cost efficiency.

There is less empirical support for the fact that ownership and business model are significant predictors of technological adoption. Regression results show that neither passenger load factor nor low-cost business model nor state ownership nor dependence on scheduled and domestic flights has a significant impact on the speed of e-ticketing adoption among airlines.

On the other hand, there is some vibrant support for the proposition that competition affects diffusion of technology. Results indicate that firms operating in countries with large airline passenger markets are not as likely to adopt technologies as fast as their counterparts, a result that is highly significant and consistent across all models. This shows that cabotage in the presence of a large market protects countries from the intensity of international competition and makes them less willing to quickly invest in new technologies. Surprisingly, the size of the country's geography indicates a positive relationship to technology adoption, at least in the time varying models. This could be due to the fact that the potential gains from adopting electronic ticketing trumps the complacency brought about by domestic protection, once I control for passenger market size. Finally, the lack of significance of the domestic airlines per capita variable is potentially caused by the operational definition of this variable due to the lack of actual figures on the annual market shares of each airline domestically.

DISCUSSION AND CONCLUSION

Overall, the empirical results validate the concept that firm-, industry- and country-specific factors all co-determine the pace of international technological diffusion. Most of the research propositions were at least partially supported, albeit some with counter-intuitive results. In summary, empirical results indicate that larger firms, facing greater competition, located in well-governed countries are more likely to adopt technologies before their counterparts. The regression results point to the relevance – albeit with less statistical significance – of the scheduled business model, potential market size, internet use and official recognition of English in the technological adoption process.

Hence, the key takeaway from this study is the fact that any study of international technological diffusion must incorporate all three factors that affect firm strategic decision-making: national, industrial and firm-level characteristics, in understanding this important process. Particularly for international business research, the powerful effect of inter-country differences makes international diffusion conceptually different from diffusion within a local setting. Differences in geographic, macroeconomic and institutional variables across countries materially affect the decision of firms in their incorporation of new technologies from abroad.

Furthermore, this international diffusion study provides some indication that the international transfer of technology occurs less on a global scale but more so on a regional level. This suggests that they may be a fourth-level of analysis when understanding any concerted global activity of firms: the regional characteristic. This insight draws parallelisms from recent papers suggesting the need for increased understanding of the internationalization processes within the ambit of semi-globalization or regionalization (Arregle, Beamish, & Hébert, 2009; Ghemawat, 2003; Rugman & Verbeke, 2004). Given strong evidence pointing to how trade, investment and multinational subsidiary behavior are driven by regional factors (Arregle et al., 2009; Rugman & Verbeke, 2007; Rugman et al., 2004), it likely follows that the diffusion of technology would follow a similar path. Some of the an anecdotal evidence in my sample points to the increased pace in electronic ticketing uptake in East Asia, the former Commonwealth of Independent States and the Middle East, when airlines from China, Russia and the United Arab Emirates decided to implement the technology respectively. The lack of significance of the geographic proximity variable, coupled with the significance of many of the regional dummy variable provides some basic empirical credence to this finding.

Apart from validating the semiglobalization proposition, what can be contributed by further analysis of the electronic ticketing diffusion process is a redefinition of which countries constitute a region. The spaghetti bowl of relationships between countries, sharing memberships in different trading blocs, linguistic commonwealths and political groupings have re-drawn the way firms invest and expand globally. Most of the studies cited previously (Arregle et al., 2009; Rugman et al., 2007; Rugman et al., 2004) have limited the scope in their definition of region only to certain parts of the globe, completely bypassing Eastern Europe, the Middle East and Africa for example, and do not explicitly re-analyze the accepted definitions of region. This relatively more complete dataset allows us to globally tease out information flows to ascertain the new country agglomerations that affect the transfer of technology globally. Again from anecdotal evidence coming from the data, it is apparent that Mexico's NAFTA relationship has tied it more closely to its Northern neighbors than to Latin America. Due to their proximity to Western Europe, Morocco and Tunisia now display a greater propensity to absorb technology akin to an Eastern European country as compared to its Middle Eastern or Sub Saharan African counterparts. Further data analyses must be made, incorporating more bilateral and multilateral relationships, in order to properly investigate this phenomenon.

