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MARKET POSITION, RESOURCE PROFILE, AND GOVERNANCE: LINKING PORTER AND WILLIAMSON IN THE CONTEXT OF INTERNATIONAL COURIER AND SMALL PACKAGE SERVICES IN JAPAN

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Two economic theories that have had an immense impact on modern strategic management research are Porter's strategic positioning framework (SPF) and Williamson's transaction cost economics (TCE). While both theories have contributed to our understanding of strategic management and to the choice of strategy and structure, each theory offers managerial prescriptions that are incomplete at best. We contend that if followed in isolation, each theory can lead to inferior performance. This paper, which studies the international courier and small package (IC&SP) services in Japan, improves upon prescriptions from both theories by linking Porter's and Williamson's approaches. Our main proposition is contained in three relationships that predict a fit among three strategic choices: market position, resource profile, and organizational structure. We test our predictions with a three-stage, reduced-form, endogenous self-selection model. While our empirical methodology is complicated and relies on a multilevel analysis, the methodology is necessary both for analyzing a constellation of activities in the vertical chain and for assessing strategy, structure, and performance when data can be drawn from only a limited number of firms. Our results suggest that a firm's market position, resource profile, and organizational choice are related in ways predicted by a positioning-economizing perspective. To be sure, our study is ambitious and suffers from a number of limitations; nevertheless, it provides one of the first attempts to theoretically and empirically link Porter's SPF and Williamson's TCE.

Two economic theories that have had an immense impact on modern strategic management research are Porter's strategic positioning framework (SPF) and Williamson's transaction cost economics (TCE) (Rumelt, Schendel, and Teece, 1991). While both theories have contributed to our understanding of strategic management and to the choice of strategy and structure, each theory offers managerial prescriptions that are incomplete at best. We contend that if followed in isolation, each theory can lead to inferior performance.[1] This paper, which studies the inter-

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[1] In his most recent discussion of strategy (Porter, 1996), Porter's main claim is that fitting together a firm's activities creates sustainable competitive advantage. Unfortunately, Porter's framework lacks a method for making trade-offs among competing activity systems and resources; for operationalizing

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national courier and small package (IC&SP) services in Japan, improves upon prescriptions from both theories by linking Porter's and Williamson's approaches to explain fit among the strategic choices of market position, resources, and organization.

The prospect of linking SPF and TCE is not new. Day and Klein (1987: 62), in a discussion of cooperative behavior in vertical markets, argue that the 'weaknesses of [Williamson's] market failure approach are the strengths of [Porter's] strategic perspective and vice versa.' Day and Klein call for research that combines SPF and TCE analyses. 'Such a combination,' they maintain, 'would allow strategically relevant activities to be analyzed with the context of efficient organization, and thereby overcome the deficiencies of each perspective in isolation' (Day and Klein, 1987: 62). However, both theories continue to talk past each other, even when a dialogue seems useful.[2]

To realize the benefit of linking these theories, we build on recent conceptual advances by Nickerson (1997) and Ghosh and John (1999). These authors propose that the asset attribute of asset specificity is of focal concern and that market position, resources, and governance are interdependent, which means each must be chosen with respect to the other. In essence, this perspective—which for convenience we refer to as the positioning-economizing perspective—adds the notion of positioning, for which Porter's is a representative perspective, to the economizing logic of TCE. Moving beyond concept to an empirical context, we face three challenges. First, the theoretical compatibility of assumptions underlying SPF and TCE has not been evaluated. If the respective assumptions are incompatible, then attempts at synthesis are not useful. Second, integrating SPF and TCE requires a unit of analysis consistent with both theories; but such a unit of analysis has not yet been clearly specified. Third, a method for operationalizing and analyzing this perspective has not been proffered.

This paper responds to all three challenges and, most importantly, develops an empirical application. We argue first that the assumptions underlying SPF and TCE are not inconsistent, which allows insights from both theories to be combined, and second that the constellation of activities in the vertical chain offers a unit of analysis consistent with both frameworks. We operationalize the relationships described by Nickerson (1997) and Ghosh and John (1999) by defining the *resource profile*—the set and type (i.e., the degree of idiosyncrasy) of resources and capabilities employed in the constellation of activities in a vertical chain—as the central measure driving the perspective. We also parse the perspective into three relationships that make it easier to develop specific predictions. Because fit depends on the characteristics of demand and alternative technologies that may be unique to an industry, predictions are not general and must be developed with respect to a particular industry context.

IC&SP services in Japan provide a good context for our analysis. The constellation of activities in the vertical chain is small in number and well defined. The number of alternative market positions is similarly small. While a variety of assets are employed in each activity, one resource, information technology (IT), is central to courier differentiation. Idiosyncrasy of IT is heterogeneous not only among industry participants but also potentially within each courier's vertical chain for each route. Also, at least one measure of performance, delivery speed, is readily measured. We develop industry-specific predictions relating market position to resource profile, resource profile to organizational form, and resource profile/organization pairings to firm performance in terms of delivery speed. We test our predictions with a three-stage, reduced-form, endogenous self-selection model. As a check on our model, we empirically examine whether or not shippers care about firm strategy and the corresponding performance differences predicted by our model.

While our empirical methodology is complicated and relies on a multilevel analysis, the method is necessary for analyzing a constellation of activities and for assessing strategy, structure, and performance. Our results indicate that a firm's

fit, which limits its predictive content; and for assessing the choice of organizational form. Williamson's TCE predicts a discriminating alignment between transaction exchange attributes (asset specificity) and organizational mode (Williamson, 1985, 1996). TCE offers almost no prescription for deciding which type of exchange attributes are desirable, which implies it has little to say about which strategy a firm should adopt.

[2] For instance, Porter (1996) fails to call upon Williamson's insights to inform whether activities should be organized internally or outsourced, and Williamson (1991a) claims that managers are well advised to concentrate on economizing instead of on positioning.

market position, resource profile, and organizational choice indeed are related in ways predicted by the positioning-economizing perspective. To be sure, our study is ambitious and suffers from a number of limitations (discussed below); nevertheless, it provides one of the first attempts to empirically link a firm's market position, its resources, governance, and performance.

The paper proceeds in the next section with refinements of the positioning-economizing perspective. We then describe the industry context and develop industry-specific predictions. The next section outlines our data and empirical methodology. We then describe our empirical results. Finally, we discuss our findings, explore the limitations of our study, and conclude.

REFINING THE POSITIONING-ECONOMIZING PERSPECTIVE

In recent years, a theoretical synthesis of market positioning and governance issues has begun (e.g., Nickerson, 1997; Ghosh and John, 1999).[3] The emerging positioning-economizing perspective argues that for each alternative market position alternative strategies are identified by the transaction-cost and production-cost minimizing resource profile and by the governance mode for each asset in the profile. The optimal strategy for a firm is the profile that offers the greatest resulting profit. Hence, decisions regarding market position, resources, and governance are made jointly. This positioning-economizing perspective thus provides value by conceptually matching strategically relevant activities and their corresponding resource profile with efficient organization. Nonetheless, the perspective remains underdeveloped in three important ways.

First, it is not clear whether SPF and TCE rely on a compatible set of underlying assumptions. TCE rests on two behavioral assumptions: economic actors are subject to bounded rationality and opportunism, which make complete contracting infeasible. SPF, in contrast, makes no behavioral assumptions. However, to eliminate the possibility of only one optimal market position, SPF does explicitly assume that consumers are heterogeneous and that no one strategy optimally serves all consumers, whereas TCE makes no assumption about the structure of demand or the feasibility of technological alternatives. We conclude that the assumptions underlying TCE and SPF are not inconsistent because they focus on unrelated factors and thus do not create internal inconsistencies for linking the two theories.

Second, prior research has not clearly defined a unit of analysis for the positioning-economizing perspective. We show that Porter and Williamson employ consistent if not identical units of analysis when discussing the firm. For instance, Porter's principal analytical tool in *Competitive Advantage* (Porter, 1985) is the value chain, which is a disaggregation of a firm into its strategically relevant and technologically distinct activities. The basis of Porter's analysis is a presumption that activities in the vertical chain can be logically and operationally unbundled.[4]

Although Williamson consistently maintains the transaction—a technologically separable interface where one stage of activity terminates and another begins (Williamson, 1985: 1)—as the basic unit of analysis, he also discusses bundling transactions and unbundling firms into transactions. In his treatment of a firm's efficient boundaries, Williamson (1985: 96–98) applies his framework to a chain of vertical activities involved in production. He conceives of the vertical chain as a set of technologically separable stages of production—activities—in which each stage may be involved in multiple transactions with other stages. Williamson unbundles the vertical chain analysis to consider one transaction at a time; however, the organization of the overall firm is implicated.

Both SPF and TCE employ the constellation of activities in a vertical chain as a launching point for understanding firm strategy and organizational form, although TCE historically unbundles the analysis to assess transactions individually.[5] Thus, we adopt the constellation of activities in a vertical chain as the unit of analysis.

[3] Relatedly, a synthesis of resource position and transaction cost theory also has begun in recent years (Silverman, 1999).

[4] He spends a considerable amount of text (ch. 2, 1985) developing ways to unbundle and identify activities by defining the value chain. Porter's (1996) paper, 'What is Strategy?', offers a refinement for analyzing the value chain—a refinement called activity systems analysis—that again emphasizes unbundling the constellation of activities (or potential activities) a firm engages in.

