PRICING EXPERIENCE GOODS IN INFORMATION GOOD MARKETS: THE CASE OF EBUSINESS SERVICE PROVIDERS

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Abstract

We study the pricing strategies of firms providing a service in experience good markets with switching costs. Using data on vendors providing "hosting and related services" at an early stage of the market, we test for pricing distortions that follow from oligopolistic competition with quality uncertainty and switching costs. We find that firms with brand name charge a premium for their product—leveraging the reputation accumulated in closely related markets. As the theoretical literature suggests, we also find that the type of pricing distortions along the product line depends on consumers' expectations about quality. If consumers underestimate the quality of the product, firms behave as if they discount introductory contracts in order to build trust, and later on markup upgraded contract. In contrast, firms that offer a quality level that is lower than consumers' expectations markup initial contracts while discounting upgraded ones.

Key words: information goods, pricing strategies, electronic business

JEL: L81, L15, L11

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1. INTRODUCTION

In the last decade, the term information technology has ballooned to encompass many aspects of computing and technology. Thinking about the term very broadly, Shapiro and Varian (1999) define information goods to be anything that can be digitized: books, music, software and even a phone conversation. One prominent feature of information goods is that they have large fixed costs of production, and small variable costs of reproduction. The challenge in pricing then becomes finding a way to sell a service with a mark-up above cost to a large enough set of consumers, so as to cover those high fixed costs. Since different consumers may have radically different values for a particular information good, differential pricing becomes very important. While there are many forms of differential pricing, one of the most common pricing strategies in information good markets is quality discrimination, also known as versioning (see Varian 1997). In this case, producers offer different qualities/versions of the same good for different prices. Versioning allows consumers to sort themselves into different groups according to their willingness to pay. Consumers with high willingness to pay choose higher quality versions, while consumers with lower willingness to pay choose the low quality versions.

Two additional common characteristics make pricing strategies in information good markets even more complex: (1) Experience goods, and (2) Lock-in. Most information goods show features of experience goods. In contrast to search goods whose quality can be determined before purchase, experience goods' true quality is only learned upon consumption (Nelson, 1970). Moreover, consumers typically invest time and other resources in the information product they acquired. These investments make it costly for the consumer to switch to other alternatives; giving rise to *lock-in*.

Using data on electronic Business Software Providers (eBSP) in 2001, this paper studies pricing strategies in an information good market that exhibits quality uncertainty and switching costs. These estimates allow us to evaluate whether (and which) distortion patterns predicted in the theoretical literature are realized empirically. Specifically, we study whether eBS providers charge a premium for brand name, for an existing relationship, for quality tiers, and whether these premiums vary with the position of the specific contract within the provider's product line.

The eBSP market provides a good example in which to observe these effects because the market is characterized by considerable uncertainty about the value of the service. During the period of our data, this market was still in the early stages of its development and only a handful of firms had more than several years' experience. Furthermore, the

market had few normalized procedures for measuring inputs or outputs, and in the eyes of the participants, had only recently experienced a shake-out affiliated with the dot-com crash. A typical contract in this market charges a monthly fee for a combination of hosting services and storefront software. Most eBSPs offer a menu of contracts that vary in the level of hosting offered and sometimes in the quality of the storefront software. Storeowners must spend time creating the store, uploading the data and learning how to use the software. This is a time consuming process and therefore creates high switching costs.

In an ideal experimental setting, examining pricing distortions in markets with experience goods requires a panel data observing producers' behavior over a long period of time. The unique structure of our data allows us to make progress on understanding pricing strategies based on a single year dataset. Specifically, most producers in our data offer a product line and let consumers choose the version of the product most appropriate for them. While the theoretical literature allows producers to adjust their prices over time so as to attract different segments of consumers, versioning allows producers to sell to different market segments at different prices in a single period of time. We, therefore, regard the pricing of low-end versions to act as first period pricing. Prices of consequent versions are then considered as pricing in consequent periods.

The economic literature provides different – and sometimes contrasting - theories for optimal pricing of experience goods. Shapiro (1983) investigates optimal pricing policy of a monopolist in a two-period model when each consumer learns the true value of the product through experience. The paper finds that if consumers overestimate the quality of the product, producers should take advantage of a good reputation and charge an initial high price. Subsequent periods should be then characterized by a declining price path followed by a jump up to a terminal price. If, however, consumers underestimate quality, the optimal way to build reputation is to start with low introductory prices followed by higher regular prices. Assuming forward-looking consumer, Bergemann and Valimaki (2006) find that in a mass market, optimal prices should decline over time. Conversely, in a niche market, optimal prices should initially be low followed by higher prices that extract surplus from the buyers with high willingness to pay.[1]

[1] The intuition behind their results is as follows. In an experience goods market, the seller is facing two different submarkets simultaneously: demand of those who already consumed the product and thus learned their preferences and demand from those who are uninformed. Since some consumers are more informed than others regarding the quality of the product, in mass markets the monopolist first skims the more attractive part of the market. This is in contrast to niche markets where the monopolist must offer low initial

Switching costs are ubiquitous in information good markets. The way information is stored, manipulated and communicated typically varies across producers. Consumers thus bear switching costs when they switch from one information system to another and consequently may face lock-in. Anticipating a price hike, consumers typically seek an initial discount or other "carrot" as a compensation for the lock-in. The literature (for a survey, see Farrell and Klemperer, 2007) offers similar pricing strategies—i.e., initial introductory prices followed by higher prices—as optimal pricing in the case of high switching costs.