The paper is not without limitations which are hoped could form take-off points for scholars intending to conduct future scholarship on this matter. The availability of additional firm-level data would contribute in expanding the sample size and providing more scope for micro-analyses, especially by allowing us to cluster airlines across countries and to properly separate the country-effect from a regional-effect. In addition, the availability of detailed industry-data, particularly of domestic market shares and international route overlaps, would have provided us with a better analytical tool for measuring the impact of differences in rivalry and inter-company contact on diffusion. Moreover, much of the research was conducted on a cross-sectional basis, whereas the diffusion of technology is also a dynamic process; additional data would have facilitated an investigation into how changes in behavior by neighboring airlines over the time period through market entry, fleet expansion or even adoption of electronic ticketing itself, impact the pace of diffusion by the home airline.

Nonetheless, this study provided additional insights regarding the process of international diffusion of innovations across firms, itself an understudied topic in management. The study utilized a unique firm-level data on airlines and a single technological innovation decision to provide a context particularly appropriate for studying the global trends in technology adoption. In addition, the study contributed to strategy theory building by utilizing all three legs of the strategy theory tripod and by analyzing the relative salience of these factors in affecting strategic decision making within firms.

This paper hopes to encourage more interest in this process of international diffusion, especially as the topic becomes of greater relevance to academics and managers. Given the importance of technological innovation in the attainment of comparative advantage in a world that is increasingly globalizing, the conclusions generated from this study are hoped to provide benefits for managers that want to better understand the direction and the pace at which innovation trends spread internationally. At the same time, the study hopes to provide policy makers and international business associations with a deeper understanding on the process by which international technological diffusion occurs, which may give them additional tools for encouraging more innovative and technologically-advanced firms.

TABLE 1
Description of Independent Variables

Variable Name	Description	Source	Effect on Diffusion
Passengers Carried	Total number of passengers carried per airline	ICAO	Positive
Passenger Load Factor	Total number of passengers carried /total airline skating capacity	ICAO	Positive
Percent Domestic	Total number of domestic passengers carried / total number of passengers carried per airline	ICAO	Negative
Percent Scheduled	Total number of scheduled passengers carried / total number of passengers carried per airline	ICAO	Positive
State Owned	Dummy variable pertaining to whether state owns more than 50% ownership of airline	Airline sources	Negative
Low Cost	Dummy variable on whether airline subscribes to low-cost business model	Airline sources	Positive
Total Airline Passengers	Total distance in '000 passenger-kilometers traveled per country	Euromonitor	Negative
Country Size	Number of '000 square kilometers of land area	United Nations	Negative
Domestic Airlines	Number of airlines operating with air operator certificate issued by national civil aviation authority per capita	Various sources	Positive
Kilometers from US	Number of kilometers between the country capital and Dallas, Texas	Various sources	Negative
English as Official Language	Dummy variable for countries where English is recognized by the state as an official language	Various sources	Positive
Log GDP/Capita	Natural logarithm of gross domestic product per capita in thousands of real 2000 US dollars	IMF	Positive
Internet Penetration	Number of internet users per capita	Euromonitor	Positive
Political Stability	Rating on low likelihood of government overthrow, violence, terrorism	World Bank	Positive
Government Effectiveness	Rating on high quality of public service and civil service independence	World Bank	Positive
Region	Dummy variable for different regions	Various	N/A
IATA	Dummy variable for time periods past June 2004 IATA e-ticketing	IATA	Positive