[5] We acknowledge that identifying activities may be challenging in some industries. Identification requires a deep knowledge and microanalytic assessment of the value chain and

Third, the positioning-economizing perspective has been conceptualized but not operationalized. Following Nickerson (1997), note that a feature common to both SPF and TCE approaches, though hidden by the use of different lexicons, is the 'resource profile'. A resource profile is the *set* and *type* of resources and capabilities employed in the vertical chain of activities used to produce a good. By *set* of resources we mean the list of resources and capabilities deployed in each activity in the value chain. By *type* of resource we mean the degree to which each resource or capability is idiosyncratic. This measure is the level of asset specificity familiar to transaction cost economists.[6] (We provide specific illustrations in the empirical section.)

We interpret Nickerson's (1997) and Ghosh and John's (1999) main proposition as follows: a target market position is supported by an underlying resource profile, which is paired with an organizational structure to generate product attributes consistent with the target position. We maintain that it is possible to put this proposition into operation by parsing it into three relationships. The first relationship describes how different target market positions are served by different resource profiles.[7] This relationship depends on the alternative technologies available and essentially involves choosing the resource profile with the lowest production cost that serves the target market.

The second relationship conveys the choice of organizational form for each activity. Each alternative resource profile generates exchange conditions that call for an economizing form of organization for each activity. The alignment of organization form with the resources for each activity follows now standard TCE prescriptions, which have been detailed elsewhere.[8] We refer to the aggregated choices of organizational form across the constellation of transactions as the resource profile/organization pairing.

The third relationship conveys the resource profile/organization pairing to product and service attributes, which can be viewed in terms of performance. Attributes are generated either by the nature of resources and capabilities used for their provision (e.g., the perceived reliability of a product depends on a firm's reputation; some product/service features are producible only by specific resources; or a product or service's production cost, which typically influences price, is directly related to the nature of resources), the way resources and capabilities are organized (e.g., certain organizational choices influence the attenuation of hold-up, maladaptation, and moral hazard problems, which may be present in the provision of products and services), or both. The resource profile/organization pairing is chosen to yield product attributes to support the target position (see Figure 1 for a schematic representation).

Each target position and corresponding resource profile/organization pairing represents a strategy. Consumers respond to the choice of strategy by purchasing products based on the match between their preference and utility and the costs and benefits of product attributes offered by alternative strategies. From a normative perspective, firms prefer the strategy with the greatest profitability. Heterogeneity in firm strategies reflects that firms occupy different feasible resource profile/organization pairings. Of course, the presence of actual and potential competitors and the level of competitive intensity will affect profits

may require judgement by analysts. Nonetheless, we rely on both Porter and Williamson repeatedly maintaining that (what equate to) constellations of activities should and can be identified to understand firm strategy, structure, and performance.

[6] It is also a measure that is central to Porter's notion of position and the source of trade-offs when considering alternative positions. For instance, critical trade-offs referred to by Porter (1996: 68–69) include nonredeployability of reputation and inflexibilities in people, equipment, and systems.

Although it relates to neither tangible nor intangible investments, temporal specificity is included in our list of specific investments. Temporal specificity refers to time and space considerations or coordination needs (Masten, Meehan, and Snyder, 1991; Pirrong 1993).

[7] As described by Porter, firms choose market position based on customers' needs, customers' accessibility, or the variety of a company's products or services. A target market position is the description of needs, accessibility, or variety of products and services a firm desires to serve.

[8] See Williamson (1985, 1996) for theoretical treatments and Shelanski and Klein (1995) and Masten (1996) for reviews of empirical research. Presently, our formulation does not feature transaction attributes of frequency and uncertainty, which TCE maintains are relevant to organizational choice. We anticipate that these attributes are readily incorporated into the proffered framework by noting that the investment profile equates, in the TCE framework, to the choice of technology, which has implications for frequency and uncertainty. We note that the choice of resource profile and organization form is interdependent, which means that governance choice, which is influenced by the external institutional environment, may influence resource profile choice (see, for example, Choi and Esfahani, 1998; Henisz, 1998; Williamson, 1991b).

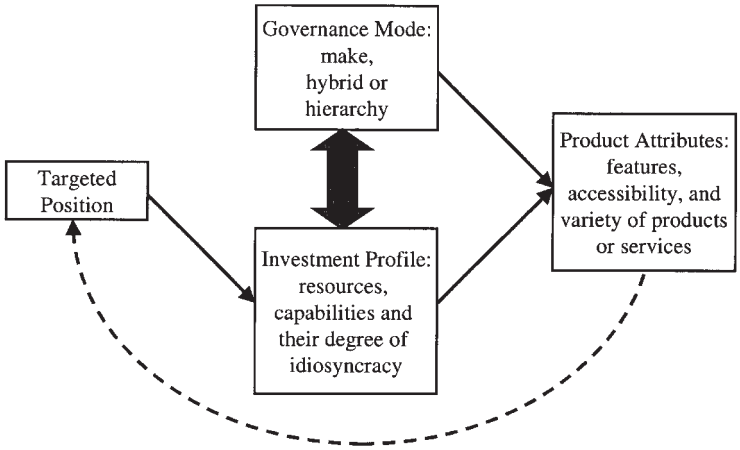

Figure 1. Schematic of the main proposition

and may affect which strategy a firm chooses. We acknowledge that our discussion does not directly incorporate competitors or competitive effects into our proposition (although a more formal representation of our proposition conceivably could incorporate competitors and entry conditions for different market positions). Instead, our focus is on identifying alternative strategies based on the relationships among three elements: market position, resource profile, and organization. Thus, the positioning-economizing perspective, absent consideration of path dependence and timing, may have more to say about which strategies are feasible and are likely to be observed in a market than about which strategy a specific firm should adopt.

Admittedly, these relationships are preliminary, generic, and not formalized—although both Porter's and Williamson's theories might be subject to similar criticisms. Nevertheless, this paper provides a starting point for empirical work and additional theoretical work. Testable predictions require a comparative analysis in a specific market context because the nature of demand and alternative production technologies typically differ across markets. The next section introduces such a context and develops three industry-specific predictions.

INDUSTRY CONTEXT AND PREDICTIONS

IC&SP service industry

The primary domain of our study is international courier and small package (IC&SP) service in Japan. As the name implies, IC&SP service involves international transport of courier and small packages. The 24 firms that compete in this market are listed in Table 1. The IC&SP service industry in Japan is a desirable market to study for our purpose because we observe (1) a small constellation of relevant transactions in the IC&SP service value chain, (2) a small number of market positions, (3) a small number of strategic resources, (4) heterogeneity in firm resource profiles, (5) heterogeneity in organizational form, and (6) heterogeneity in one readily measured product attribute, delivery speed.

First, IC&SP service is comprised of five separate activities, which limit the number of transactions to be analyzed (see Figure 2). The set of transactions in the transportation chain are: (1) a domestic truck picks up a parcel[9] from a shipper (the sender of a parcel) and transports the parcel to an airport; (2) a freight forwarder advances the parcel through domestic customs and consolidates it for air transit; (3) an international air carrier flies the parcel to a foreign airport; (4) a foreign freight forwarder advances the freight through customs and separates parcels; and (5) a foreign truck delivers the parcel to its final destination. We focus on three of these five transactions—domestic trucking, international air carriage, and foreign trucking—because the shipper typically contracts with a freight forwarder (hereafter referred to as a courier) that coordinates transportation, and we find that domestic and

[9] The term *parcel* is used to describe either a package or document.

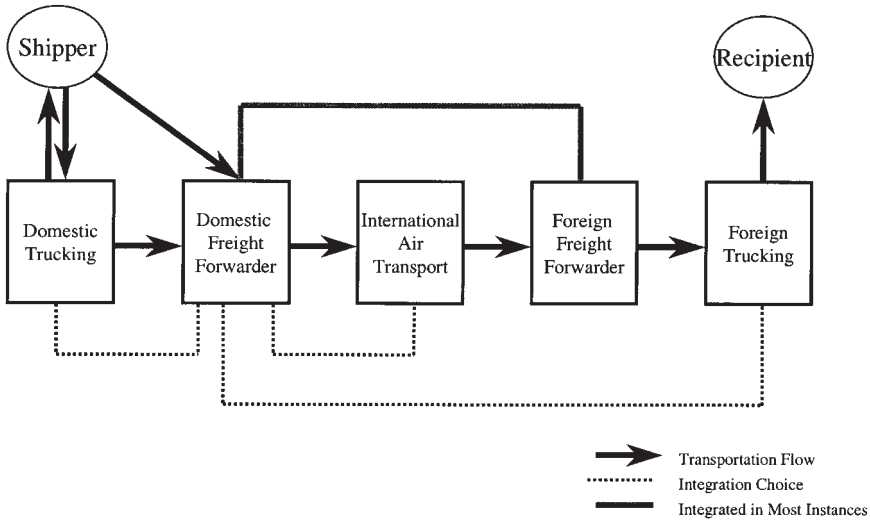

Figure 2. IC&SP service value-chain and organization alternatives

Table 1. JAFA IC&SP subgroup member firms

Airborne Express Japan, Inc.*
BAX Global Japan K.K.*
DHL Japan, Inc.*
Emery Air Freight Japan Corp.
Federal Express Japan K.K.*
TNT Express Worldwide (Japan) Inc.*
UPS Yamato Co., Ltd*
Fukuyama Transporting Co., Ltd*
Hankyu Express International Co. Ltd*
Japan Schenker Co. Ltd*
JNE Corporation
Keihin Air Service
Kintetsu World Express. Inc.
'K' Line Air Service, Ltd
Maruzen Air Express International Ltd
Nippon Courier Service Co., Ltd*
Nippon Express Co., Ltd*
Nishi-Nippon Railroad, Co. Ltd
Nissin-Nissin Air Cargo Co., Ltd*
Onboard Courier Express Inc.
Overseas Courier Service Co. ,Ltd*
Pegasus Parcel Service Co., Ltd
Proco Air Service Inc.
Seino Transportation Ltd
Tokyu Air Cargo Co. Ltd
World Courier K.K.
Yusen Air & Sea Service Co., Ltd*

*Firms with asterisk provided us package-level data, or for which we collected data by test package or from shippers.