The economic literature offers contrasting pricing strategies for experience good markets, some of which differ, and sometimes contrast, optimal pricing strategies in markets with lock-in. Moreover, the literature on optimal pricing strategies in markets with experience goods has focused mainly on monopolistic markets. It is not clear, however, whether the same predictions apply once we introduce competition. We also examine this open question.

We find that firms with brand name in closely related markets, as expected, charge a premium for their product. Nevertheless, the existence of previous relationship in a related, yet different, market does not help with the uncertainty consumers have for the goods; and thus does not allow for a premium. As the theoretical literature suggests, the combination of experience good with switching costs encourages firms to discount their initial contract, so as to attract consumers to try their goods. Firms then take advantage of the high switching costs, as well as the resolved uncertainty, and markup their top contracts. While most providers seem to be tilting the whole pricing line in a way that lowers prices for basic contracts and raises prices of top contracts, an interesting set of providers in our data set appears to be tilting prices the other way around—i.e., charging a premium for initial products while discounting top contracts. These providers are newly founded firms that focus on the eBSP market. While these startups have not managed to establish a brand name yet, their focus and specialization in the market may act as a signal of high quality for consumers. Their pricing strategy is then in line with Shapiro's (1983) optimal pricing in the case where consumers overestimate the quality of the good.

We perform two robustness checks. In the first, we examine pricing differences within portfolios. The results show that firms that offer low quality products have smaller pricing differences within their product line. This suggests that such firms

prices to capture a larger share of the uninformed consumers at the expense of targeting the more attractive informed segment of the market.

cannot mark up their top contracts, and despite the switching costs, a premium would most likely result in consumers switching to other alternatives. Furthermore, we find that firms with high level of uncertainty about the quality of their product—e.g., firms that offer open source—find it hard as well to tilt the pricing of their product line.

The second robustness check looks at firms' quality choice. We find that, in general, firms with a brand name tend to choose a quality level that is lower than the average in the market. These firms have already established their reputation and thus tend to invest less in quality in comparison to those lacking a reputation. Interestingly, while one would expect the set of specializing firms discussed above to offer a higher than average quality, in practice these firms offer an average quality in the market. This finding supports the hypothesis that consumers likely overestimate the quality these firms offer.

We know of only one paper examining pricing in hosting markets and related areas, namely, Thompson and Thompson (2006). The authors estimate a hedonic price equation for a sample of hosting firms gathered from the *FastFind* Directory. We ask quite a different question from their study, so our data sets reflect different goals. We add additional information, in particular with regards to the quality of the storefront software. Such data is hard to collect, so their data set has more observations than ours, while we have more depth about our question of interest.

The paper proceeds as follows: Section 2 provides a review of the marketplace. Section 3 presents our empirical model, while in Section 4 we discuss our data. We discuss the key results in Section 5, and finally Section 6 concludes.

2. THE EBSP MARKET

We study the e-Business Service Providers (eBSP) market. By 2001, the commercial Internet had diffused to over half the households in the United States and to virtually all medium and large businesses—with estimates for retail electronic commerce exceeding $32 billion a year in the United States.[2] This demand grew from almost nothing six years earlier, most of it in applications of the World Wide Web. eBSPs offer solutions for small or medium-sized businesses that are interested in creating an online store or in improving their already existing online storefront. These businesses anticipated the value of an on-line outlet, but did not have a large set of employees devoted to information systems operations. Hence, they generally preferred to outsource

[2] See e.g., Table 6, U.S. Electronic Shopping and Mail Order Houses (NAICS 454110) for total sales in 2002 in E-Stats, http://www.census.gov/eos/www/papers/2002/2002finaltables.pdf.

development activity and operational tasks. Large business users with in-house staff also may have preferred to hire an eBSP if the needs of the storefront exceeded the capabilities of the staff.

eBusiness service providers offer a bundle of hosting services (mainly disk space) and a storefront software which includes a store builder and a store manager. The store builder helps with creating the online store: designing the store's layout (usually from a predefined template) and recording the products characteristics: name, price, picture and quantity (most store builders require a manual entry of each and every product, while some offer automatic loading). Once the store has been created, the store manager software accepts online transactions, calculates taxes, manages quantities and produces reports.

The monthly fee an eBSP charges depends on the contract's hosting level as well as on the quality of the storefront software (hereafter cart). While basic contracts usually offer a small disk space together with a low quality cart, top contracts typically offer a large disk space as well as a sophisticated cart. Under the above structure, a small business that wants to go online but is not sure about its online scale, or about the value an e-presence can generate for it, can start with the basic contract and only if and when needed, can upgrade to a better contract with more disk space and a higher quality cart. One would, therefore, expect to see some self-selection in this market where firms that have a clear understanding of the value of creating an e-presence would choose more advanced contracts relative to firms who are uncertain about this value.

Note that, "going online" means that the storeowner has to spend time on creating the store, uploading the data and learning how to use the software. This is a time consuming process and therefore creates high switching costs. Moreover, engaging with an eBSP the consumer is uncertain about the scale of its online store, the scalability of the contract is very important and therefore a forward-looking user considers the entire product line offered by the eBSP before choosing a provider.