TABLE 2
Summary Statistics for Regression Variables

Variable Name	Mean	Standard Error	Correlations							
			Dependent	Passengers Carried	Passenger Load Factor	Percent Domestic	Percent Scheduled	State Owned	Low Cost	Total Airline Passengers
Dependent Variable	118.325	43.331	1.000							
Passengers Carried	629,762	1,228,927	-0.689	1.000						
Passenger Load Factor	65.573	9.060	-0.409	0.321	1.000					
Percent Domestic	0.433	0.353	-0.114	0.223	-0.101	1.000				
Percent Scheduled	0.930	0.217	-0.287	0.192	-0.112	0.233	1.000			
State Owned	0.505	0.501	0.142	-0.159	-0.015	-0.262	0.103	1.000		
Low Cost	0.096	0.296	0.005	-0.063	0.148	0.059	-0.038	-0.3107	1.000	
Total Airline Passengers	110857.5	278238.7	-0.452	0.547	0.248	0.328	0.007	-0.305	0.070	1.000
Country Size	2.19e+09	4.04e+09	-0.157	0.249	0.168	0.394	-0.006	-0.021	-0.052	0.467
Domestic Airlines	0.002	0.006	-0.036	-0.064	-0.025	-0.335	-0.043	0.198	-0.052	-0.114
Kilometers from US	9167.151	3992.657	0.327	-0.326	-0.067	-0.124	0.051	0.463	-0.004	-0.655
English as Official Language	0.284	0.452	-0.423	0.294	0.219	0.097	0.111	-0.117	0.119	0.492
Log GDP/Capita	8.693	1.824	-0.373	0.312	0.254	-0.116	-0.221	-0.314	0.148	0.362
Internet Penetration	0.179	0.157	-0.549	0.438	0.199	-0.022	-0.089	-0.307	0.111	0.550
Political Stability	0.084	0.874	-0.448	0.268	0.153	-0.262	-0.101	0.147	-0.082	0.228
Government Effectiveness	0.084	0.874	-0.513	0.360	0.273	-0.120	-0.144	-0.272	0.147	0.421
Individualis m	49.88636	26.11532	-0.399	0.370	0.279	0.018	-0.209	-0.295	0.190	0.567
Uncertainty Avoidance	64.46212	22.55998	0.353	-0.214	-0.082	-0.078	-0.175	-0.175	-0.127	-0.309

Variable Name	Country Size	Domestic Airlines	Kilometers from US	English as Official Language	Log GDP per Capita	Internet Penetration	Political Stability	Gov't Effective
Country Size	1.000							
Domestic Airlines	-0.117	1.000						
Kilometers from US	-0.266	0.013	1.000					
English as Official Language	0.134	0.024	-0.157	1.000				
Log GDP/Capita	-0.026	0.329	-0.399	0.096	1.000			
Internet Penetration	-0.036	0.278	-0.394	0.373	0.804	1.0000		
Political Stability	-0.191	0.386	-0.244	0.153	0.765	0.7674	1.000	
Government Effectiveness	-0.104	0.283	-0.284	0.335	0.863	0.8807	0.836	1.000

TABLE 3
Hazard Model Regressions for Financial Cards Circulation per Capita

Explanatory Variables	Hazard Regressions	
	Model 1: Time Invariant	**Model 2: Time Variant**
Passengers Carried	2.84e-07** (2.87e-08)	4.79e-08** (1.09e-08)
Passenger Load Factor	1.64e-06 (1.213-04)	-4.51e-06 (2.09e04)
Percent Domestic	-0.0706 (0.0590)	-0.7469 (0.4750)
Percent Scheduled	0.0941 (0.0930)	0.7912 (0.6068)
State Owned	0.0439 (0.0429)	0.1569 (0.2859)
Low Cost	-0.0411 (0.0589)	-0.8515 (0.6562)
Total Airline Passengers	-9.44e-07** (1.54e-07)	-4.68e-06** (1.40e-06)
Country Size	6.54e-12 (6.37e-12)	6.19e-11† (3.48e-11)
Domestic Airlines/ Capita	-6.5662 (4.1253)	-63.03826 (68.2761)
Kilometers from US	1.48e04 (1.18e04)	-1.27e04 (8.56e04)
English as Official Language	0.1357* (0.0575)	0.5108 (0.4379)
Log GDP/Capita	-0.0386* (0.0189)	-0.0726 (0.1790)
Internet Penetration	0.4172 (0.2645)	1.96e-04* (9.57e-06)
Political Stability	-0.0083 (0.0360)	0.2261 (0.2166)
Government Effectiveness	0.0899† (0.0494)	0.7093* (0.3316)
Airlines	180	107
Observations	180	912
LR Chi Square	312.72	110.16
P	0.000	0.000