Twenty-seven member firms were registered in the International Courier and Small Package Service Subgroup in the Japanese Air Cargo Forwarders Association (JAFA) in 1997. Twenty-four of these firms actively competed in the Japanese IC&SP service market at the time of our data collection.

foreign freight forwarding activities in almost all cases are jointly owned or organized through some type of equity relation. Limiting the constellation of activities to three greatly facilitates our analysis.

Second, shippers perceive only a small number of positions in the market, which limits the positions we need to analyze. Based on interviews with shippers, couriers, and government officials at the Ministry of Posts and Telecommunications and at the Ministry of Transport, we inductively identified three types of market positions: couriers primarily transporting packages (package specialists), couriers primarily transporting documents (document specialists), and couriers with one-stop shopping who transport a mix of packages and documents (full-line service). These categories also are generally consistent with the way couriers view their own lines of business.[10] In Porter's terms, the document specialist could be classified as *differentiation*, while the full-line generalist and package specialist could be classified as *cost leadership* and *cost focus*, respectively.

Third, the number of strategic resources is small, which simplifies our analysis of the resource profile. Arguably, information tech-

[10] For instance, UPS and Federal Express divide transportation operations into two categories that correspond to our definition of documents and packages. Other firms have similar classifications and provide services consistent with one of the three identified market positions.

nology (IT) is the most strategically valuable asset in IC&SP service. Executives from leading courier firms like Federal Express, UPS, and Airborne Express, all of which compete in the Japanese IC&SP service market, claim information technology as their most important strategic asset, being at least as important as transportation resources. Federal Express executives, for instance, claim that the movement of information about a package is as important as the movement of the package itself and that IT is the key to their operations (e.g., Maglitta, 1991). Similar claims from the other firms' executives, including Japanese firms, can be found in the popular press. IT resources include mobile communications for trucks, input/output devices for tracking packages, computers and networks, and software. Many, but not all, of these components, which make up courier IT systems, are idiosyncratic. More importantly, the integration of these components to make them work together as a single system can be substantial and is highly idiosyncratic.[11] In contrast, most other transportation resources such as aircraft, vehicles, parcel handling facilities, and sorting equipment, are comparatively redeployable and thus are unlikely to be critical sources of competitive advantage.[12] Thus, our resource profile consists of the idiosyncrasy of IT resources in domestic trucking, international air carriage, and foreign trucking.

Fourth, resource profiles are heterogeneous, which provides variation needed to assess the linkage between market position and structure. Japanese freight forwarders actively invest in proprietary IT, though the investment levels vary substantially from 0.3 percent to 5.0 percent of annual expenditures. We find that IT resource profiles can differ *by transport segment* and *by route* even for a particular courier. Interviews with several couriers, the Ministry of Posts and Telecommunications, and the Ministry of Transport confirm that each pick-up and delivery city pair may rely on IT assets with different degrees of idiosyncrasy. Importantly, we conclude from our interviews that collecting information on parcels requires IT in each transportation segment, and idiosyncratic IT resources in each segment increase with the amount of data collected and processed in real time.[13]

[11] Wada and Nickerson (1998: 127–129) describe how IC&SP IT varies from relatively generic systems that can be purchased from information technology suppliers with minor modifications to highly idiosyncratic systems like those developed by Federal Express and UPS. While off-the-shelf IT may be available for collecting, storing, and distributing information, no off-the-shelf system at the time of this study was available for entering, processing, and tracking in real-time large amounts of information in an integrated way. For instance, information exchange protocols must be specialized and adopted throughout the entire information network to handle large amounts of information for each parcel. Data base management software must be customized to store and retrieve desired data. Even mobile communication systems require substantial idiosyncratic investments when real-time and widely distributed data collection is needed (e.g., Takada, 1999).

The cost of such customization, although difficult to measure, can be substantial. For instance, Federal Express and UPS together employ 4000 IT staff and spent approximately $2.5 billion in 1995 and 1996 to maintain and enhance their information networks. UPS alone is approaching annual expenditures of $1.5 billion on IT (Bicknell, 1996). The software developed by these firms is highly customized and of little value if redeployed outside each firm.

[12] Aircraft, the most costly assets, are mostly generic: all firms have access to aircraft suppliers and the secondary market, and the FAA has approved only a small number of designs. Firms that acquire aircraft typically do so through operating leases, which further suggests that, while some aircraft modification might be undertaken to facilitate loading and unloading of parcels, air frames are relatively generic and can be readily redeployed (i.e., to other parcel transportation firms or passenger airlines). Similarly, vehicles used to transport parcels are mostly generic with, in some instances, minor modifications for carrying parcels. While some trucks, like those used by UPS and Federal Express, are somewhat idiosyncratic, many other vehicles are close substitutes for these trucks, which limits their contribution to a carrier's competitive advantage. Parcel-handling facilities are most often generic structures at or near airports that, at least in the United States, are typically leased. All firms appear to have access to such facilities. Package-sorting equipment may be specialized to some degree; but it is typically purchased from outside vendors rather than developed internally, which indicates that all carriers may be able to purchase near-equivalent sorting equipment. (Handling facilities and package-sorting equipment are parts of the freight-forwarding activity that we do not empirically investigate.) It is unlikely that generic assets, because of their availability to all carriers, represent critical sources of competitive advantage.

[13] Admittedly, we are unable to specify a precise relationship between the amount of data collected for each parcel and the amount of idiosyncratic IT. Nonetheless, interviewees indicated that the magnitude of idiosyncratic IT in each segment increased with the number of pieces of information collected on each parcel. Unlike other types of IT systems (e.g., banking), complex calculation or customization of the system to each route is not needed. Thus, computer and network capacity needs increase directly with the scope of geographic coverage and the amount of real-time parcel data. While the relationship between the number of pieces of parcel data and the level of idiosyncrasy may not be linear, interviewees nonetheless indicate that the number of pieces of parcel data is an important cost driver in system design. Systems integration within and across transportation segments becomes more complex with increases in data collected on each parcel. This complexity leads to a substantial incremental cost for collecting each new piece of parcel data. For instance, col-

Fifth, we observe substantial heterogeneity of organizational configurations both across and within firms. Although the phrase 'integrated carrier' is used by most industry participants, not all transportation segments of these couriers are organized under unified governance. For instance, among 16 firms interviewed, we have found that only one firm, Fukuyama Transporting Co. Ltd, fully internalizes all pick-up/delivery trucking operations. More typically, freight forwarders vertically integrate some domestic trucking routes while contracting out for other trucking routes. Similarly, only a few firms are integrated into international air transport out of Japan. While Federal Express, DHL, and UPS-Yamato can be classified as integrated, all other freight forwarders contract for international air carriage. Many of the firms, such as Airborne Express, BAX Global, Emery Air Freight, and TNT Express Worldwide, do integrate into international air transport between some foreign cities or in the United States, but have not integrated air transport into or out of Japan. Vertical integration and contracting out can be found in all three transportation segments and can vary by route (origin–destination city pair) even within the same courier.

Finally, we can readily measure delivery speed, which allows us to evaluate the extent to which strategy and structure choices influence at least one measure of performance. Interviews with shippers indicate that delivery reliability and delivery speed are the primary product attributes for differentiating IC&SP service and that these two product attributes go hand in hand.[14] For instance, document parcels often contain legal paperwork, contracts, and papers for which fast reliable service is critical—slow or late delivery frequently imposes large opportunity costs on shippers or recipients. Packages, on the other hand, contain items such as compact disks, product samples, motorcycle parts, automobile parts, cloth, etc., for which the opportunity cost for slow or late delivery is less than for documents. Hence, document shippers generally require faster and more reliable shipping than package shippers. The fact that the product attributes of both delivery reliability *and* delivery speed move together is important for our empirical analysis because, of the two, only delivery time is readily observed.

Predictions

We develop our three relationships within the context of IC&SP service to generate testable predictions. A courier's ability to quickly locate an errant parcel, which is necessary for high levels of reliability, increases with real-time tracking information about the parcel. The more real-time information that is available, the faster and easier a courier can identify who handled the parcel and where in the transportation chain it may have been misplaced. Our prior discussion of IC&SP service indicates that the degree of idiosyncratic IT in each transportation segment increases with the amount of information entered and tracked in each segment. Thus, providing high levels of reliability in any segment requires a high level of idiosyncratic IT in that segment. Document specialists face higher real-time tracking needs than package specialists, which implies the former rely on more idiosyncratic IT than the latter.[15]

Couriers pursuing a full-service position have real-time information needs that are higher than package specialists because at least some parcels are documents. But they may have equal or lesser IT needs compared to document specialists because carrying both types of parcels may lead to performance degradation and high costs, which would limit their ability to attract the most time-sensitive document shippers. Ignoring the needs of the most time sensitive document shippers obviates the need for the highest level of real-time information needs. The two specialist positions

lecting one additional piece of information requires, at a minimum, (1) hardware (potentially specialized) to enter the data, (2) changes in the data storage and exchange protocols not only within a transportation segment but also throughout a courier's computer and communications network, and (3) increased storage capacity and transmission capacity. Almost all of these expenditures are costly and primarily idiosyncratic.