We observe entrants of three different types. We label them *Brand, Relation*, and *Specialist*. Brand firms, like Microsoft and IBM, have build reputation in other markets and attempt to extract rents for their promises of reliability, continuity, and quality service in this experience good market. Relation firms are firms that were in a related business before entering the eBSP market; typically as an ISP. Relation firms enjoy a pre-existing relationship with a set of customer to whom they now offer hosting services. In this situation, the Relation firm offers complimentary services that take advantage of

close relationships between the supplier and buyer or of other factors that underlie trust, which is a valuable factor to some buyers in a market with experience goods.[3] The third set of entrants is a Specialist. Most of these firms are newly founded. They specialize in all facets of being an eBSP and are typically small firms that develop all their own software.

The three firm identities coincide with distinct approaches to offering quality. The vast majority of Specialists focus on offering high-quality solutions, typically programmed by their own employees. When these firms provide only low-quality carts, they have little to distinguish themselves from others. In contrast, since the storefront services are not the core business of the Relation firms, these firms buy a third-party cart and resell it to their customers. The quality of the carts offered by Relation and Brand firms varies considerably, depending on the firms' reselling choices.

The data for this study comes from 2001. By then, market forces had already eliminated a set of risky (or, perhaps, better characterized as intemperate) approaches to pricing. For example, during 2000, before the dot-com crash, many providers offered their basic contract for free and charged a monthly fee only once the consumer chose to upgrade to a better contract. This strategy was aimed at generating switching costs with users, with firms gaining revenue later as long as the users remained with their existing provider. The crash of 2000 appears to have rendered this pricing strategy ineffective or simply unpopular, as by 2001 the providers who offered free contracts either went out of business or moved to charging a monthly fee for all contracts.

3. THE EMPIRICAL MODEL

The unit of observation is the contract offered to potential customers. For each contract, i, we observe a price offered to customers, as well as a vector, X_i, which represents the features of each contract. We will assume that there exists a function that maps features into prices. In practice, we might consider a function such as $P_i = f(X_i\beta) + \varepsilon_i$, where ε is an error term, f is chosen by a set of econometric procedures, and β must be estimated.

P_i is chosen by firm of type τ, where τ can be Brand, Relation, or Specialist. We observe the vector of characteristics Hi, Q_i, where these are contract i's hosting and

[3] As Greenstein (2000) shows, ISPs typically offer one or more of the following services: ISP services, Hosting services, Web-design services and, Maintenance and support services. We focus on the group of providers that offer many of all four services, focusing specifically on whether they do offer maintenance and support. We capture this fourth service with the variable *phonesupport* which we define below. While the group of Relation firms we study may still differ in their geographical locations, which might affect the type of consumers they face, we have studied this effect in a previous version of the paper and found that these differences do not affect Relation firms' pricing behavior.

quality of features, respectively. In addition we observe the firm's choice of cart K_i. Finally, l is the position of the contract variety within the firm's product line, which we define subsequently. It will be an ordinal category, such as lowest, highest, or middle contract within a product line offered by an eBSP. We denote by N_c the total number of firms that offer a contract variety with an overall similar level of homogeneous features, c—e.g., memory size and product slots. In general we write the price function as $f(\tau,l,H_i,Q_i,K_i,N_c)$, where we treat all these determinants as exogenous. In practice, empirical data will violate this exogeneity assumption, especially for N_c, which concerns us less because we treat it as a control. We defer a full discussion until later.

Now we discuss the interpretation of the coefficients. We imagine a two step entry process, where firms first enter and then compete in prices. From the viewpoint of a firm in 2001, most of these entry costs are sunk. We think of contract i's cost function as pertaining to only its variable expenses, while the monetary component of entry costs are debts the firm tries to pay through pricing above variable costs. For reasons we will describe momentarily, we write the costs function as $C(H_i,Q_i,K_i)$. Hence, we will think of τ, l, and N_c as contributing to contract i's margins above costs, but not cost levels. In some situations we can also interpret Q_i similarly.[4]

Clearly, increases in hosting service, H_i, raise both unit costs and prices for a contract. Hence, a positive coefficient on either variable is uninformative about margins. In contrast, while it is clear that higher Q_i should raise prices, some quality improvements involve regular operational expenses that affect unit costs. Consequently, we can attribute margins to quality when those qualitative improvements involve little operational cost or the costs are largely sunk, as they are for Brand and Specialist providers.[5] Nevertheless, for a Relation firm the cart choice, K_i, shapes a firm's prices as well as variable costs, since cart owners may charge licensing fees (except when it is open source). Hence, a coefficient on carts informs us about price, but not margins.

By a similar line of reasoning, upgrades strategies involve few operational expenses, so we interpret differences in price levels affiliated with a contract's position, l, as indicating differences in margins. Similarly, the level of competition for each contract, N_c, affects margins, not costs.

[4] Note that there was almost no new entry into this market after the dot-com crash. As a result, we do not observe any firms who entered around the time of our survey. Most firms expended the vast majority of their entry costs before we observe them.

[5] While the coefficient tells us about which designs generated higher or lower margins for these providers, it will not tell us whether the total incremental improvement in revenues from increasing quality over the next highest level exceeded the cost of designing it.