Notes:
Standard errors in parentheses
†=p<0.10 *=p<0.05
**=p<0.01

REFERENCES

Abeyratne, R. 2005. Electronic Ticketing in Air Transport-Commercial Strategies and Consequences. ***Journal of World Trade***, 39(6): 1095-1118.

Adler, P. S., & Kwon, S. W. 2002. Social Capital: Prospects for a New Concept. ***Academy of Management Review***, 27(1): 17-40.

Albuquerque, P., Bronnenberg, B. J., & Corbett, C. J. 2007. A Spatiotemporal Analysis of the Global Diffusion of ISO 9000 and ISO 14000 Certification. ***Management Science***, 53(3): 451-468.

Allison, P. D. 2001. ***Survival Analysis using the SAS System: A Practical Guide***. Cary: SAS Publishing.

Anderson, B. 1991. ***Imagined Communities: Reflections on the Origin and Spread of Nationalism***. New York: Verso.

Antoniou, A. 1992. The Factors Determining the Profitability of International Airlines: Some Econometric Results. ***Managerial and Decision Economics***, 13(6): 503-514.

Arregle, J. L., Beamish, P. W., & Hébert, L. 2009. The Regional Dimension of MNEs Foreign Subsidiary Localization. ***Journal of International Business Studies***, 40(1): 86-107.

Arruñada, B. 2003. Property Enforcement as Organized Consent. ***Journal of Law, Economics and Organizations***, 19(2): 401-444.

Audretsch, D. B., & Feldman, M. P. 1996. R&D Spillovers and the Geography of Innovation and Production. ***American Economic Review***, 86(3): 630-640.

Barney, J. B. 1991. Firm Resources and Sustained Competitive Advantage. ***Journal of Management***, 17(1): 99-120.

Barua, A., Sophie Lee, C. H., & Whinston, A. B. 1996. The Calculus of Reengineering. ***Information Systems Research***, 7(4): 409-428.

Barzel, Y. 1989. ***Economic Analysis of Property Rights***. Cambridge: Cambridge University Press.

Behn, B. K., & Riley, R. A. 1999. Using Nonfinancial Information to Predict Financial Performance: The Case of the US Airline Industry. ***Journal of Accounting Auditing and Finance***, 14: 29-56.

Belobaba, P. P., Swelbar, W., & Barnhart, C. 2009. Information Technology in Airline Operations, Distribution and Passenger Processing. In P. P. Belobaba, A. Odoni, & C. Barnhart (Eds.), ***The Global Airline Industry***: 441. Chichester: Wiley and Sons.

Bennett, S. 1983. Log-logistic Regression Models for Survival Data. ***Journal of the Royal Statistical Society***, 32(2): 165-171.

Boyne, G. A. 2002. Public and Private Management: What's the Difference? ***Journal of Management Studies***, 39(1): 97-122.

Branstetter, L. G. 2001. Are Knowledge Spillovers International or Intranational in Scope? Microeconometric Evidence from the US and Japan. ***Journal of International Economics***, 53(1): 53-79.

Brass, D. J., Galaskiewicz, J., Greve, H. R., & Tsai, W. 2004. Taking Stock of Networks and Organizations: A Multilevel Perspective. ***Academy of Management Journal***, 47(6): 795-817.

Brezis, E. S., Krugman, P. R., & Tsiddon, D. 1993. Leapfrogging in International Competition: A Theory of Cycles in National Technological Leadership. ***American Economic Review***, 83(5): 1211-1219.

