

THE EMERGING ROLE OF VERTICAL SEARCH ENGINES IN TRAVEL DISTRIBUTION: A NEWLY-VULNERABLE ELECTRONIC MARKETS PERSPECTIVE

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Abstract. Information technology (IT) advances often create turmoil and disturb existing industry structures. We analyze the impact of the Internet and e-commerce technologies on digital intermediaries in the travel distribution sector. We suggest that the emerging role of *meta-search agents*, which act as shopbots for online travel, lead to the increasing vulnerability of existing intermediaries in the industry, especially the information infrastructure-providing *global distribution systems* (GDSs) and the distribution-based *online travel agencies* (OTAs). We base our analysis on the theories of newly-vulnerable markets and intermediation. This supports our examination of the characteristics of existing electronic distribution players in the industry that make them vulnerable to new search engine technologies. The main findings that we report are: (1) technological advances change the defensibility of e-market intermediaries to new value-adding *secondary intermediaries*, and (2) the value-added opportunities come from providing consumers with enhanced transparency-based price and feature search, as well as comparison capabilities. Our analysis allows us to make bold predictions about the future of the industry, and to apply our findings to other industry contexts.

Keywords: Digital intermediation, electronic markets, meta-search travel agents, newly-vulnerable markets, secondary intermediaries, technology adapters, travel industry.

1. INTRODUCTION

For a long time, the travel distribution industry has enjoyed structural stability due to the high barriers-to-entry imposed by the complexity of distributing travel products. Upon the emergence of mainframe computers in the late 1970s, airlines introduced electronic air travel distribution through the development of computer reservation systems (CRSs). Based on millions of lines of code, CRSs annually construct air travel products by combining prices and flight schedules for approximately 30 million flights worldwide. Airlines originally used these systems to lock in travel agencies through preferential long-term contractual agreements, upon the installation of terminals in travel agency offices [13]. CRS firms have since enjoyed a stable position in travel distribution due to the high capital investment required for new entrants to develop a reservation system, and the high switching costs that airlines and travel agencies would have to incur to test new forms of distribution.

After decades of high margins and stability, however, the travel distribution sector is facing new threats in

the new millennium, triggered by advanced e-commerce technologies, and faster, more powerful computers. We will examine the developments in the industry that have led to new competitive dynamics and the increasing risk of disintermediation of CRSs. We will show how new ventures have emerged with advanced Internet-based technologies for travel distribution which exploit vulnerabilities of capital-intensive, inflexible infrastructures.

In particular, new booking and search engines have emerged with nimble distributed architectures, and new *vertical search engines* or *meta-search agents* are capitalizing on these technologies to offer full transparency of travel products and prices.¹ In just a few years since their inception, meta-search agents have been able to reach more than 10% of the travelers who search for tickets online, with a business model that has the potential to disintermediate existing reservation systems. Airlines and travel agencies took notice, and some of them have started using these technologies to power their own booking and search tools. In the most audacious move to date, Air Canada (www.aircanada.com) announced in 2006 that it would develop a new reservation system in a partnership with ITA software (www.itasoftware.com), one of the companies that have pioneered the new technological era of travel distribution [1]. Other companies that have announced similar efforts include Alaska Airlines, American Airlines, and Continental Airlines [5].

These developments in the travel distribution sector represent a theory-building opportunity, because they mark one of the first real-world instances of IT advances that make established e-markets vulnerable. In many industries, electronic distribution has only emerged with the advent of the Internet in the 1990s, and in many of these markets the online channel is still in its infancy. These e-markets have yet to develop to maturity, let alone be threatened by new e-commerce technologies. As a result, a theory-based analysis of the travel distribution sector will shed new light not only on how advanced IT makes markets vulnerable, but also on how the struc-

¹ *Meta-search* simply means a search of multiple search engines' results. The term *vertical* refers to industry structure, and implies that the meta-search engines will pick up results from the range of players representing the full spectrum of the industry (airlines, OTAs, GDSs, non-airline intermediaries).

ture of established e-markets is impacted by IT.

From a theoretical perspective, much of the existing literature has developed in tandem with the development of Internet-based electronic markets and their impact on market structure, the emerging role of the online channel, and the need for a sound multi-channel strategy. On the other hand, there is an opportunity to develop theory by studying the few industries in which electronic distribution channels have already reached maturity, yet they are being threatened by a second generation of advanced e-commerce technologies.

Our study is based on the theories of newly-vulnerable markets and intermediation. In §2 we present a synthesis of these theories, and combine their premises to derive the theoretical underpinnings that may apply to newly-vulnerable electronic markets. In §3 we provide an interpretive discussion of the application of advanced e-commerce technologies in the travel distribution sector during the past decade. Applying our theoretical perspective in §4 we analyze the vulnerabilities of players in the travel industry information infrastructure, and what changes have occurred that are in line with our theory. We explore the reduced barriers-to-entry in travel distribution, and the extent to which technological innovation creates the basis for secondary intermediaries who add unique value to the travel search process. We conclude in §5 with contributions and limitations.

2. THEORY

We will discuss the background theory on technology and newly-vulnerable markets, IT and intermediation, and what we know about the application of these theories in the context of newly-vulnerable e-markets.