[14] One might argue that tracking information itself is a product attribute. However, only recently have couriers in Japan provided web-based tracking to shippers. Even then, only a subset of electronic tracking information is provided to shippers. We conclude that real-time tracking data for Japanese IC&SP service has more to do with ensuring reliable delivery than with product attributes.

[15] This is not to say that package specialists need not make any investments in IT. Basic tracking and billing information need to be recorded. However, these needs are satisfied with generic systems available from multiple vendors and are not idiosyncratic.

conform to Porter's notion of focusing on specific types of customer needs, whereas the full-service position conforms to offering a variety of products or services. Thus, we predict:

> *Proposition 1: For* each *IC&SP transportation segment, document specialists rely on more idiosyncratic IT than that used by full-service couriers, and full-service couriers rely on more idiosyncratic IT than that used by package specialists.*

Idiosyncratic resources create contracting hazards that influence organizational choice. Firm-specific resources by one trading partner could be exploited by the other partner in *ex post* negotiations or in an opportunistic response to changing conditions, or could impose substantial costs should the partners fail to adapt in a coordinated way in response to changing circumstances (Williamson, 1985).[16] Such contracting problems increase as idiosyncrasy deepens. Also, IT and the expected gains in delivery reliability are for naught if operating personnel do not reliably use the IT. Shirking data entry greatly diminishes a courier's ability to quickly locate errant packages. In such cases, underinvestment and moral hazard yield spillover effects that can greatly devalue a courier's reputation for fast and reliable delivery—damage that is difficult for a third party to verify. TCE maintains that hierarchy, although a costly form of organization, offers efficiency advantages over markets and contracts for minimizing these contracting hazards in transportation services. (For a discussion of these issues with respect to trucking, see Nickerson and Silverman, 1999.) Conflicts can be quickly resolved by fiat, which includes quick replacement of operating personnel who shirk, instead of an appeal to the courts to resolve contract disputes. Therefore, even if IC&SP service requires few idiosyncratic physical assets, IT can be idiosyncratic, which, according to TCE, would call for vertical integration. Remembering that freight forwarding is most always vertically integrated, we predict:

> *Proposition 2: The greater the idiosyncrasy of IT in any particular IC&SP transportation segment, the greater the likelihood of integration between freight forwarding and that segment.*

Idiosyncratic IT and vertical integration may provide delivery reliability benefits, but do they provide delivery time benefits? Delivery time sensitivity generates an exchange condition referred to as temporal specificity (Masten *et al.*, 1991; Nickerson and Silverman, 1999; Pirrong, 1993), which creates coordination needs between the freight-forwarding activity and each transportation segment. Temporal specificity generates contracting hazards because vehicle operator effort is difficult to measure: vehicle operators are engaged in remote tasks, and vehicle operators face an uncertain transportation environment.[17]

Nickerson and Silverman (1999) claim that vertical integration provides a mechanism superior to contracting for efficiently coordinating freight when temporal specificity is present. In their study of carriage by interstate for-hire trucking companies, Nickerson and Silverman argue that contracting provides incentive intensity and monitoring advantages for minimizing vehicle operating costs. However, the use of owner-operators can lead to control problems: an owner-operator will be tempted to abandon his/her existing carrier if more lucrative loads become available, or will threaten such action in order to bargain for better terms. In contrast, company drivers, who do not own the vehicles they drive and who, if fired, have fewer immediate outside options than owner-operators, face muted incen-

[16] For instance, a trading partner might underinvest in IT or shirk in ways that diminish delivery reliability. Carriers may not be unable to fully specify future IT functionality, which gives rise to *ex post* haggling when IT is idiosyncratic. Even if specifying the functionality of idiosyncratic IT is feasible (i.e., specifying computer configurations and software features), specifying the reliability level of service is not feasible because all potential operating problems and corresponding adjustments are unknown. Further, if all potential problems were known, specifying appropriate contingencies to all operating problems is likely to be prohibitively costly.

[17] A late delivery may result from a number of events outside an operator's control, such as weather, unexpectedly heavy traffic, accident-related traffic jams, construction, slow/late unloading of freight at prior stops (if the operator is engaged in a multiple-stop trip), etc. The stochastic nature of such disturbances uncouples operator effort and outcome, which may defeat the purpose of incentive compensation. Also, temporal specificity introduces spillover effects on other hauls or on a carrier's intangible assets, which incur costs that are difficult to observe or verify. Thus, stochastic disturbances and the difficulty of observing or verifying operator effort limit the efficacy of contracts between freight forwarders and operators in each transportation segment.

tives that reduce the propensity for such behavior.[18] While costly, the added control provided by vertical integration yields coordination benefits by reducing driver opportunism and thereby decreasing average delivery time. Thus, vertical integration in response to temporal specificity reduces delivery time.

As described in the prior section, delivery reliability needs, which lead to vertical integration, move together with delivery speed needs, which also lead to integration. Hence, vertical integration in response to delivery reliability in this industry indicates precisely those situations in which the need for delivery speed requires vertical integration and where vertical integration yields delivery speed benefits. Thus, we predict that:

Proposition 3: Vertical integration into any of the three transportation segments reduces delivery time.

DATA AND METHOD

Data

We employ data that were collected in conjunction with the Institute for Telecommunications Policy (IPTP). Our data consists of information on 995 parcels shipped from 37 different origin cities in Japan to 160 destination cities in 42 countries during February and March 1998.[19] Fourteen IC&SP couriers (see Table 1) transported the test parcels.[20] The amount of parcel data collected by couriers' IT was either self-reported, recorded directly based on test parcels sent by researchers,[21] or reported by shippers who assisted in IPTP's research. We further augmented this data by collecting information on the ownership structure of the freight forwarder and of each transportation segment for each city pair.

Our theoretical unit of analysis is the constellation of transactions/activities involved in the provision of IC&SP service, which equates to the courier's route (i.e., each city pair a courier serves) a parcel travels. Unfortunately, we were unable to collect a measure of reliability by route and courier, and collecting additional data was prohibitively costly. Our data set of 995 parcels encompasses 250 city pairs for which we have data on only one parcel for each of 160 city pairs and only one parcel per courier route for 451 of the 995 observations. Such a large number of single observations severely limits the number of courier routes for which we could construct useable performance measures such as delivery time variance or average delivery time. Moreover, we believe it is inappropriate to assume that any single observation for a particular courier route is a random draw.[22] Because of this limitation, we employ the parcel as the unit of analysis. The parcel is useful because (1) it captures heterogeneity in resource profile and organizational form, both of which vary by courier, transportation segment, and city pair, and (2) it does not require us to assume that any individual parcel is a random draw from the population of parcels for a particular courier route. Also, it allows us to investigate one measure of performance, elapsed delivery time, controlling for the distance a parcel is shipped. After omitting observations with missing data, we have 565 observations for our analysis.[23] Our variables are described below.

[18] Asset ownership also affects a carrier's legal recourse, at least in the United States, regarding monitoring and enforcement—ownership affords the carrier the right to inspect the vehicle and to collect complete information on vehicles. Such data collection is not feasible with most forms of contracting. Enforcement is easier because a carrier may threaten a driver with legal sanctions if she uses a carrier's vehicle in unapproved ways, such as interrupting one haul to execute another haul. Such threats are less viable with owner-operators.

[19] The total number of document couriers shipped from Japan in fiscal year 1995 was 6.93 million, which was about five times more than small packages (1.39 million). The total weight of those two were approximately the same (7119 tons and 7853 tons, respectively), ('Suji de miru butsuryu 1997,' Ministry of Transport, Japan).

[20] Since the market share of IC&SP carriers was unavailable, we attempted to distribute the parcels evenly among all carriers, though the number of packages per carrier ultimately varied from 49 to 200.

[21] In cases where test parcels or shippers' packages are used, we asked the carriers for all the information that the carrier could obtain on the package based on the carrier's information network, even when some of the information is not normally provided to customers.

[22] Alternatively, we could select one parcel for every carrier route in our data base, and so use the carrier route instead of the parcel as the unit of analysis. To test this approach, we reestimated all of the regressions reported in the paper. The qualitative nature of the results remained unchanged, although levels of significance were slightly lower due to the smaller data set. Results are available upon request from the authors.

[23] Observations were omitted because of missing data on pick-up delivery location or time information (170), on organizational form (102), on the control variable market size (42), and because of political risk (116). Comparison of the dropped

Dependent variables

Resource profile. Our first prediction relates the level of idiosyncratic IT resources in each transportation segment to the choice of market position. From the previous discussion, we expect document specialists to employ more idiosyncratic IT than full-service couriers, which in turn employ more idiosyncratic IT than package specialists. Unfortunately, we were unable to obtain financial data on each firm's idiosyncratic IT in each transportation segment. As a proxy for idiosyncratic resources, we developed in conjunction with the IPTP a survey to collect data on the type and availability of real-time parcel information tracked by a courier's information network for each transportation segment (the survey is displayed in the Appendix) and each route. We then created an index for each transportation segment that counts the pieces of information available from each transportation segment to the freight forwarder. These indices, described below, assume that the level of idiosyncratic IT is positively correlated with the amount of real-time information collected in each transportation segment.[24] Thus, we assume that the amount of parcel-tracking information is a proxy for the level of idiosyncratic resources.

k_{domtrk}, k_{intair}, and k_{fortrk} are count indices, which increase by one for each piece of parcel-level data collected from domestic trucking, international air, and foreign trucking activities, respectively. The indices range from 0, which indicates no data are available from the courier's information network, to 7, 8, or 7, for k_{domtrk}, k_{intair}, and k_{fortrk}, respectively, which indicate all of the information is available on the courier's information network. Substituting our proxy for the level of idiosyncratic IT, Proposition 1 predicts that document specialists will display higher k_{domtrk}, k_{intair}, and k_{fortrk} than full-service couriers, who will display higher k_{domtrk}, k_{intair}, and k_{fortrk} than package specialists. The amount of information collected on each parcel for each transportation segment and its predicted correspondence to different market positions is a proxy for the trade-offs Porter describes between the nature of activities and different market positions: high levels of IC&SP service provide greater value than low levels of service but at the cost of making greater idiosyncratic resources to collect and process large amounts of parcel-tracking data.