Finally, when interpreting the firm type, τ, we also bring one historical trend to our interpretation. Most of these firms were not mass market providers. Most Relation firms and Specialists attempted to target user communities with inelastic demand. In these cases we associate higher prices for a type of firm with greater margins. We do not expect low mark-up to support high profitability unless it translates into large market share, which – based on trade press reports of industry events – few, if any, of these firms achieved. Judging from news reports, even the Brand firms did not realize such aspirations. [6]

4. DATA

By 2001, the eBSP market contained a large number of providers offering a large variety of Web solutions, from basic hosting to sophisticated store managers. In this section we describe the data we collected about these firms.

To build a comparable set of services, we focus on custom Internet solutions offered to small and mid-sized firms, which offer online transactions in addition to help with building and managing the storefront. We include only those observations that (1) offer a store-builder, (2) offer online credit card processing, and (3) do not require users to have any knowledge in HTML/ XML or any other computer language.

The data collection process was as follows: We first searched Yahoo! and *thelist* for listings of providers.[7] We then looked at each provider Web site; and for each contract offered, we collected information on monthly prices, cart's features and hosting attributes.[8] We kept observations that were complete. In total, we collected data on 433 contracts offered by 145 firms. As a further check, we randomly called a number of providers to verify the online quotes; we found no discrepancies. We now discuss the definitions of the variables that determine price.

Firm Type. Firm type was comparatively easy to assess. The few Brand firms that existed in 2001 were IBM, Microsoft, Yahoo!, and Ameritech. Another prominent branded firm, Intel, had recently exited. All the Relation firms were regional ISPs from a wide variety of locations across the United States. There were also a significant number of Specialists.

[6] As illustrated by Intel's high profile exit prior to our data collection.
[7] This site, maintained by Meckler Media, provides ISPs the opportunity to advertise their services. The ISPs fill out a questionnaire where the answers are partially formatted; answers are then displayed in a way that allows users to compare different ISP services.
[8] Since, in some cases, the pricing quotations advertised on *thelist* were inaccurate, we disregarded these quotes and used only the quotations advertised on the providers' Web site.

Overall, we have in our data 11 contracts by Brand firms, 394 by Relation, and 33 by Specialists. In our regressions, we define two dummy variables, ***Brand*** and ***Specialist,*** respectively. Relation is omitted.

Hosting Services. Standard contracts provide users (e.g., store owners) with server space—hosting services. We define the variables ***Storage*** and ***ProductSlots*** as the available disk space and the maximum number of product slots allowed in the store, respectively. Some firms, however, offer contracts with an unlimited, or infinite, amount of features in either one dimension or both. There were several different but econometrically equivalent specifications for this feature of contracts. We employ the following: In case of an infinite amount of storage or product slots, the variable is set to a somewhat arbitrary number, at a level equal to a step above the highest level in the data. Then the corresponding dummy variable, that is, ***InfStorage*** or ***InfProdSlots***, is set to one. These arbitrary numbers are 5000 MB for storage and 200,000 for product slots. Note that since from the store owner's point of view, the variables ***ProductSlots*** and ***Storage*** are complements, a store owner would not value a contract with unlimited disk space (or, conversely, product slots) but a very small number of product slots (or disk space) as most of the offered disk space (or product slots) cannot be used.

In Table 1, we show the storage–product slot offerings distribution. For each storage–product slot range combination, the Table gives the number of contracts offered (top number) and the average monthly price of these contracts (bottom number). Interestingly, the combinations are spread all over the storage–product slot space. Furthermore, the Table shows that providers tend to use a limitation on one dimension of the space (storage or product slots) as a tool to also limit the other dimension. Almost 60% of the contracts in our data limit either storage or product slot space, and of these more than 80% offer an unlimited, or infinite amount of product slots. Note that 10% of the available contracts offer an unlimited amount of product slots with a small amount of storage (less than 50 megabytes, or MB), while there are no contracts that offer unlimited storage with less than 25 product slots. In addition, note that there is plenty of variability in the pricing of the contracts, without any notable trend.

Table 1 about here

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*Quality of Cart***.** A cart is a combination of a store builder and a store manager and its quality is directly related to the quality of the store builder and the store manager software. We found 10 relevant features for an on-line store that are indicative of the software's quality: (1) Templates - Different layouts, color schemes, and styles for the storefront display; (2) Inventory Controls - An inventory manager to prevent backorders; (3) Shipping Calculator - automatically calculates shipping cost, primarily on the basis of weight and location; (4) Tax Calculator - automatically calculates the tax on products shipped within the United States; (5) Customer Reports and Trend Reports - Overviews of the activity on the store's site, such as a count of viewed pages, the average number of pages each visitor looked at, and which sites and search engines referred the visitors to the site; (6) Transaction Data Exporter - Helps keep track of sales for accounting purposes; (7) Catalogue Importer - Enables the use of a database, such that the store data can be uploaded from a file rather than added one by one; (8) Coupons/Discount Creator- Create coupons for customers to use in the store; (9) Site Search - A search engine for items on the store's site; and (10) Tools for Saving User Profiles. The presence of the five latter features is a symptom of a high-quality cart.