2.1. Technology and Newly-Vulnerable Markets

New ITs can shake up the structure of industries when they change the basis of competition, making markets attractive to attack or difficult to defend.

Attractive to Attack. Markets are *attractive to attack* when there is a customer, product, or activity gradient such that profitable sectors of the business subsidize unprofitable ones [9]. In this environment, IT advances may allow new entrants to expose these economic imbalances and enter the market with niche strategies that better satisfy customer needs, at a lower cost. Clemons et al. [9] examined the relative vulnerabilities of established music and news industry players with cross-subsidies between the production and selling activities, and between different consumer groups. They conclude that the economic imbalances from these cross-subsidies are driven by the market power of music producers and newspapers, but this market power can be challenged by technological innovation.

Difficult to Defend. Markets are vulnerable if they are *difficult to defend*. IT advances may reduce barriers-to-entry, thereby diminishing the ability of incumbents to

defend their positions. For example, the Internet has made many markets vulnerable because it is a distribution channel available to potential new entrants at a relatively low cost.

On the other hand, with IT-driven reductions in barriers-to-entry, new business models will become sustainable when they are well protected. New entrants have the same imperative as incumbents to build barriers-to-entry or replication, by increasing switching costs, obtaining regulatory protection, establishing long-term contracts with customers, or taking advantage of co-specialized assets [9, 15].

If new entrants can't raise their own barriers, then in the long run new ITs will become competitive necessities rather than a source of sustainable advantage [10]. With no first-mover advantage or barriers to duplication, firms that capitalize on a new IT will be vulnerable to incumbents or new entrants, leading to competition where the benefits of an innovation bring market efficiency but not higher rents for the sellers. Instead, consumers will benefit from increased competition in the form of higher value and lower prices.

The First Mover Paradigm. Processing power, storage capacity, and capacity to transmit data across networks continues to increase exponentially, following Moore's law. In the presence of IT advances, firms thus must also weigh two potential disadvantages of being a first-mover. First, if there are no barriers to replication of an innovation, followers will benefit from the experience of the first-mover and innovations will diffuse across competitors, leaving the first-mover with the sunk costs of experimentation, research, and development [29]. Second, followers may learn from the experience of the first-mover and enter the market with a better product and a more agile, less costly technology infrastructure [10].

2.2. IT and Intermediation

There are three distinctive outcomes related to disintermediation in the presence of e-commerce technologies: The elimination of intermediating roles, resulting in a shorter value chain, replacement of a traditional intermediary with an e-market, and emergence of new intermediation functions that lead to a longer value chain.

A Shorter Value Chain. Transaction cost theory suggests that as search costs for market information decrease for buyers and sellers, the information brokerage role of intermediaries ceases and sellers will transact directly with buyers, so middlemen are eliminated [4]. If the search and brokerage roles of intermediaries become more affordable and effective for the end-consumer through direct interaction with the seller, intermediation no longer has economic value [7, 24, 26, 27].

Cybermediation and Reintermediation. IT advances can lead to the emergence of electronic trading

mechanisms or *cybermediaries* that will replace traditional intermediaries [4]. On the other hand, if human intervention is still necessary in the intermediation process, then the likely outcome is a new set of intermediating organizations that include the human intervention role—albeit heavily reliant on IT, rather than pure cybermediaries. As a result, new intermediaries may take the form of pure electronic exchanges, or intermediating organizations that enable exchange with the support of IT.

New electronic market-makers are not only threatened by replication from other potential new entrants, but also by established players that attempt to reintermediate a market with their own electronic mechanisms [6]. Established firms will tend to adopt a wait-and-see approach to electronic market mediation opportunities, and will eventually reintermediate the market, often with an enhanced electronic market mechanism. For example, in 2001 five major airlines reintermediated the online travel sector with Orbitz (www.orbitz.com), which brought higher levels of transparency to consumers using state-of-the-art technology to search for and display priced travel products [19]. Established financial firms, Merrill Lynch and American Express, witnessed the entrance of cybermediaries, E*Trade and Ameritrade, and eventually introduced their own electronic trading mechanisms to compete.

A Longer Value Chain. Transaction cost theory suggests that if coordination costs between firms decrease, there will be a higher proportion of market-based economic activity [21]. Therefore, the incentives for vertical integration will decrease and, instead, the supply chain may elongate as suppliers and intermediaries outsource their value-adding functions.

Some argue that the observed explosion of cybermediaries in many industries fueled by venture capital is not only the product of experimentation, but a consequence of the innovative intermediating roles that are made possible by e-commerce technologies. Anderson and Anderson [2] contend that the Web empowers consumers by enabling new services that satisfy their needs, hence spurring new ways in which intermediaries can add value. They add that, because electronic networks make masses of information available, new intermediaries that filter and personalize market information for consumers will arise and play a sustainable value-adding function in the supply chain.