Resource-profile/organization pairing. Our second prediction derives from TCE and predicts that vertical integration is the economizing choice of organization when resources in IT are idiosyncratic. We collected information on the organizational choice of each courier for each transportation segment and city pair by interviewing each of the participating IC&SP couriers and then mapping onto each parcel the courier's organizational structure for domestic trucking, international air transit, and foreign trucking, according to origination and destination cities. The existence of any equity relationship between freight forwarder and transportation segment is classified as vertically integrated. The absence of an equity relation is classified as contracting out. *DomOrg*, *AirOrg*, and *ForOrg* quantify whether or not domestic trucking, international air transit, and foreign trucking, respectively, are vertically integrated (coded 1) or contracted out (coded 0). Proposition 2 predicts that the coefficients for k_{domtrk}, k_{intair}, or k_{fortrk} are positive.

Product attribute. Our third prediction is that vertical integration into any of the three transportation segments reduces delivery time. TCE maintains that vertical integration in IC&SP service serves not only to safeguard idiosyncratic resources in IT but also to improve delivery performance and reliability, a relationship ignored by Porter. We collected information on parcel pick-up time at the place of origin, on parcel drop-off time at the destination, and we computed net delivery time in days. Because of kurtosis on the data, we took the natural logarithm of the net delivery time to form our variable *lnDays*. Proposition 3 predicts couriers who vertically integrate in response to specific resources in idio-

observations with those included in the analysis indicated that the dropped observations had longer delivery times and were more likely to be packages.

[24] We also collected data on information pertaining to domestic and foreign customs clearance (Q8, Q9, Q18, Q19). However, freight forwarders typically are approved customs brokers. Since we are primarily interested in the specific investment in each transportation segment and its effect on organizational form, the relationship on the integration between freight forwarding and customs brokerage is not theoretically clear. Moreover, customs practices differ by country, and both airlines and foreign trucking firms may be able to collect and report this data, possibly through a publicly operated network. Therefore, we leave the implication of customs information for future research.

syncratic IT realize faster delivery times.

Additional explanatory variables

DocSpec, PackSpec. Prediction 1 describes the relationship between a courier's market position and its idiosyncratic resources in IT. *DocSpec* and *PackSpec* identify a courier's market position as a document specialist or package specialist, respectively. We use a firm-level measure to classify a courier as a document specialist when 90 percent or more of the parcels a firm carries are documents. Similarly, we classify a courier as a package specialist when 90 percent or more of the parcels a firm carries are packages. Couriers shipping between 10 percent and 90 percent documents are classified as full service. Because we were unable to ascertain information on each firm's annual document–package mix, we calculate these percentages from our data base of 995 parcels. Full service is the omitted market position in our analysis. *DocSpec* is coded as 1 when a courier is a document specialist; otherwise it is coded 0. *PackSpec* is coded as 1 when a courier is a package specialist; otherwise it is coded 0. With full service as the omitted category, Prediction 1 indicates a positive relation between *DocSpec* and idiosyncratic IT and a negative relation between *PackSpec* and idiosyncratic IT.[25] Courier market position is hypothesized to influence organizational form and performance only through its effect on the resource profile.

Control variables

Dist. Because delivery time is expected to increase with the distance over which a parcel is transported, we need to control for distance traveled if our measure of delivery time is to be a useful performance metric. We do not anticipate distance-influencing dependent variables other than performance and price (longer distances are likely to incur greater cost, which leads to higher prices). As an approximation for actual distance, we geo-coded both origin and destination cities and calculated the spherical distance. *Dist* is the spherical distance in miles, divided by 1000, between origin and destination cities.

PolRisk. Williamson (1991b) points out that organization mode choice depends on the political risk engendered by a nation's institutions. To measure that risk, Henisz (1998) constructed an index that ranges from zero (low risk) to one (high risk), which reflects the probability of policy changes by country.[26] This theoretically derived index indicates the degree to which actors have decreasing ability to make credible commitments through the institutional environment, which can influence both the nature of resources and the integration decisions. Firms in higher-risk institutional environments are less likely to make specific investments for fear of public and private expropriation. Higher-risk institutional environments also may lead firms to integrate vertically to avoid private expropriation.[27] We control for the effects of institutional environment on the level of specific investment and organizational mode choice using Henisz's index based on destination country.

We anticipate that demand for international air transit and foreign trucking varies by destination and that this variation may affect the level of idiosyncratic IT. We expect that economies of scale would lead to a positive relationship between size of market and idiosyncratic resources. A commonly held rationale is that large demand invites idiosyncratic investment to realize economies of scale, which require a large sunk investment. IT, especially of an idiosyn-

[25] We were concerned that our market position classification, which is calculated from our data, may be inaccurate because of our small sample and because samples were not randomly generated. We evaluated the robustness of our results by varying the rule to 5 percent and 15 percent. These variations produced no substantial difference in any of our analyses.

[26] Henisz averages political risk value by country over the years 1980–92.

[27] Henisz and Williamson (1999) argue that organizational choice depends on both direct and indirect political hazards. Increases in direct political hazards (i.e., expropriation by the state) increase the level of asset specificity above which hierarchy is the economizing choice, whereas increases in indirect political hazards (i.e., expropriation by host-country firms) decrease the level of asset specificity above which hierarchy is the economizing choice. However, Henisz and Williamson (1999) ignore the level of asset specificity (k) as a decision variable and hence treat it as exogenous. In contrast, we directly control for the extent to which the institutional environment influences the level of specific investment in the first stage of our analysis. We do not incorporate interaction terms in our second-stage analysis to control for such direct and indirect hazards because it adds unnecessary complexity to the analysis and interpretation of coefficients. A specification check in which the appropriate interaction terms are added to our analysis supports this view—the interaction terms are insignificant and do not substantially improve model explanatory power.

cratic kind, may be subject to such economies, which suggests that investments are more likely in large markets. Alternatively, large demand would invite entry by many suppliers of international air transit or foreign trucking. The resulting 'thick' markets for these two transportation segments would lessen the need for idiosyncratic resources—forwarders have a credible threat to shift to alternative air carriers should performance fall below expectations, which would produce a negative relationship between size of market and idiosyncratic resources. The size of demand is not expected to directly influence organizational choice or performance. We proxy size of demand in these two segments with two variables:

MarkSize. This measures the cumulative weight (in billions of kilograms) of international air freight (a freight segment including parcels larger than courier and small packages) from Japan to each destination country in the most recent year for which we have data: 1995. We employ this data as our best available proxy for country-specific volume.

FinCities. This is a dummy variable that is coded 1 for the parcel destination cities of Chicago, Hong Kong, London, Los Angeles, New York, San Francisco, and Singapore. These cities are financial centers, which are likely to have a large demand for IC&SP service. More than 60 percent of our parcels were delivered to these cities. With competing and opposing relationships, we make no specific predictions for either *MarkSize*'s or *FinCities*' effect on the resource profile.

However, in addition to the demand effects described above, interviewees suggested that financial cities are the destination of most of the legal and financial parcels that have the highest shipping reliability requirements. Consistent with our discussion preceding Proposition 2, vertical integration affords shipping reliability benefits. Since these benefits are more likely to be needed for the mix of parcels delivered to financial centers, we expect the coefficient for *FinCities* to be positively related to integration in international air and foreign trucking.

Summary statistics and correlations are provided in Table 2. Unfortunately, we were unable to collect firm-level attributes like firm size or the number of employees, which are often used in empirical TCE studies.

Method

Our econometric approach assumes a partial equilibrium (at least in the short run) and sequentially estimates separate regression models, which explain in turn the level of idiosyncratic IT resources, the impact of this investment on a firm's choice to vertically integrate, and the relationship between vertical integration and delivery performance. The estimation method explicitly accounts for potential simultaneity bias in the choice of organizational form and performance. Failure to account for endogeneity may have serious consequences. For example, unobserved heterogeneity like the quality of managers may affect both organizational form and performance. If this is the case, then simple OLS estimation of a given organizational form's impact on performance will reflect, in part, managerial quality rather than the direct impact of vertical integration. Such endogeneity problems would lead to an underestimate of asset specificity's effect on organization choice and/or of organization choice's effect on performance. Our approach explicitly allows for these potential biases. Models that account for the endogeneity of the resource profile and organizational form typically have not been estimated in the literature.