Buhalis, D. 2004. eAirlines: Strategic and Tactical Use of ICTs in the Airline Industry. ***Information and Management***, 41(7): 805-825.

Caselli, F., & Coleman, W. J. 2001. Cross-Country Technology Diffusion: The Case of Computers. ***American Economic Review Papers and Proceedings***, 91(2): 328-335.

Chen, F. 2007. Passenger Use Intentions for Electronic Tickets on International Flights. ***Journal of Air Transport Management***, 13(2): 110-115.

Clougherty, J. A. 2001. Globalization and the Autonomy of Domestic Competition Policy: An Empirical Test on the World Airline Industry. ***Journal of International Business Studies***, 32(3): 459-478.

Cohen, W. M., & Levinthal, D. A. 1990. Absorptive Capacity: A New Perspective on Learning and Innovation. ***Administrative Science Quarterly***, 35(1): 128-156.

Comin, D., & Hobijn, B. 2004. Cross-Country Technology Adoption: Making the Theories Face the Facts. ***Journal of Monetary Economics***, 51(1): 39-83.

Cox, D. R., & Oakes, D. 1984. ***Analysis of Survival Data***. London: Chapman & Hall.

Cuervo-Cazurra, A., & Genc, M. 2008. Transforming Disadvantages into Advantages: Developing-Country MNEs in the Least Developed Countries. ***Journal of International Business Studies***, 39: 957-979.

D'Aunno, T., Succi, M., & Alexander, J. A. 2000. The Role of Institutional and Market Forces in Divergent Organizational Change. ***Administrative Science Quarterly***, 45(4): 679-703.

Davila, A., & Venkatachalam, M. 2004. The Relevance of Non-Financial Performance Measures for CEO Compensation: Evidence from the Airline Industry. 9(4): 443-464.

Devaraj, S., & Kohli, R. 2003. Information Technology Payoff Paradox and System Use: Is Actual Usage the Missing Link? ***Management Science***, 49(3): 273–289.

Dewar, R. D., & Dutton, J. E. 1986. The Adoption of Radical and Incremental Innovations: An Empirical Analysis. ***Management Science***, 32(11): 1422-1433.

Doganis, R. 2001. ***The Airline Business in the 21st Century***. London: Routledge.

Easterly, W., & Levine, R. 2001. What Have We Learned from a Decade of Empirical Research on Growth? It's Not Factor Accumulation: Stylized Facts and Growth Models. ***World Bank Economic Review***, 15(2): 177-219.

Eaton, J., & Kortum, S. 1999. International Technology Diffusion: Theory and Measurement. ***International Economic Review***, 40(3): 537-570.

Eaton, J., & Kortum, S. 2002. Technology, Geography, and Trade. ***Econometrica***, 70(5): 1741-1779.

Fiss, P. C., & Zajac, E. J. 2004. The Diffusion of Ideas Over Contested Terrain: The (Non) Adoption of a Shareholder Value Orientation Among German Firms. ***Administrative Science Quarterly***, 49(4): 501-534.

Gatignon, H., Eliashberg, J., & Robertson, T. S. 1989. Modeling Multinational Diffusion Patterns: An Efficient Methodology. ***Marketing Science***, 8(3): 231-247.

Ghemawat, P. 2003. Semiglobalization and International Business Strategy. ***Journal of International Business Studies***, 34(2): 138-153.

Goldberg, V. P. 1976. Regulation and Administered Contracts. ***Bell Journal of Economics***, 7(2): 426-448.

Gooderham, P. N., Nordhaug, O., & Ringdal, K. 1999. Institutional and Rational Determinants of Organizational Practices: Human Resource Management in European Firms. ***Administrative Science Quarterly***, 44(3): 507-531.

Greve, H. 2009. Bigger and Safer: The Diffusion of Competitive Advantage. ***Strategic Management Journal***, 30: 1-23.

Greve, H. R. 1996. Patterns of Competition: The Diffusion of a Market Position in Radio Broadcasting. ***Administrative Science Quarterly***(41): 29-60.