2.3. Newly-Vulnerable Electronic Markets

ITs that change the economics of trading can have a significant impact on e-market structure. Perhaps a good theoretical starting point to understand how new ITs may impact existing electronic markets is to trace the characteristics of electronic markets that distinguishes them from traditional ones. Bakos [3] suggests:

- *Reduce buyer search costs.* By more effectively providing information to consumers at a low cost, e-markets outperform offline marketplaces. In other words, e-commerce technologies increase the level of accuracy and completeness, and diminish the bias of price and product information. This increases market transparency [18].
- *Impose network externalities.* The value to individual market participants of belonging to an electronic market is higher for each new participant that joins.
- *Require large capital investments.* Electronic markets typically demand significant infrastructure investments to operate.
- *Impose switching costs.* Users typically incur in large investments to participate in an electronic market, such as the infrastructure necessary to have real-time electronic links, personnel training, and process reengineering.
- *Uncertainty.* Potential participants are uncertain about the benefits of joining the electronic market, so they may adopt a wait-and-see approach.

Network externalities, high capital investments, and high switching costs are potential barriers to entry that can make it easier for an established electronic market to defend its position. However, as electronic markets mature and IT advances materialize, the economics may change along one or more of these five dimensions to make existing electronic markets vulnerable. Therefore, disintermediation is likely to emerge within the online channel, as new entrants capitalize on new technologies to eliminate or displace established online intermediaries. How do advanced e-commerce technologies affect an established electronic market structure?

We next examine the supply chain of e-travel distribution, started in the 1970s. It shows how established e-commerce firms are threatened by new entrants that deploy more advanced market-transforming technologies.

3. META-SEARCH AGENTS: EMERGING ROLE

We next analyze historical developments in travel distribution. We identify three generations of e-market structures, which will allow us to examine two transitions within the industry. Based on a cross-case analysis of these developments, we derive propositions related to newly-vulnerable e-markets.

3.1. GDS-Based Travel Distribution

Using mainframe technologies, major airlines participated in the development of CRSs in the late 1970s. These CRSs were used as co-specialized assets to lock in business from the travel agents [15]. Airlines placed CRS terminals at travel agency locations to support their operations, in return for preferred contractual arrangements based on sales quotas and volume discounts. Competitive pressures led to the inclusion of multiple airline offers in

all CRSs [4], and other travel products were also added, including hotels and car rentals. These enhanced reservation systems came to be known as *global distribution systems* (GDSs), and the four major players are Sabre, Worldspan, Galileo, and Amadeus. Regulations to curb alleged anti-competitive behavior took away much of the advantage that GDSs provided to the airlines, so they were for the most part spun-off or sold.

In the 1980s, GDSs accounted for 80% of air travel sales [17], and they continue to play a major role in travel distribution. This advantageous position has allowed the GDSs to enjoy high profit margins, while airlines have struggled to remain profitable [4].

In 2005, the GDSs enjoyed a return on capital in excess of 30% [28]. The online channel started eroding the strong competitive position of GDS firms, however. The same year, the GDS-based bookings share was 54%, down about 30 market share points relative to the 1980s. Next, we describe the technological developments that led to new forms of travel distribution and the increased vulnerability of GDSs. (See Figure 1.)

3.2. The Online Travel Channel

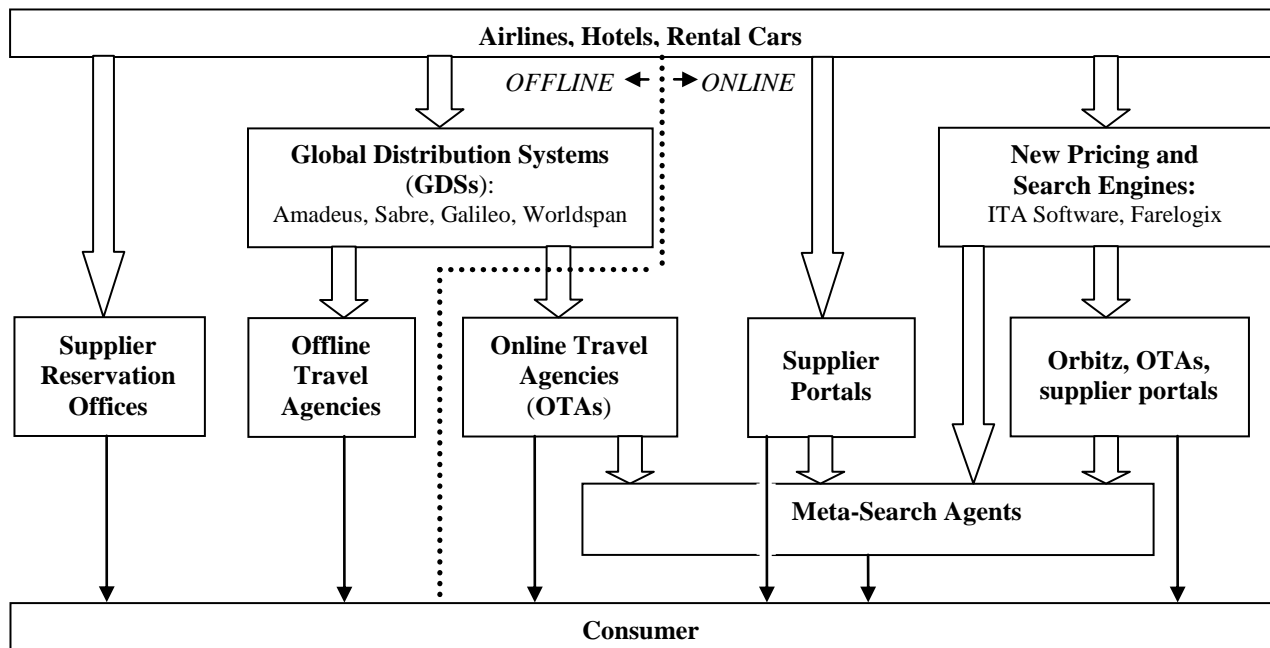
Supplier Portals: Shorter Supply Chain. With the Internet, suppliers developed online portals to offer their inventory of airline seats, hotel rooms, and rental cars. These portals are disintermediators of GDSs and lead to a shorter value chain, since they are electronic mechanisms that suppliers use to transact directly with the consumer. In a sense, they are an electronic extension of the