Following the insight of the SPF literature, the first set of equations examines the impact of market position on the level of idiosyncratic IT in each transportation segment. Let k_{ji} be the level of idiosyncratic resources for parcel i, and let $j = \{domtrk, intair, fortrk\}$ index the transportation segment. Then

$$k_{ji} = \beta_{0j} + \beta_{1j}PackSpec_i + \beta_{2j}DocSpec_i + \beta_{3j}Dist_i + \beta_{4j}FinCities_i + \beta_{5j}MarkSize_i + \beta_{6j}PolRisk_i + \varepsilon_{ji} \quad (1)$$

where ε_{ji} is a random error term. Note that Equation 1 models a regression equation for each of the three transportation segments. For econometric reasons, all instruments used in Equations 3 and 4 are included in Equation 1. It is plausible that firms with high levels of idiosyncratic IT in one transportation segment, such as domestic

Table 2. Summary statistics and correlations

	Variable	Mean	S.D.	Min.	Max.	1	2	3	4	5	6	7	8	9	10	11	12	13
1	*PackSpec*	0.163	0.370	0	1													
2	*FullServ*	0.531	0.499	0	1	−0.469*												
3	*DocSpec*	0.306	0.461	0	1	−0.293*	−0.707*											
4	k_{domtrk}	4.018	2.600	0	7	−0.256*	−0.368*	0.603*										
5	k_{intair}	4.428	2.183	0	8	−0.142*	0.069	0.039	0.373*									
6	k_{fortrk}	5.216	2.217	0	7	−0.430*	−0.097*	0.450*	0.702*	0.644*								
7	*DomOrg*	0.701	0.458	0	1	−0.120*	−0.304*	0.426*	0.394*	−0.446*	0.001							
8	*AirOrg*	0.432	0.496	0	1	−0.385*	−0.076	0.390*	0.664*	0.135*	0.447*	0.414*						
9	*ForOrg*	0.699	0.459	0	1	−0.233*	−0.091*	0.285*	0.247*	0.306*	0.362*	−0.075	0.377*					
10	*lnDays*	0.744	0.572	−1.473	2.202	0.464*	−0.163*	−0.195*	−0.190*	−0.107*	−0.293*	0.030	−0.171*	−0.128*				
11	*Dist*	5.016	1.626	0.752	7.504	0.118*	−0.063	−0.026	−0.035	0.042	0.006	−0.085*	−0.069	0.049	0.162*			
12	*MarkSize*	11.864	8.194	0.118	19.775	0.062	−0.018	−0.031	−0.059	0.022	−0.029	−0.129*	−0.050	0.126*	−0.045	0.630*		
13	*FinCities*	0.658	0.475	0	1	0.095*	−0.034	−0.040	−0.080	−0.062	−0.124*	−0.063	−0.110*	0.016	−0.069	0.377*	0.475*	
14	*PolRisk*	0.294	0.273	0.120	1	−0.171*	0.126*	0.000	0.069	−0.010	0.057	0.101*	0.123*	−0.108*	−0.073	−0.807*	−0.705*	−0.573*

*Indicates 95% confidence interval, N=565

trucking, will have high levels of idiosyncratic IT in the other two segments. To account for this possibility, we specify

$$\mathrm{Var}(\varepsilon_{\mathrm{Domtrk}},\varepsilon_{\mathrm{Intair}},\varepsilon_{\mathrm{Fortrk}}) = \begin{pmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{12} & \sigma_{22} & \sigma_{23} \\ \sigma_{13} & \sigma_{23} & \sigma_{33} \end{pmatrix}. \quad (2)$$

The three regression equations defined in Equation 1 are estimated as a system using the Seemingly Unrelated Regression (SUR) method because of the nonzero covariances across equations indicated by Equation 2.[28] We also account for courier-level correlation in the construction of the standard errors.

After establishing the impact of market position on the level of idiosyncratic IT in each transportation segment, the next stage of our econometric model examines the relationship between the extent of this investment and the organizational choice in each segment. Recall that TCE predicts that organizational choice reflects the level of vertical integration, as measured by whether or not the freight forwarder had an equity relationship in the segment. The regression models examining the organizational choice for each transportation segment are given by:

$$\begin{aligned} DomOrg_i = {} & \alpha_{D0} + \alpha_{D1} k_{domtrk,i} \\ & + \alpha_{D2} Dist_i + \alpha_{D3} FinCities_i \\ & + \alpha_{D4} MarkSize_i + \alpha_{D5} PolRisk_i + u_{Di} \end{aligned} \quad (3D)$$

$$\begin{aligned} AirOrg_i = {} & \alpha_{A0} + \alpha_{A1} k_{intair,i} + \alpha_{A2} Dist_i \\ & + \alpha_{A3} FinCities_i + \alpha_{A4} MarkSize_i \\ & + \alpha_{A5} PolRisk_i + u_{Ai} \end{aligned} \quad (3A)$$

$$\begin{aligned} ForOrg_i = {} & \alpha_{F0} + \alpha_{F1} k_{fortrk,i} + \alpha_{F2} Dist_i \\ & + \alpha_{F3} FinCities_i + \alpha_{F4} MarkSize_i \\ & + \alpha_{F5} PolRisk_i + u_{Fi} \end{aligned} \quad (3F)$$

Each equation is estimated using a probit model, where the error terms u_D, u_A, and u_F are assumed to have a zero mean and unit variance. However, as noted above, we were concerned that unobservables that influence the level of idiosyncratic IT in each segment may be correlated with unobservables influencing the choice to vertically integrate. Following Maddala (1983), to account for the possible endogeneity of these variables, k_{domtrk}, k_{intair}, and k_{fortrk} were replaced in Equations 3D, 3A, and 3F by their predicted values, denoted k_{domhat}, k_{inthat}, and $k_{forhat,}$, respectively, generated from Equation 1. Use of the predicted values in place of actual levels eliminates bias introduced by potential correlation between error terms in Equations 1 and 3D, A, F.

Finally, our analysis examines how vertical integration in each transportation segment influences delivery performance. Suppose that the relationship between delivery performance, measured by $lnDays_i$, and organizational choice is given by:

$$\begin{aligned} lnDays_i = {} & \delta_{0j} + \delta_1 DomOrg_i + \delta_2 AirOrg_i \\ & + \delta_3 ForOrg_i + \delta_4 Dist_i + \zeta_{ji} \end{aligned} \quad (4)$$

Equation 4 could be estimated by OLS. However, as in the organizational choice model, we expect that unobservables affecting performance may be correlated with those influencing organizational choice, implying that simple OLS estimation of Equation 4 will lead to biased estimates of δ_1, δ_2, and δ_3. Equation 4 may be estimated via a two-step procedure (Maddala, 1983). In the first step, predicted values of the organizational choice variables are generated using Equations 3D, 3A, and 3F. In the second step, the organizational choice variables are replaced in Equation 4 by the predicted values, *DomOrgHat*, *AirOrgHat*, and *ForOrgHat*, and the model is estimated by OLS to obtain unbiased estimates of the δ's.

RESULTS

Models 1, 2, and 3 in Table 3 examine the relationship between market position with our full complement of control variables and idiosyncratic IT for domestic trucking, international air, and

[28] Because the dependent variable in Equation 1, k_{ji}, is measured as a count, we also estimated each regression using a Poisson model. The estimates were qualitatively the same as those found using OLS. Consequently, we use the linear regression specification, since it is straightforward to estimate the three-equation system using the SUR method, which is difficult using a Poisson specification.

Table 3. Three-stage endogenous self-selection analysis

Coefficients	Investment analysis			Organizational choice			Performance
	(1) k_{domtrk}	(2) k_{intair}	(3) k_{fortrk}	(4) *DomOrg*	(5) *AirOrg*	(6) *ForOrg*	(7) *LnDays*
PackSpec	–0.519*	–0.871**	–1.942**				
	(0.250)	(0.262)	(0.223)				
DocSpec	3.287**	–0.030	1.705**				
	(0.197)	(0.206)	(0.176)				
k_{domhat}				0.623**			
				(0.116)			
k_{inthat}					2.760**		
					(0.736)		
k_{forhat}						0.388†	
						(0.202)	
DomOrghat							0.254
							(0.227)
AirOrghat							–0.636**
							(0.185)
ForOrghat							–1.202**
							(0.186)
Dist	0.152	0.082	0.180*	–0.055	–0.188	–0.194	0.064**
	0.093	(0.097)	(0.083)	(0.082)	(0.123)	(0.159)	(0.013)
FinCities	–0.075	–0.444†	–0.465*	0.137	1.040**	–0.969	
	(0.229)	(0.239)	(0.204)	(0.296)	(0.390)	(0.236)	
MarkSize	–0.001	0.005	0.001	–0.022	–0.009	0.0185	
	(0.015)	(0.016)	(0.014)	(0.017)	(0.016)	(0.034)	
PolRisk	1.157†	–0.226	0.431	–0.426	1.000	–1.548†	
	(0.661)	(0.692)	(0.590)	(0.752)	(1.131)	(0.881)	
Constant	2.062**	4.468**	4.276**	–1.085†	–12.512**	–0.159	1.357**
	0.706	0.740	(0.631)	(0.631)	(3.571)	(1.253)	(0.123)
R^2/pseudo R^2	0.377	0.030	0.315	0.211	0.143	0.117	0.235
$p > \chi^2$	0.000**	0.008**	0.000**	0.000**	0.004**	0.254	
$p > F$							0.000**
Log-likelihood				–272.0	–331.2	–305.2	
N	565	565	565	565	565	565	565
	Correlation of residuals						
k_{domtrk}	1						
k_{intair}	0.433	1					
k_{fortrk}	0.610	0.704	1				

**99% two-tailed confidence interval; *95% two-tailed confidence interval; †90% two-tailed confident interval

foreign trucking, respectively. All three models are significant, displaying χ^2 statistics at the 99 percent confidence interval. Models 1 and 3, which yield R^2 statistics of 0.38 and 0.32, respectively, explain a substantial amount of variation in the number of pieces of information collected in domestic and foreign trucking. In contrast, Model 2 with an R^2 of 0.03 has substantially less predictive power in explaining data collection in international air. Models 4, 5, and 6 in Table 3 examine the relationship between the predicted number of pieces of information collected in each segment and the organizational choice in each segment. Models 4 and 5 are significant at a χ^2 99 percent confidence interval; however, Model 6 is not significant, indicating that our control variables do a relatively poor job of explaining the variation in organizational choice in foreign trucking. Pseudo R^2 is 0.21, 0.14, and 0.12, for Models 4, 5, and 6, respectively. Finally, Model 7, which examines performance as a function of organizational form, is significant, with an *F*-statistic at the 99 percent confidence interval, and yields an R^2 of 0.24.