Grossman, S. J., & Hart, O. D. 1986. The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration. ***The Journal of Political Economy***, 94(4): 691-719.

Guler, I., Guillen, M. F., & Macpherson, J. M. 2002. Global Competition, Institutions, and the Diffusion of Organizational Practices: The International Spread of ISO 9000 Quality Certificates. ***Administrative Science Quarterly***, 47(2): 207-232.

Hoosain, A., & Khan, S. 2000. Japan Airline: The Impact of e-Ticketing, ***Center for Asian Business Cases***. Hong Kong: School of Business, The University of Hong Kong.

IATA. 2009. E-Ticketing: http://www.iata.org/stbsupportportal/e-ticketing.htm.

Katz, M. L., & Shapiro, C. 1985. Network Externalities, Competition, and Compatibility. ***American Economic Review***, 75(3): 424-440.

Kedia, B. L., & Bhagat, R. S. 1988. Cultural Constraints on Transfer of Technology across Nations: Implications for Research in International and Comparative Management. ***Academy of Management Review***, 13(4): 559-571.

Keller, W. 2002. Geographic Localization of International Technology Diffusion. ***American Economic Review***, 92(1): 120-142.

Keller, W. 2004. International Technology Diffusion. ***Journal of Economic Literature***, 42(3): 752-782.

Kotabe, M. 2002. Using Euromonitor Database in International Marketing Research. ***Journal of the Academy of Marketing Science***, 30: 172-175.

Kshetri, N., Williamson, N. C., & Schiopu, A. 2007. Economics and Politics of Advertising: Evidence from the Enlarging European Union. ***European Journal of Marketing***, 41(3/4): 349-366.

Kumar, V., & Krishnan, T. V. 2002. Multinational Diffusion Models: An Alternative Framework. ***Marketing Science***, 21(3): 318-330.

Lazzarini, S. G. 2007. The Impact of Membership in Competing Alliance Constellations: Evidence on the Operational Performance of Global Airlines. ***Strategic Management Journal***, 28(4): 345-367.

Luo, Y., & Peng, M. W. 1999. Learning to Compete in a Transition Economy: Experience, Environment, and Performance. ***Journal of International Business Studies***, 30(2): 269-295.

Makino, S., Isobe, T., & Chan, C. M. 2004. Does Country Matter? ***Strategic Management Journal***, 25(10): 1027-1043.

McCann, B. T., & Folta, T. B. 2008. Location Matters: Where We Have Been and Where We Might Go in Agglomeration Research. ***Journal of Management Studies***, 34(3): 532-565.

Ménard, C. 2005. A New Institutional Approach to Organization In C. Ménard, & M. Shirley (Eds.), ***Handbook Of New Institutional Economics***. Boston: Kluwer Academic Press.

Niskanen, W. 1971. ***Bureaucracy and Representative Government***. Chicago: Adler-Atherton.

North, D. C. 1990. ***Institutions, Institutional Change and Economic Performance***. Cambridge: Cambridge University Press.

O'Hanlon, A. 2007. ***Global Airlines: Competition in a Transnational Industry*** (3rd ed.). Oxford: Butterworth-Heinemann.

Osterman, P. 1994. How Common Is Workplace-Transformation and Who Adopts It. ***Industry and Labor Relations Review*** 47(2).

Oxley, J. E. 1999. Institutional Environment and the Mechanisms of Governance: The Impact of Intellectual Property Protection on the Structure of Inter-Firm Alliances. ***Journal of Economic Behavior and Organization***, 38(3): 283-309.

Oxley, J. E., & Yeung, B. 2001. E-Commerce Readiness: Institutional Environment and International Competitiveness. ***Journal of International Business Studies***, 32(4): 705-724.

Peng, M. W. 2002. Towards an Institution-Based View of Business Strategy. ***Asia Pacific Journal of Management***, 19(2): 251-267.

Peng, M. W., Wang, D., & Jiang, Y. 2008. An Institution-Based view of International Business Strategy: A Focus on Emerging Economies. ***Journal of International Business Studies***, 39(5): 920-936.