Each cart received one point for the availability of each of these features. In practice, the variable ***Quality*** takes on values between four and ten. We also add one additional measure of quality. ***PhoneSupport*** is a dummy variable that gets a value of one if the monthly price includes *free* phone support. Phone support, which many providers charge extra for, is a very important service for the new online storeowner. If the free phone support is given only for couple of months ***PhoneSupport*** gets the relative fraction of these months within the first year. To test for different behavior of Specialists, we add ***SpecialQual*** and ***SpecialPhone,*** which interacts ***Specialist*** with ***Quality*** and ***PhoneSupport***, respectively.

Our data consists of eight different third-party carts and sixteen Specialist carts. Table 2 gives the distribution of the most common carts[9]—Akopia, Miva, Kurant and AlaCart—along the storage, product slots, price, and quality lines. The table shows that, on average, Relation firms tend to offer more storage than Specialists. This makes sense given that Relation firms are also active in the hosting business, and consequently are likely to have lower storage costs than Specialists. Whereas there is dispersion with the amount of storage offered, with product slots, each third-party firm tends to offer only a specific range. Specifically, Miva and Akopia only offer an unlimited amount of product

[9] Constitute 90% of all observations. The other 10% involve four other uncommon third-party carts.

slots, while AlaCart offers contracts with a comparatively low amount of product slots. In terms of range of cart quality, Table 2 shows that AlaCart is at the low-end, Miva is in the middle, and Kurant and Akopia are at the high end. The Specialists are found everywhere along the quality line. Accordingly, we define ***Akopia, AlaCart, Kurant, and Miva*** as dummy variables of the major carts and omit the four small carts. We treat these as "fringe" suppliers.

Table 2 about here

Position within Product Line. The switching cost literature (e.g., Farrell and Klemperer, 2007) or the more recent literature on versioning of information goods (Shapiro and Varian, 1998; Chen and Hitt, 2006) suggests a star prediction. A firm's price will be low at the bottom of the product line to attract consumers who will purchase higher margin products later. In the classic price discrimination model of Mussa and Rosen (1978), mark-ups at the bottom of the product line are distorted upward to induce purchase at the top of the product line, where there is monopoly pricing. More recent generalizations by Rochet and Stole (2002) argue that this effect depends on trade-offs between the participation constraint and valuation of vertical quality dimension.

We define three variables for the position of a contract within the firm's product line: ***Bottom***, ***Top***, and ***Position***. ***Bottom*** is a dummy variable for the simplest contract in a portfolio. ***Top*** is a dummy for the highest. ***Position*** is a variable number that equals one for the lowest contract, two for the second, and so on. The variable ***Portfolio*** gives the number of contracts the firm offers. ***PortBottom*** and ***PortTop*** interact ***Portfolio*** with ***Bottom*** and ***Top***, respectively.

Upgrade Path. If firms, indeed, offer introductory prices in order to reduce the cost of "experiencing" their product, or in order to lock-in consumers; the pricing and attributes of subsequent contracts would have a key effect on the profitability of such pricing strategies. One would expect store owners to value product lines that offer contracts with balanced number of product slots and storage, and would thus expect providers to offer portfolios of balanced contracts along which users could grow. Actual data, however, seem

to defy this expectation.[10] As it turns out, a firm's upgrading path strategy is highly correlated with its type as well as with the third-party cart the firm offers. Most firms tend to upgrade along the storage line, in which case the number of product slots stays the same for all contracts within a portfolio. While high-quality carts like Akopia mostly do not limit the number of product slots, lower-quality carts like AlaCart tend to fix the number of available product slots at a low level, in which case the marginal benefit from additional storage decreases as the available storage increases. Specialists use many different upgrading strategies; however, they tend to use one specific dimension to limit the whole space. That is, they upgrade along one dimension while not limiting the second one.

Given this behavior, we experimented with a variety of specifications for the upgrade path choice. Because it is the least common, the choice to fix storage levels is difficult to identify from other behavior. We, therefore, define a dummy variable, ***Notfixed***, to account for the differences between contracts that are part of a portfolio where one feature is fixed and contracts that are part of a portfolio in which both features grow.

Competition. Most of the literature on optimal pricing in experience good markets focuses on monopolistic markets. However, the literature on switching costs suggests that firms may compete ex-ante for the ex-post market power that comes with lock-in (see Farrell and Klemperer, 2007 for a survey). Our empirical analysis examines the effect of competition on firms' pricing strategies. In particular, firms may have little market power at the "entry level" end of their portfolios and more at the high end.

As it turns out, firms tend to offer their hosting services at a few modal levels or ranges. Hence, it is straightforward to define competition at a practical level around scalar focal points, such as "between 80 and 100 products." We then define competition around supply within each storage–product slot box; as is shown in Table 1. In each segment, firms compete both with contracts offering the same cart as well as with contracts offering different carts. That is, in general, competition within segments depends on the total number of contracts within the segment, the total number of firms, as well as the total number of different carts. We define the following additional variables: ***marketSize*** is

[10] One interpretation suggested to us was that this represented deliberate attempts at obfuscation by vendors—see, for example, Ellison and Ellison (2005). Another was that this represented a simple marketing strategy to "frame" middle choices, making them appear comparatively more attractive by making the end choices appear to be less attractive. We are agnostic between these and other explanations. As elsewhere, our approach is to characterize this behavior and identify whether it facilitates higher or lower prices, then we discuss the range of interpretations the estimates allow for.

the total number of contracts offered within the segment; ***numCarts*** is the number of different carts offered within a segment.