The empirical results provide broad support for Proposition 1. Models 1, 2, and 3 indicate that

the coefficients of our proxies for the level of idiosyncratic IT are greater and statistically significant for full-service couriers, our omitted category, than for package specialists (*PackSpec*) in each transportation section.[29] Relatedly, coefficients of our proxies for the level of idiosyncratic IT are greater for document specialists (*DocSpec*) than for full-service couriers, except for international air transport, in which there is no significant difference between document specialists and full-service couriers.

Models 4, 5, and 6 provide broad support for Proposition 2. The coefficients for k_{domhat}, k_{inthat}, and $k_{forhat,}$ are positive, with the first two highly significant and the last one weakly significant. Thus, the predicted amount of information collected in each transportation segment increases the likelihood of integration in that segment.[30]

Model 7 provides substantial support for Proposition 3. The coefficients for *AirOrg* and *ForOrg* are negative and highly significant, which indicates that vertical integration in response to collecting high levels of information on each parcel reduces delivery time. The coefficient for *DomOrg* is positive, which is opposite our prediction, but statistically insignificant and much smaller in magnitude than the coefficients for either *AirOrg* or *ForOrg*.[31]

This last finding deserves comment. Our analysis indicates that vertical integration in domestic trucking does not affect delivery speed. What, then, is the benefit of idiosyncratic IT and vertical integration in this segment? Even though idiosyncratic resources and integration do not reduce delivery time, they may influence unmeasured product attributes like delivery reliability. Indeed, we maintain that high levels of delivery reliability are predicated on idiosyncratic IT, which would invite vertical integration to safeguard the resources whether or not a fast delivery time is implicated.[32]

An additional concern is that a carrier may handle documents differently than packages in a way that is unobserved by our performance model. To evaluate this concern, we reestimated Equation 7 including the variable *Doc*, where *Doc* is a binary variable and coded 1 for parcels containing documents only, and coded 0 otherwise. The coefficient for *Doc* in this specification is insignificant. Also, the sign, magnitude, and statistical significance of all other coefficients are unchanged except that the coefficient for *AirOrghat* drops in significance to $p = 0.12$. Including *Doc* in Equation 7 leads to no substantial increase in R^2. This finding suggests that firms in this market may not be able to selectively intervene to provide different handling, and hence different delivery performance, for documents and parcels.

Statistically significant control variables provide several interesting findings. The amount of parcel data collected appears to increase for the foreign trucking segment when the destination city is distant (*Dist*). It may be the case that monitoring costs increase with distance, which increases the benefit from collecting real-time data with information systems, or that data collec-

[29] One might be concerned that the market positioning variables are picking up the effect of parcel type (document vs. package), rather than positioning *per se*. We reestimated Models 1 through 3, including a dummy variable indicating whether the parcel was a document. The coefficients for *DocSpec* and *PackSpec* were of the same sign and generally of the same magnitude as those reported in Table 3, indicating that our results for the positioning variables do not reflect a parcel effect. Results are available upon request from the authors.

[30] To assess the importance of accounting for the potential endogeneity of investment, we reestimated the organizational choice probit models using the actual (rather than the predicted) levels of idiosyncratic investment. We found that the coefficient estimates all have the same sign but smaller magnitude compared to coefficients for the predicted levels of investment. Nevertheless, variation in the level of statistical significance for these variables and variation in the sign and magnitude of control variables justify controlling for endogeneity effects.

[31] We reestimated the delivery time model using the actual (rather than the predicted) levels of organization choice to assess the importance of accounting for the potential endogeneity of organizational choice and found coefficient estimates with the same signs and smaller magnitudes compared to coefficients for the predicted levels of investment. Nevertheless, controlling for endogeneity effects appear justifiable.

We also reestimated Equations 1 through 7 using a logarithmic specification for information count indices. A logarithmic specification is consistent with the cost declining for additional pieces of information collected. The coefficients for *PackSpec* and *DocSpec* in Equations 1, 2, and 3 are all significant with the expected sign, whereas our present linear model yields significance in only five of these six coefficients. All other results are similar except that the logarithmic specification yields weaker results for Equation 7: the coefficient for *AirOrghat* is insignificant, whereas the coefficient in our current model is significant. While the logarithmic formulation produces higher R^2 for Equations 2 and 5, it produces lower R^2 in the remaining five models. We conclude that our results are generally robust to the logarithmic specification and that our linear specification provides the better fit.

[32] This finding suggests that integration is a necessary but not sufficient condition for delivery speed enhancing coordination.

tion in the United States and Europe trucking is systematically higher than in Japan. Model 7 shows that increasing *Dist* has the expected effect of increasing delivery time.

MarkSize is insignificant in Models 1 through 6; however, *FinCities* is significant, to varying degrees, in three models. Models 2 and 3 indicate that fewer pieces of information are collected for international air (weakly significant) and foreign trucking (significant) whose destination cities are financial centers. These coefficient estimates are consistent with a thick market hypothesis in which high demand invites entry by many suppliers, which may make it low-cost for freight forwarders to switch to alternative air carriers should performance fall below expectations. Model 5 indicates that forwarders are more likely to integrate when the destination city is a financial center (highly significant), which is consistent with the premise that legal and financial parcels shipped to financial centers have the highest shipping reliability requirements. Such requirements are better met with vertical integration of air transit (although we find no such effect for foreign trucking). Combined, the findings suggest that thick markets lead to outsourcing when shipping reliability is not critical, but that vertical integration provides a central support for highly reliable delivery.

PolRisk is weakly significant in Models 1 and 6. Surprisingly, *PolRisk* is positively related to idiosyncratic resources in domestic trucking, which implies that freight forwarders collect more real-time information when the destination city is in a weak institutional environment. Collecting more real-time domestic trucking information may substitute, at least to some degree, for difficulty in collecting information in weak institutional environments. *PolRisk* has a negative and significant effect on integration in foreign trucking, which suggests that a weak institutional environment discourages vertical integration. Such outsourcing may limit information accessibility, which is consistent with the earlier mentioned rationale that couriers might want to collect greater amounts of domestic trucking information.

Although not control variables, the bottom row of the table reports the correlation of residuals from Models 1, 2, and 3, which indicates that unobservables affecting the level of idiosyncratic resources tend to be strongly correlated across segments, justifying our use of the SUR model.[33]

Before proceeding to our discussion, we evaluate two assumptions used in developing our analysis. First, an alternative explanation for vertical integration is that integration into transportation segments may be due to idiosyncratic resources that provide transportation cost savings rather than to idiosyncratic IT. For instance, international air couriers may modify aircraft and use specialized cargo boxes to provide low-cost loading and unloading of parcels. Similarly, trucking firms may optimize document sorting, handling, and delivery costs by investing in specialized equipment and trucks, which, for example, minimize fuel consumption for specific freight and haul characteristics. Vertical integration is implicated in both instances. Assuming a competitive environment, we presume that such idiosyncratic resources in physical assets and vertical integration would lead to lower prices. We explore this explanation by taking advantage of price information collected on 397 of our 565 observations. We reestimated our Equation 4 using as a dependent variable not delivery time, but the natural logarithm of price in yen, *lnPrice*.

The results, shown in column 1 of Table 4, indicate the model is highly significant and displays an R^2 of 0.37. Coefficient estimates indicate that vertical integration in international air (*AirOrghat*) and foreign trucking (*ForOrghat*) are weakly statistically significant and associated with lower price. The coefficient for domestic trucking (*DomOrghat*) also is negative but is insignificant. While not conclusive, these results might suggest that idiosyncratic resources that reduce transportation costs may exist in conjunction with IT resources in international air transit and foreign trucking.

Our predictions and empirical analysis are predicated on the assumption of three market positions and on the assumption that these positions influence consumer choice.[34] We undertook

[33] A Breusch–Pagan test of independence ($p < \chi^2(3) = 0.000$) indicates that the investment decisions in the three transportation segments are not independent. Complementarities among these investments could provide one reason for this result. If complementarities are present, investment in one transportation segment increases the benefit from investment in other segments. However, we are unable to econometrically test for complementarities.

[34] Our analysis assumes the three alternative market positions are exogenous. However, the number and type of positions

Table 4. Price analysis and shipper endogenous self-selection analysis

Coefficients	Price analysis	Consumer selection analysis	
	(1) LnPrice	(2) Position	(3) lnDays
DomOrghat	–0.133		
	(0.633)		
AirOrghat	–2.295†		
	(1.084)		
ForOrghat	–2.174†		
	(1.048)		
Doc		2.384**	0.361
		(0.144)	(0.287)
Dist	0.064*	–0.093†	0.061**
	(0.025)	(0.048)	(0.013)
FinCities		0.118	–0.060
		(0.074)	(0.054)
MarkSize		0.010**	–0.004†
		(0.002)	(0.002)
lnPrice		–0.225**	
		(0.017)	
PackSpechat			0.793†
			(0.402)
DocSpechat			–1.807**
			(0.285)
constant	10.680**		0.456
	(0.676)		(0.233)
cut 1		–2.186	
		(0.301)	
cut 2		1.034	
		(0.252)	
R^2/pseudo R^2	0.373	0.336	0.312
$p > \chi^2$		0.000**	
$p > F$	0.001**		0.000**
log-likelihood		–244.8	
N	397	397	397

**99% two-tailed confidence interval; *95% two-tailed confidence interval; †90% two-tailed confident interval

an analysis to evaluate empirically whether shippers should expect performance differences that correspond to our model and the three market positions. First, we examined a model in which consumers choose among a package specialist, a full-service courier, or a document specialist. Second, we investigated whether such courier specialization leads to performance benefits by regressing *lnDays* on variables indicating whether the forwarder is a package specialist, a full-service courier, or a document specialist.