Porter, M. E. 1980. ***Competitive Strategy***. New York: Free Press.

Porter, M. E. 1990. ***The Competitive Advantage of Nations***. New York: Free Press.

Porter, M. E. 2000. Location, Competition, and Economic Development: Local Clusters in a Global Economy. ***Economic Development Quarterly***, 14(1): 15-34.

Pustay, M. W. 1992. Toward a Global Airline Industry: Prospects and Impediments. ***Logistics and Transportation Review***, 28(1): 103-128.

Rainey, H. G., Backoff, R. W., & Levine, C. H. 1976. Comparing Public and Private Organizations. ***Public Administration Review***, 36(2): 233-244.

Rosenberg, N., & Birdzell, L. E. 1986. ***How the West Grew Rich: The Economic Transformation of the Industrial World***. New York: Basic Books.

Roy, A. D. 2007. IATA relaxes e-ticketing switchover deadline, ***The Financial Express***.

Rugman, A., & Verbeke, A. 2007. Liabilities of Regional Foreignness and the Use of Firm-Level versus Country-Level Data: A Response to Dunning et al.(2007). ***Journal of International Business Studies***, 38(1): 200-205.

Rugman, A. M., & Verbeke, A. 2004. A Perspective on Regional and Global Strategies of Multinational Enterprises. ***Journal of International Business Studies***, 35(1): 3-18.

Sanders, W. G., & Tuschke, A. 2007. The Adoption of Institutionally Contested Organizational Practices: The Emergence of Stock Option Pay in Germany. ***Academy of Management Journal***, 50(1): 33-56.

Santacreu, A. M. 2009. Innovation, Diffusion and Trade: Theory and Measurement, ***Working Paper***: New York University.

Schieffelin, B. B., & Ochs, E. 1986. Language Socialization. ***Annual Review of Anthropology***, 15(1): 163-191.

Sethi, V., & King, W. R. 1994. Development of Measures to Assess the Extent to Which an Information Technology Application Provides Competitive Advantage. ***Management Science***, 40(12): 1601-1627.

Shane, S. 1993. Cultural Influences on National Rates of Innovation. ***Journal of Business Venturing***, 8(1): 59-73.

Shon, Z. Y., Chen, F. Y., & Chang, Y. H. 2003. Airline E-commerce: The Revolution in Ticketing Channels. ***Journal of Air Transport Management***, 9(5): 325-331.

Singh, J. 2005. Collaborative Networks as Determinants of Knowledge Diffusion Patterns. ***Management Science***, 51(5): 756-770.

Vilaseca-Requena, J., Torrent-Sellens, J., Meseguer-Artola, A., & Rodríguez-Ardura, I. 2007. An Integrated Model of the Adoption and Extent of E-Commerce in Firms. ***Advances in Economic Research***, 13(2): 222-241.

Walmsley, G., & Zald, M. 1973. ***The Political Economy of Public Organizations***. Lexington: Lexington Books.

Walsh, J. P., & Seward, J. K. 1990. On the Efficiency of Internal and External Corporate Control Mechanisms. ***Academy of Management Review***, 15(3): 421-458.

Weitzel, U., & Berns, S. 2006. Cross-Border Takeovers, Corruption, and Related Aspects of Governance. ***Journal of International Business Studies***, 37(6): 786-806.

Williamson, O. E. 1991. Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. ***Administrative Science Quarterly***, 36(2): 219-244.

Zhu, K., Kraemer, K. L., Gurbaxani, V., & Xu, S. 2006a. Migration to Open-Standard Interorganizational Systems: Network Effects, Switching Costs and Path Dependency. ***Management Information Systems Quarterly***, 30(1): 17.

Zhu, K., Kraemer, K. L., & Xu, S. 2006b. The Process of Innovation Assimilation by Firms in Different Countries: A Technology Diffusion Perspective on E-Business. ***Management Science***, 52(10): 1557-1576.