suppliers' reservation offices, which are available for consumers that prefer to purchase their products directly from the supplier via phone or in person.

OTAs: Cybermediation. On the other hand, OTAs such as Expedia and Travelocity emerged to turn the functionality and information provided by GDSs into user-friendly interfaces for travelers [19]. OTAs were a new form of intermediation that allowed consumers to access the information provided by the GDSs electronically at a low cost. OTAs represented a disintermediation risk for offline travel agents, which had traditionally performed the information brokerage role between GDSs and consumers. By providing higher market transparency of travel products to consumers, OTAs and supplier portals were able to capture a substantial share of travel distribution. In an unprecedented development relative to other industries, PhocusWright Inc. [23], an industry travel consultant, predicted that in 2007 online travel bookings would surpass offline bookings for the first time.

The business model of these first OTAs favored the GDSs, so they started playing a major role in both the offline and online channels. The availability of GDS-based pricing and search engines allowed the OTA market to develop early in the Internet era, because they only needed to develop a browser-based view of GDS search results. Nevertheless, the infrastructure investment to link an OTA to a GDS was substantial, and OTAs were effectively locked in to specific GDS suppliers due to high switching costs.

Figure 1. U.S. Travel Distribution Supply Chain



Note: In the U.S. travel distribution supply chain, left of the dotted line is the offline channel, and right is the online channel.

Orbitz: Reintermediation. In 2001, however, some of the major U.S. airlines reintermediated the online travel distribution channel with Orbitz, using state-of-the-art search technology developed by ITA Software. ITA Software utilizes the same databases that are used by GDSs to construct travel products (i.e., combining complex pricing structures with flight schedules to generate airline ticket offers), but it uses a distributed IT architecture with powerful servers and Linux-based applications to provide a more comprehensive set of travel search results. Orbitz increased structural market transparency levels by displaying a higher number of search results, in user-friendly Web interfaces [20].

By the same token, the legacy infrastructure of established GDSs has become an impediment to effectively compete against this new threat. The GDSs are locked into a capital-intensive, mainframe-based infrastructure since their inception. Likewise, GDS-based OTAs have not been able to compete well to offer the same level of transparency of product and price information as Orbitz, due to their reliance on GDS technology and the high switching costs to consider alternative options [20]. Therefore, the high capital investment required to develop a GDS, which originally raised barriers to entry and provided a sustainable advantage, has backfired in the presence of new e-commerce technologies. GDSs are faced with the challenge of making massive investments to update their technologies, despite revenue decreases due to new competition. A GDS executive reflected on the new competitive environment:

“The primary emphasis has been converged capability to accelerate overall cost reduction across the business units. While innovation has always been conveyed, it generally takes significantly less priority. If it aligns to a desired business need ... or if it dramatically reduces cost, or even improves stability or performance, it may see the light of day.”

3.3. Meta-Search Agents: Longer Supply Chain

As OTAs consolidated their position in the online channel, Sidestep (www.sidestep.com) and FareChase (www.farechase.com) were launched around 2000 as the first two vertical online search engines for travel. These travel *meta-search agents* search across multiple OTA and supplier portals, and refer a customer to the respective supplier site or OTA once a travel product has been selected for purchase. They serve as information aggregators who provide value-added *secondary intermediation services* for the online travel channel. (See Fig. 1.)

The First Generation. Initially, the search mechanism of meta-search agents was based on *screen-scraping* of supplier portals and OTAs with the use of bots that performed thousands of search requests per day. Mobissimo (www.mobissimo.com), for example, searches 172 sites in domestic and international markets. For consumers, the value of the first meta-search sites was primarily

for price-comparison shopping, in the same way that online *shopbots* allow price comparisons across suppliers and online retailers in other industries.

Screen-scraping technology has caused congestion in suppliers' Web servers, despite its ability to capture real-time price offers. The response from suppliers was mixed. American Airlines sued FareChase in 2003 for its screen scraping data collection. Other suppliers were more receptive. An executive of a travel supplier stated:

“Meta-search agents are causing unnecessary congestion to our portal, but they help save on distribution costs. We want to work with them to develop new ways of getting access to our data.”

Some suppliers have upgraded their processing capacity to handle screen-scraping, and others now provide Extensive Markup Language (XML) feeds to meta-search sites to avoid being screen-scraped.