Though each firm treats its rival's decisions as exogenous, we still face an endogeneity issue related to an omitted variable. For example, Table 1 shows that the high end of the space is very crowded. Does the heavy competition on the high end of the product slot space limit the firms' ability to extract high value? Or does high supply simply reflect the presence of more users in these segments? The first (second) process supports a negative (positive) relationship between more competition and prices. In light of these inherent ambiguities, we interpret the coefficients for these variables with caution.

We apply our approach to the menu of prices and characteristics for 433 contracts offered by 145 firms based in the United States. The appendix provides some descriptive statistics of our data. Our statistical approach resembles the few other empirical studies of contracting in technology markets, i.e., we closely examine each contract's features and classify these features.[11] As in other research where contracting practices have never before been analyzed, we focus on establishing the statistical regularities and identifying the underlying economic relationships determining value. In this sense, we also resemble empirical studies of pricing of other high technology firms.[12]

5. *RESULTS*

In Table 3, we present four specifications analyzing firms' pricing strategies. We follow statistical procedures established by prior researchers (Berndt 1991). For each specification, we present the Ordinary Least Squares estimators with clustered standard errors.[13] The log of prices is the dependent variable.[14] In all our estimates we assume the right-hand-side variables are statistically exogenous and discuss ways in which violation of this assumption might shape the interpretation of coefficients.

Table 3 about here

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[11] See, e.g., Lerner and Merges' (1998) study of contracts between venture capitalists and biotech firms or Elfenbein and Lerner's (2003) study of contracts between Internet portals and their online partners.

[12] Much of this dates to Griliches (1961). For recent work see, e.g., White et al (2004) on prices for operating systems, Berndt et al (1995) on prices for personal computer hardware, or Berndt and Rappaport (2005) on pricing of mobile computers.

[13] We also estimated a random-effect regression, which was superior to a fixed effect regression by standard tests; however it does not add much over the OLS regression with clustered standard errors. Sometimes the coefficients or standard errors change slightly, but not by much or not in qualitatively important ways. For the sake of parsimony and space, we show only the OLS with clustered standard errors results.

[14] Box-cox tests strongly favor the log price specification.

The first specification examines the effect of brand name and reputation on firms' ability to charge a premium in experience good markets; while not controlling for quality levels or competition. Since hosting services are a commodity, and since many of the competing firms (mostly ISPs) offer hosting independently of their eBSP offerings, we include ***Storage*** and ***ProductSlots*** as controls in the regression. As the results show Brand firms charge a premium of more than 50 percent on their products. That is, the high level of uncertainty regarding quality allows firms with brand name and reputation to charge a premium for the confidence, in terms of quality, they provide. Note that, in this market, making the right choice is crucial, as choosing a product of low quality would not only result in high-switching cost but may also affect the user's brand name in its market. A poor quality website would not only negatively affect the user's current sales, but might affect its reputation and thus its future sales as well.

Of the four common third party carts only Kurant commences a premium. This is, most likely, because of the third-party brand name the cart has among ISPs together with its high quality. Note that Relation firms that resell Kurant probably share the premium with Kurant in licensing revenue,[15] so higher prices do not necessarily translate into higher margins. Akopia and AlaCart have a negative significant coefficient. While AlaCart's discount can be explained by its low quality in addition to its lack of reputation, Akopia offers a very high-quality cart.[16] Akopia, however, is an open source and Relation providers are not charged when they offer it. Moreover, this also means that the providers cannot as easily give support for the operation of the cart, as ISPs often do not understand all the source code well enough to be able to solve all problems for their users. This is in contrast to firms like Kurant which offer support to the ISPs that use them, and thus enables the ISPs help their customers solve complex problems. Thus, discounting Akopia might be directly related to the increased uncertainty consumers face when choosing an Akopia cart.

As mentioned before, Specialists are mostly newly founded firms that specialize in all facets of being an eBSP. Unlike the Brand and Relation firms which are active in many other markets—e.g., ISPs, software, search engine—Specialists focus only on the eBSP market. Whether Specialists can charge a premium for their product or not depends then on consumers' expectations. While on one hand these are startups with little reputation,

[15] However, the cart vendors were reluctant to share information about their historical licensing practices with us, so we could not verify what fraction of this premium stayed with hosting firms who resold it.
[16] The third column in Table 4 presents the discount/premium a Relation firm can charge due to quality.

on the other hand this market is their core expertise. The results show that given this tradeoff, Specialists indeed do not charge a premium for their product. Nevertheless, as specification II shows, once we control for quality the coefficient on Specialist becomes positive and significant. That is, controlling for quality, Specialists charge a premium for the expertise they offer.

The second specification in Table 3 controls for "observable" quality of the contract. Based on the ten features described in section 4, we create a measurement for quality that consumers can observe before purchasing the contract, and can thus reduce the uncertainty with regards to the quality of the good. In addition, typically consumers feel more comfortable purchasing an experience good when the firm offers close customer support. We, therefore, also control in our analysis for whether the firm offers phone support or not. We interact both variables with Specialist firms and examine whether the different types of providers charge differently for these features.