There may be unobservable characteristics of the shipper or parcel that affect both the choice of courier type and the speed with which the parcel is delivered, implying that the coefficients in the performance equation are biased. Consequently, we employ an endogenous self-selection model. In the first stage, shippers select from among the three market positions, which are modeled by a three-level ordered probit in which *PackSpec* is the lowest level and *DocSpec* is the highest level. Our independent variables are *Dist*, *FinCities*, *MarkSize*, *lnPrice*, and *Doc*. The inde-

are a function of consumer heterogeneity and of the number of alternative investment profile/organization pairings. The number and type of positions may change if either consumer heterogeneity or the number of alternative investment profile/organization pairings changes because of exogenous shocks. We believe our assumption is appropriate because firms develop a brand and reputation associated with their market position and that this intangible asset is likely to be more durable that either a carrier's investment profile or its organization choice.

pendent variables attempt to capture parcel-specific attributes associated with distance, destination, price, and type of parcel.[35] In the second stage, we modeled delivery time as a function of *Dist*, *FinCities*, *MarkSize*, *Doc*, and the predicted probability of choosing each market position, which is estimated from the first stage. In both equations we account for shipper-level correlation in the construction of the standard errors.

Results for both stages of the analysis are displayed in columns 2 and 3 in Table 4. Both models are highly significant and produce moderate R^2: 0.34 and 0.31, respectively. In column 3 we find that *DocSpec* is negative and statistically significant, which implies that shippers choosing document specialists achieve faster delivery than full-service couriers and package specialists. Relatedly, *PackSpec* is positive and weakly significant, implying that shippers choosing package specialists receive the slowest delivery.[36] In addition, shippers sending parcels to larger markets are significantly more likely to use full-service couriers than package specialists and are more likely to use document specialists than full-service couriers. This may reflect the greater availability of document specialists and full-service couriers in high-volume markets like the United States.

DISCUSSION AND CONCLUSION

The empirical results provide broad support for our industry-specific predictions and hence for our main proposition. A courier's resource profile, which was limited to the level of idiosyncratic IT resources in each transportation segment, is chosen to support a courier's market position as a package specialist, full-service courier, or document specialist. Different levels of idiosyncratic IT support each market position, which is consistent with the SPF literature. Idiosyncratic resources in IT, in conjunction with temporal specificity, generate exchange conditions that influence the choice of organization form in the way predicted by TCE. Vertical integration is paired with high levels of asset specificity, and contracting is paired with low levels of asset specificity. The resulting resource profile/organization pairing affects delivery time and possibly delivery reliability and transportation cost, although these latter two performance dimensions were not assessed directly except for delivery to financial centers. Differences in delivery time (and presumably in the other performance dimensions not measured directly) influence a shipper's choice in type of courier.

Our empirical results indicate that couriers face bundles of interdependent choices. For instance, targeting document shippers requires idiosyncratic resources in real time and highly reliable IT for keeping track of parcels. But idiosyncratic resources in IT alone are insufficient for producing fast and reliable service. Fast and reliable service depends additionally on vertical integration of each transportation activity—a critical element of a document specialist's strategy that is not indicated by Porter's SPF. Conversely, package specialists should rely on neither idiosyncratic IT nor vertical integration because these moves are costly, and package shippers appear to be unwilling to pay for the added speed and reliability benefits a document specialist strategy implies.

Attempts to selectively choose resources and organizational forms that do not correspond to one of these three interdependent bundles of choices equates to Porter's classic description of being stuck in the middle. For instance, vertical integration is not always desirable for a courier. Vertical integration leads to delivery performance advantages only in conjunction with idiosyncratic IT resources. Without the supporting IT resources, vertical integration is unlikely to provide high levels of delivery performance and command the price needed to pay for the high cost of vertical integration. Resource profile or organizational inconsistencies—in other words, being stuck in the middle—are bound to lead to poor product performance or high costs and represent a strategy that is not sustainable in the long run.

Our empirical analysis has several limitations.

[35] All three types of carriers carry documents. Similarly, all three types of carriers carry packages. Thus, a parcel that is a document does not uniquely define either one or two types of carriers.

[36] *Dist* is positive and significant; *FinCities* is insignificant; and *MarkSize* is negative and significant in the delivery speed analysis. Notably, *Doc* is insignificant, which implies that documents are not delivered more quickly than packages after controlling for a carrier's market position. Also, *lnPrice* is the instrument in the first equation that is omitted in the second equation. We assume that price influences a shipper's choice of carrier strategy but does not influence delivery speed once a carrier is chosen.

The number of couriers, 13, and the number of shippers, 16, in our sample limit our empirical results. We controlled for these small numbers by allowing intra-group correlation of errors in the appropriate equations. For instance, columns 4 through 7 in Table 3 all allow for intra-courier correlation. Similarly, columns 2 and 3 in Table 4 allow for intra-shipper correlation. Nevertheless, our empirical analysis could benefit from additional data collection. As indicated above, a measure of expected delivery reliability would provide a more complete analysis of the product attributes generated by resource profile/organization pairings. Also, our covariates only explain about 3 percent of the variation in idiosyncratic IT in international air transit, which warrants further investigation. Other factors, including the politics of acquiring landing slots not captured by our institutional environment variable, may provide additional explanation for the choice of IT resources.

We were unable to measure courier costs and thus competitive advantage. Nevertheless, our synthesis suggests that the logic of SPF and TCE both contribute to our understanding of the strategy and structure choices in IC&SP service. Alternative market positions, as Porter would maintain, attract different types of parcels or shippers and are supported by a corresponding resource profile. Vertical integration, as Williamson would maintain, safeguards idiosyncratic resources and provides coordination advantages. However, neither framework alone could provide as much explanatory power as is provided through the combined lens: Porter has little to say about the choice of organizational form and the benefit from vertical integration, and Williamson has little to say about the implications of choosing a particular market position. We note that the unit of analysis (the constellation of activities in a vertical chain used to produce a good or service) and the resource profile (with its inclusion of asset specificity in each activity) are keys to linking these perspectives.

An important caveat of our study is that it assumes a partial equilibrium, and we investigate neither the number of firms adopting any particular market position nor entry–exit decisions. Nevertheless, we posit that industry structure and entry, at least in IC&SP service, are likely to be related to the magnitude of idiosyncratic resources. For instance, we anticipate higher entry and exit rates for package specialists because this position relies on relatively more generic assets, which incur lower entry and exit costs compared to document specialists. Also, we do not explain why shippers might choose one courier over another even when both couriers have the same strategy. However, such decisions may be related to specific investments in advertising and reputation or to each courier's marketing tactics.

Of course, our main proposition may not appear new to many. One foundation of strategic management is the notion of fit—that firms adopt strategies and structures to attract a set of targeted consumers. However, our main proposition and method of empirical analysis offer a theoretical and empirical foundation that generally is absent in the literature on fit. The positioning-economizing perspective potentially adds precision to the definition of a strategy. In essence, our results support the concept that choices of market position, resource profile, and organizational form combine to define a firm's strategy, and that these choices are endogenous in the sense that they are made to reinforce one another. Combinations that are not reinforcing are not feasible in the long run. The positioning-economizing perspective also calls for more explicit consideration of the demand structure that determines which strategies are feasible—a consideration that all too often is omitted from most analyses. Indeed, our study, too, would greatly benefit from more detailed information on the structure of demand and heterogeneity of consumer preferences.

These benefits notwithstanding, one empirical study is insufficient to assert that the positioning-economizing perspective provides substantial value for researchers and practitioners. Such a claim must await application of the theory and methodology to other markets. Fortunately, additional applications are likely because the methodology developed herein provides a basis for analyzing other markets, even those with small numbers conditions.

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APPENDIX

Package-level survey

Variable	Questions	
k_{domtrk}	Q1	Whether not the package has been picked up
	Q2	Name of the pick-up driver
	Q3	Time of pick-up
	Q4	Place of pick-up
	Q5	Whether or not the package arrives at the local terminal
	Q6	Time of local terminal arrival
	Q7	Name of local terminal
Customs clearance information	Q8	Whether or not customs are cleared
	Q9	The time of customs clearance
k_{intair}	Q10	Whether or not the package was loaded onto an airplane
	Q11	The loading time
	Q12	Whether or not the airplane departed
	Q13	The departure time
	Q14	The city the airplane departed from
	Q15	The cities that the package visits during the airline transit
	Q16	Whether or not the airplane landed at the destination airport
	Q17	Time of arrival
Customs clearance information	Q18	Whether or not customs in the destination country has been cleared
	Q19	The time of customs clearance
k_{fortrk}	Q20	Whether or not the delivery truck departed from the local terminal
	Q21	The time the delivery truck departed from the local terminal
	Q22	Name of the local delivery terminal
	Q23	Whether or not the parcel has been delivered
	Q24	Time of delivery
	Q25	Location of delivery
	Q26	Name of receipt