The Second Generation. Kayak (www.kayak.com) was launched in 2005, and in just two years it became the travel meta-search leader with the highest number of visits. Kayak is powered by the pricing and search engine of ITA Software, and it uses a cluster of new Web application technologies called Ajax, which reduces the number of clicks necessary to modify and filter search results.² It is used by popular sites like Google Maps, among others. See Figures 2 and 3 for illustrative screen shots of Kayak's user interface.

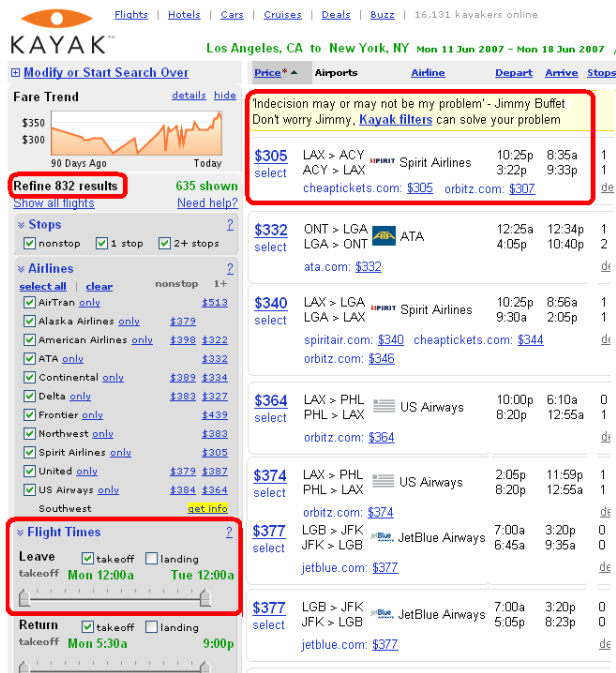
In addition to the price transparency that a typical vertical search engine provides, Ajax technologies allow Kayak to produce interactive filtering of search results based on product characteristics, such as the number of stops, departure times, and departure and arrival airports. The interface enables the consumer to quickly derive the *value ladder* of travel offers and the *price premium* required to select a higher value offer.

Kayak's innovations forced the meta-search sector to compete for market transparency, a development analogous to Orbitz in the OTA sector. With the inclusion of ITA Software's search engine, and the use of Ajax to enhance the user interface, other meta-search sites have tried to match the level of market transparency of Kayak. For example, Yahoo! Travel (www.travel.yahoo.com), which purchased FareChase in 2004, launched an Ajax-powered version of this meta-search agent in 2006.

Though the meta-search agents still account for a small portion of travel bookings, they have quickly gained a relatively high level of awareness in the online

² Ajax technologies use: standards-based presentation using XHTML and CSS; dynamic display and interaction using the Document Object Model; data interchange and manipulation using XML and XSLT; asynchronous data retrieval using XMLHttpRequest; and JavaScript binding everything together. For additional details with and without the hype from Adaptive Path, the reader should see Garrett [16] and Schalk [25].

Figure 2. Kayak's Search Result Interface



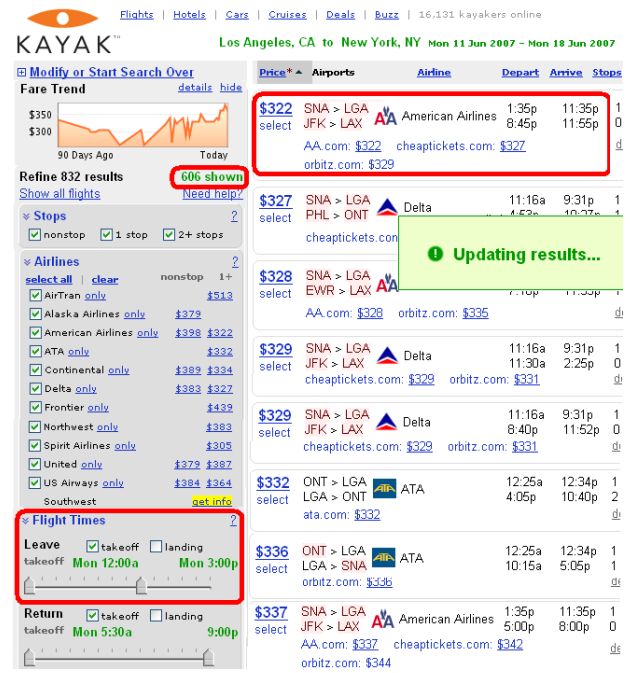
Note: This figure is a snapshot of Kayak's results for a flight search between Los Angeles and New York. The search produced 832 itineraries, with a low fare of \$305. Accessed on May 28, 2007 (www.kayak.com).

travel sector. In 2006, more than 10% of the online travel audience used meta-search agents in the search process. We contend that this emerging presence of meta-search agents in the online travel market space is due in part to the technological advances that have triggered competition for consumers with innovative mechanisms that improve the display of search results.