As the results in specification II show, the higher the discernible quality of the product the higher the price firms charge for it. Since higher quality is typically more costly to produce, the increase in price may just convey the higher costs firms face when offering higher quality. Interestingly, Specialists charge lower prices on quality. While this can be related to the uncertainty that comes with startup firms, an alternative explanation can be actually related to cost. While Relation firms outsource the carts, Specialists develop the features in house. It is, therefore, reasonable to assume that the Specialists' cost of quality is lower; specifically given that this cost is mostly part of their fixed rather than variable cost. The coefficient on ***phonesupport*** is positive but not significant; both overall as well as when interacted with Specialists.

In order to isolate the "brand/quality" effect, we conduct a counter-factual experiment: How would prices change as an ISP alters its cart choice while not altering other features? To illustrate this question, we take as a benchmark a Relation firm that did not engage with one of the more common third-party carts—Kurant, Miva, Akopia or AlaCart. The median quality offered by such providers is 5. We take this benchmark and calculate the marginal premium or discount Relation firms can charge by switching to one of the common third-party carts. The last column in table 4 shows the results. Kurant offers two carts with two different quality levels. While Relation firms that offer the higher quality cart can charge a premium of about 150%, offering the lower-quality cart allows for a premium of 120%. Relation firms offering either of these carts are pursuing a "brand-name" strategy. Relation firms offering AlaCart, in contrast, are

taking a distinct tact—offering a "generic-products" strategy. As a result, such firms must discount their contracts.

Table 4 about here

5.1 PRICING STRATEGIES ALONG THE PRODUCT LINE

The third specification in Table 3 adds the effect of ordering and upgrading on a firms' pricing strategy. ***PortBottom*** is negative and significant, ***PortTop*** is positive and significant, and ***Position*** is positive and significant. This suggests the following basic pattern: In line with the theoretical literature, firms discount their initial prices and charge a premium for their top products. This is consistent with pricing experience goods as well as pricing goods with switching costs. It is also consistent with the self-selection behavior discussed above. As consumers get to know the product better, appreciate better the value an e-presence can generate for them, and once they invested in learning it, firms increase prices as well as their premium. Interestingly, the more contracts a firm offers, the lower the initial price and the higher the top price. The discounts can reach more than 25% for product lines with four contracts, where the premium for the top contract in these product lines is around 35%. That is, firms seem to be tilting the entire pricing line in a way that lowers prices for basic contracts and raises prices of top contracts.

As mentioned in the introduction, Shapiro (1983) finds that whether firms should initially discount their product and then price it up, or the other way around, depends on whether consumers over-estimate or underestimate the quality of the product. Since consumer, most likely, underestimate the quality of carts offered by Relation firms (as this is not their core competence), the pricing strategy above makes sense for Relation firms. In the case of Specialists, however, this is not necessarily the case. While, as startup firms, consumers may have some uncertainty regarding their sustainability, since the eBSP market is the heart of their business, consumers probably expect Specialists to develop high quality carts. In order to examine Specialists pricing strategies, we define the following variables. ***PortSpecial*** interacts ***Portfolio*** (the number of contracts the firm offers) with ***Specialist***. ***PortSpecialBottom*** and ***PortSpecialTop*** then interact

PortSpecial with ***Bottom*** and ***Top***, respectively. Finally, ***PositionSpecial*** interacts ***Position*** (the location of the contract within the product line) and ***Specialist***.[17]

The coefficient on ***PortSpecialBottom*** is positive but not significant and the coefficient on ***PortSpecialTop*** is negative and significant. This suggests that while Specialists may find it optimal to mark up their initial contract, the uncertainty consumers have toward startups, together with the lock-in effect stops them from doing so. Still, combining the effects of ***PortTop*** and ***PortSpecialTop,*** Specialists discount their top contracts by almost 10%. This discounting strategy is consistent with the optimal pricing strategy in Shapiro (1983) for the case where consumers overestimate the quality of the product. Certainly, this discount may be a result of competition. We control for competition in the next section, and show that this result is not driven by competition.

Interestingly, once we control for pricing along the product line, both ***phonesupport*** and ***SpecialPhone*** become positive and significant. The premium charged for these services can be explained by either the confidence customer support gives consumers, or by the higher costs associated with these services. Finally, ***Notfixed*** is positive and significant, supporting the hypothesis that consumers value an upgrading path that balances the amount of storage and product slots. Consumers do not want to pay for storage or product slots they cannot use because of other limitations; therefore, firms must discount such contracts.

5.2 COMPETITION

The fourth specification in Table 3 presents the results controlling for competition. Both measures of competition are significant. The coefficient on ***numCarts*** is negative, which suggests that prices decrease as the number of carts offered within a segment increases. This result is in line with Thompson and Thompson (2008) who find in the hosting market that, once controlling for quality, firms' mean price decreases with the number of their immediate competing neighbors. The coefficient for ***marketSize*** is positive and seems to capture an unmeasured demand effect. The variables ***marketSizeBottom*** and ***marketSizeTop*** are the interactions of ***marketSize*** with ***Bottom*** and ***Top***, respectively. The coefficient on ***marketSizeTop*** is positive and significant. This result is in line with the premise that firms have more market power at the high end of their

[17] Unfortunately, the small number of observations of Brand firms in our dataset does not provide enough variation for us to study Brand firms' pricing strategies along the product line.

product line – once consumers have learned about the quality of their product and also experience high switching costs. Surprisingly, the coefficient on ***marketSizeBottom*** is positive as well, yet on the border of significance. To better understand the effect of competition on firms pricing strategies, we look at a "monopolistic market"—a box with only one contract, and compare it to the most competitive box—a box with sixty-three contracts and five competing carts.[18]

The results show that prices in the more competitive box are on average higher by 14% than the monopolistic market. While this result is very surprising on the surface, it is consistent with our findings in the data description section. While as Bresnahan, Stern and Trajtenberg (1997) suggest, in an industry with no obvious barriers to entry one would expect participants to seek out relatively under-populated market segments, we speculate that crowded product spaces—specifically, the top and bottom of the product space—are crowded because most users are there. The settings are competitive to some degree, but we cannot tell how much difference this competition makes. Endogenous entry means the statistics about the presence of suppliers are more informative about the size of demand than the competitive intensity of rivalry.