The Third Generation. Concurrent with this research, new generations of meta-search agents continue to emerge, with innovative mechanisms that once again challenge the market transparency levels of second generation meta-search agents. Farecast (www.farecast.com) has an algorithm that estimates the probability that a fare will increase for a given city-pair and itinerary. Farecompare (www.fare-compare.com) provides the lowest fares by month and date to provide a broad picture of seasonality, although it does not include real-time inventory availability. Flyspy (www.flyspy.com) displays market fares for a city pair in a stock-chart like interface by departure date or return date, and for different lengths of stay. Both Farecast and Flyspy use ITA Software's pricing and search engine.

Although the presence of these sites is still not significant and they have yet to consolidate their position, they continue to mark the trend of new ventures that use emerging technologies to enhance the intermediary function of e-markets, particularly in the dimension of market transparency on the consumer side. Next, we analyze

Figure 3. Kayak's Ajax-Based Interactive Filtering



Note: The search results shown in Figure 2 were filtered with the slider at the bottom left, based on a preferred takeoff no later than 3:00 pm. The final results were returned in approximately 2 seconds. 606 itineraries were returned and the lowest fare was \$322. Therefore, for this preferred schedule the price premium is \$17 relative to the lowest fare available of \$305. Similar filtering can be done along multiple criteria, including airline carrier, number of stops, and airport.

these findings to derive new propositions about newly vulnerable electronic markets.

4. ANALYSIS AND PROPOSITIONS

The developments in travel distribution that have led to the emergence of meta-search sites are driven by advances in e-commerce technologies, processing power, data storage, and transmission capacity. These technological developments exposed the vulnerabilities of the GDS sector, reduced barriers to entry in travel distribution, and spurred innovation in the intermediary function for travel products.

4.1. GDSs and OTAs: Attractive to Attack

Based on the theory of newly-vulnerable markets, e-markets will be attractive to attack if there is a customer, product, or activity gradient that causes cross-subsidies from one sector of the business to another.

Activity Gradient. The e-markets enabled by GDSs and OTAs are attractive to attack because there is an *intermediation activity gradient* in travel distribution. Travel suppliers' product and price information is the commodity that is transacted with travel intermediaries. This commodity is more profitable to suppliers when GDSs are not part of the booking transaction. Moreover,

meta-search and general search engines offer suppliers the possibility of lower distribution relative to the commission payments incurred via OTAs. Therefore, suppliers are cross-subsidizing sales via GDSs with sales from other channels.

One way of viewing the intermediation activity gradient is in terms of the profitability of the different players in the supply chain prior to the penetration of the online channel. In the 1990s, the net profit margin of the GDS sector was around 13%, compared to 5% for U.S. airlines and travel agencies [17]. GDS profits, apparently, were being subsidized by suppliers and other intermediaries.

Customer Gradient. Business travelers have different needs and are more profitable than leisure travelers [11]. They are frequent travelers who have more experience in the search process, yet the GDSs provide a core functionality to display product offers that is fixed and has not changed significantly to address the different needs. We view the business traveler segment as subsidizing the leisure travel segment in profit and search functionality.

Cross-Subsidies and Market Power. One of the reasons why GDSs enjoyed high profits has been their market power. In an oligopolistic fashion, four major players controlled travel distribution, as we noted before. So despite the fact that travel distribution became an attractive market to attack due to the cross-subsidies across the customer and activity gradients, it was difficult for new entrants to do so due to the GDSs' advantageous competitive positions. Large industry players such as the major airlines and the leading hotel chains were subject to the dominance of the GDSs, and even they would find it difficult to reintermediate electronic distribution. Only after barriers to entry in the GDS market decreased were new players able to successfully attack.³

4.2. Barriers-to-Entry and First Mover Disadvantage: Difficult to Defend

GDSs and OTAs have become vulnerable to new e-commerce technologies due to a reduction in the barriers to entry. In addition, the dependence on older technologies and an established business model makes it difficult for GDSs and OTAs to defend their position in the face of new innovations for electronic distribution.

Lower Capital Investments. A few decades ago the complexity of pricing and searching for travel products could only be managed by large mainframe computers. With the advent of the Internet and other technological

advances, the large capital investments that are necessary to compete with GDSs were significantly reduced. For example, firms like ITA Software and Farelogix use less expensive and more powerful hardware and software to perform the task of pricing millions of flights and prices, and optimally selecting among thousands of itineraries to display the best set of options to the consumer. ITA Software has entered travel distribution not only as an intermediary, but also as a *technology adapter* [14] that integrates and standardizes information from multiple vendors to offer a seamless search experience across suppliers.

GDSs have benefited from co-specialized IT assets that allow them to perform the complex task of distributing travel products. Technological progress increased the affordability of these assets by potential new entrants though. Lower capital investments required to intermediate the travel sector will continue to threaten the position of GDSs. For example, reservation systems designed and tailored for Internet distribution have entered the market, such as Navitaire (www.navitaire.com) and ITA Software's recently announced project to develop a new reservation system.

Lower Switching Costs. Though the capital investments required to develop e-markets for travel distribution have decreased, they are complex and capital-intensive for small businesses and startups. Open source software and information standards like XML have allowed ITA Software to effectively connect their pricing and search engines to OTAs and meta-search engines. The consequence has been that, despite the inability of innovators to develop their own pricing and search engines, new vendors like ITA can perform the value-adding role of technology adapter to provide this IT infrastructure at a lower price than the GDSs. OTAs and meta-search agents thus have been able to outsource pricing and search to launch their operations in a fraction of the time and with less effort than it would otherwise take to develop their own proprietary systems.

Other players in the online channel are also taking advantage of the benefits of the advanced pricing and search capabilities of ITA Software. Both Orbitz and ITA Software license their booking tools to offline travel agencies. The low cost of deploying these technologies, together with the enhanced functionality and flexibility of the search engines, makes these services attractive to both offline and online travel agencies.

Of the five differentiators of electronic markets, capital investments, switching costs, and network externalities are potential barriers to entry for established electronic markets. We observe that the first two are influenced by technological innovation. This leads us to assert a general proposition:

- **Proposition 1 (The E-Markets Barriers-to-Entry**

³ This observation is backed by sponsored research interviews that the second author conducted with colleagues, Michael Davern and Alina Chircu, at Radisson Hotels, Carlson Wagonlit Travel and the Carlson Companies from 1998 to 2003, and unrelated work from 2004 to 2007 with a large U.S. air carrier.

Reduction Proposition). *Technological progress reduces barriers-to-entry of established e-markets, by reducing the capital investments necessary for entry, as well as the participants' switching costs.*

First Mover Disadvantage. Because of technological progress, it will remain a challenge for established electronic markets to morph in time to survive attacks from new entrants that introduce innovative business models based on advanced technologies. For example, both GDSs and GDS-based OTAs were faced with limitations in their abilities to compete with new entrants.

GDSs are dependent on and locked into their mainframe-based infrastructure and software for pricing and search. The proprietary nature of these systems makes it particularly challenging and costly to merge with more advanced IT infrastructures to compete effectively.

- **Proposition 2 (The Outdated IT Infrastructure Proposition).** *Established electronic markets are difficult to defend in the face of technological progress, because they are dependent on outdated IT infrastructure with lower capability than that of new entrants.*

On the other hand, second generation e-markets like Orbitz, and meta-search engines will find it less difficult to morph and adapt to new entrants. They have access to technologies that have open architectures and standards, and less capital-intensive, distributed infrastructures. So while the difficulty to defend will remain, it will take less effort for them to morph in order to survive.

- **Proposition 3 (The More Advanced E-Markets Proposition).** *More advanced generations of e-markets with higher capabilities will find it less difficult to defend their market position.*

5.3. Innovation: Newly Easy-to-Enter

Technological advances have made it easier for new entrants to penetrate the travel distribution sector for two reasons. First, they enabled the development of mechanisms that significantly reduce the cost of searching for lower prices. Second, they spurred innovation of selling mechanisms that allow consumers to effectively value the different product offers.

Lower Search Costs for Prices. Thanks to the increased processing power and data storage capacity of computers, and the use of distributed architectures and advanced e-commerce applications, new ventures like ITA Software can deploy more powerful and faster pricing and search engines. Intermediaries such as Orbitz and Kayak, which are powered by ITA Software, are then able to offer higher price transparency to the consumer by displaying a comprehensive set of priced itineraries. GDSs, in turn, are still limited by the limited ability of the mainframe-based search engines to price as many itineraries. On a sample of 100 searches, for example, Granados et al. [20] found that Kayak and Orbitz dis-

played on average 343 and 166 itineraries, compared to 65 for Travelocity, which is powered by the Sabre GDS. They also found that the lowest price offer decreased when a higher number of itineraries was displayed.

- **Proposition 4 (The Price Comparison Proposition).** *Advanced e-commerce technologies will enable new e-markets that further reduce buyer search costs and enhance price comparison capabilities.*

Higher Product Transparency. In both the OTA and meta-search agent sectors, new and innovative mechanisms were developed to enhance the purchase experience of the traveler, not only by providing price information, but also by displaying the product offers in such a manner that consumers can compare all the different value propositions. Here, innovators are taking advantage of the customer gradient and the cross-subsidy of the leisure travel segment by the business travel segment.

The search capabilities of established GDSs and GDS-based OTAs provide basic sorting and filtering options that do not fully address the different information requirements of the business segments. In contrast, OTAs like Orbitz and meta-search agents like Kayak, Farecast, and Flyspy developed mechanisms that offer a product valuation experience, in addition to the traditional search facilities for the lowest price. Low price, it turns out, is hardly the most relevant piece of information for air travel consumers, who look to multiple other bases for differentiation in travel products [12].

A representative example is the stock-chart type interface of Farecast and Flyspy. These sites provide a broad view of offers, with interactive filtering based on product characteristics. The key technological challenge is that these interfaces are data-intensive. For example, Flyspy's interface demands 200-plus times more data than one search in a traditional OTA. (See Figure 4.) That is, it would take more than 200 searches in an OTA like Travelocity or Expedia to get same the information that is condensed in this graphical interface. This leads us to observe:

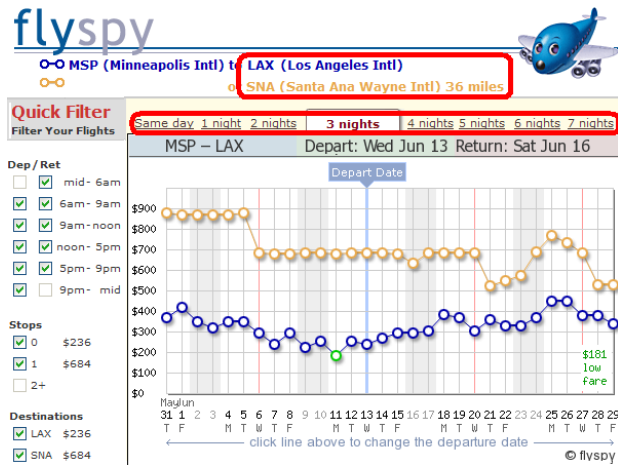
- **Proposition 5 (The Product Valuation Proposition).** *New entrants will produce technological innovations that enable a product valuation-based purchase process.*

These propositions offer starting points for understanding some of the changes that are occurring with digital intermediation in the travel distribution section. They also apply more broadly in the context of other industry settings, where secondary intermediation involving even higher technological approaches bear value.

5. CONCLUSIONS

We conclude with a reading on our main contributions, and an assessment of their limitations related to generalizability to other industry contexts.

Figure 4. Flyspy’s Stock Chart-Type Interface



Note: Flyspy’s results for a search from Minneapolis to Los Angeles show fare levels by departure date and airport for a month range. Charts can be shown for 0 to 7 night stays, with filters for departure and return times, number of stops, and airports. Alternate screens show charts with a fixed departure date and flexible return date, or a flexible departure date and a fixed return date. These options help business travelers who have schedule requirements based on set agendas or meetings.

5.1. Contributions

A primary contribution that this research offers is its perspective on the value-adding role of secondary intermediators who leverage new technological capabilities to create value in travel distribution. More specifically, we emphasized the changes in the key roles of the leading distribution players, as well as how technology-enabled innovations have changed the nature of competition.

Although we contend that new technologies have created disintermediation risks for GDSs and OTAs, the impacts of meta-search entrants are still small and diffusing. Therefore, it is likely that OTAs and GDSs will match or create new innovations to compete. Based on the More Advanced E-Markets Proposition (P3), since OTAs’ technology development is more recent, they will continue to enhance their role as information aggregators to continue saving search time and effort for consumers. Typically, consumers search almost twice the number of travel sites when they purchase from a supplier than when they purchase via an OTA [30]. On the other hand, in line with the Outdated IT Infrastructure Proposition (P2), GDSs are particularly affected by their legacy technology. Nevertheless, they maintain a strong foothold in the travel distribution sector with high market shares worldwide, so we expect them to make significant investments in reintermediation strategies.

Based on the Product Valuation Proposition (P5), we expect innovation in the meta-search sector to continue. We foresee the creation and proliferation of fourth-generation meta-search agents that, together with general

search agents, push targeted information and personalized offers to consumers based on analysis of click-stream behavior and search terms. These innovations in Web personalization will establish the market-making role of meta-search sites, as they find more effective ways to better match travelers and suppliers and to enable hyperdifferentiation strategies [8].⁴

5.2. Generalizability and Limitations

An important consideration is the extent to which our propositions are generalizable beyond the air travel distribution industry context. The most immediate applications come in the context of hospitality and rental car services bookings in B2C e-commerce. Although some of the infrastructure systems are different in these other industries, they do report prices through the GDSs, so we expect similar developments in the distribution sector of these industries. Another application is to the pricing of travel product bundles, for example, “weekend getaway,” “honeymoon travel” and other bundles involving a flight, a hotel stay and a car. The decision-making for travel services becomes more difficult when they have *combinatorial needs*, just as combinatorial auctions require more complex informational support than simple single-item auctions. Understanding price premia associated with travel services bundles is a major opportunity that the theoretical observations we have offered support.

Our theory is generalizable to cargo transportation, including trucking and intermodal freight, air cargo handling [22], and ocean shipping, where revenue management and electronic market practices have been more nascent in their development. These B2B services have yet to truly come to the Internet, as we have seen with the related B2C services. In other procurement contexts, the move to financial markets-based forms of exchange has brought market transparency-creating innovation.

We note the following limitations. First, we have yet to fully evaluate our propositions in other contexts. Second, our explanations do not touch on the issue of ownership, particularly as it relates to interorganizational

⁴ We thank Eric Clemons, who suggested the relevance of hyperdifferentiation strategy here. From our discussions, we recognize how the technologies we have discussed also make it possible for firms to leverage customers who are empowered to exhibit *true informedness* as opposed to *mere awareness* in the travel setting for greater profitability. This resets the value the market places on the technological innovations we have discussed. Clemons makes a particularly important point in this respect: informed customers will be willing to pay a premium to purchase exactly what they want. We see this, for example, in the final seat selection upgrade policies of Northwest Airlines, which permit travelers to pay for first class upgrades, aisle seats, seats towards the front of coach class, and so on. The level of informedness on the part of the consumer reflects the transformed role of information in the services delivery and marketing mix of the airlines and other travel industry firms.

IS capabilities in the travel distribution industry. Analysis of ownership, as we know from shared e-banking networks and interorganizational systems investments, is likely to provide additional interpretation on how support for product transparency has ensued.

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