5.3 ROBUSTNESS CHECKS

Pricing within a Product Line. Our focus in the previous section was on differences across firms. To better understand a firm's pricing strategy, we next study the difference of prices within a portfolio. For each firm *i*, we define $priceDiff^i = \log\left(\frac{P^i_{Top}}{P^i_{Bottom}}\right)$, where P^i_{Top} and P^i_{Bottom} are the prices of the top contract and bottom contract offered by firm *i,* respectively. We run a regression with *priceDiff* as the dependent variable. This is a robustness check for our inferences in the hedonic price equation. This new equation has differenced out unobservables for two contracts coming from the same firm. It is identified from differences between firms. We define the differences in the product slots and storage offering in a similar way, $prodDiff^i = \log\left(\frac{productSlot^i_{Top}}{productSlot^i_{Bottom}}\right)$, $storDiff^i = \log\left(\frac{storage^i_{Top}}{storage^i_{Bottom}}\right)$. We use as many of the same variables as possible,

[18] The competitive segments—boxes—are based on the product-storage space introduced in Table 1.

dropping the measurement of competition, which cannot identify any single coefficient in this specification. Because we want to study price ranges, we look only at firms that offer portfolios with at least two contracts. The resulting data set includes 116 observations of 116 firms. We present the results in Table 5. This robustness check is largely consistent with the earlier specifications, though with less statistical significance due to the smaller number of observations.

In general, given the way firms tilt their prices along the product line, one would expect Brand firms to have larger price differences within the portfolio, while Specialists should have smaller price differences. In the first specification, both coefficients have the right sign, however both are not significant. Of the four third-party carts, only Akopia and AlaCart have significant coefficients. The coefficient for Akopia is positive, suggesting that offering an open source, ISPs that offer Akopia indeed tilt their pricing: reducing introductory contracts in order to attract consumers. Once consumers, however, have invested in understanding the product and learning how to work with it, these Relation firms can enjoy some market power and markup their top contracts. On the other hand, AlaCart's low quality does not allow its product to be marked-up, even once consumers experience high costs to switch to other alternatives. As expected, the results in specification II show that price differences increase with the number of contracts the firm offers. This effect is large and significant.

Quality levels. Shapiro (1982) studies firms' optimal quality decisions in markets where consumers are imperfectly informed about product quality. Viewing reputation as an expectation of quality, the paper finds that optimal quality level must lie below the perfect information quality level. While we cannot test this finding directly, as it is not clear what is the perfect information quality level in our case, we can test whether firms with brand name choose quality levels that are lower or higher than the average qualities in the market. Using the same data as in the price differential regression above, we run a regression with Quality as the left hand side variable, and firms' type: Brand, Specialist, Akopia, Kurant, AlaCart and Miva, on the right hand side. The results can be found in Table 6.

Table 6 about here

There are no surprises; the coefficient on Brand is negative and significant. This suggests that Brand firms indeed invest less in quality compared to other participants in the market. These firms take advantage of the reputation and brand name they have and expect to attract consumers based on these assets. Specialists' quality seems to be in line with the average quality in the market—the coefficient on Specialist is negative but not significant. Since this market is the heart of their business, one could imagine that consumers would expect a higher quality from this type of providers. This result then supports the pricing strategy we observed in the previous section where Specialist markup their introductory contracts, yet discount their top ones.

There is no uniformity in the quality choice of third party carts. The coefficients on Akopia and Kurant are positive and significant, while the coefficient on AlaCart is negative and significant. Note that since Relation firms only resell these carts, we are not interested in the quality choice of the third-party firms, but rather the cart choice of Relation firms. Out of the 105 Relation firms in our data, 17 chose Akopia, 28 chose Kurant, 20 chose Miva and 26 resell AlaCart. That is, more than 40% of Relation firms choose a cart that offers a higher than average quality. This suggests that, in line with our findings, most Relation firms suspected that previous relationship with the customer would most likely not help reduce consumers' uncertainty in the eBSP market, and thus chose to invest in a high quality cart.

6. *CONCLUSION*

Young technology markets typically feature high level of uncertainty as consumers are not sure about the quality of the products offered. Furthermore, many of these markets normally exhibit lock-in as consumers have high costs of switching from one firm to the other. Finally, these markets are mostly characterized by high fixed costs and very low variable costs. As a result of all these characteristics, pricing in such markets is a challenge. The theoretical literature offers a variety of optimal pricing strategies. In particular, versioning—creating different version of the same product—has been found especially beneficial in allowing consumers to segment themselves and thus choose their optimal version given their willingness to pay. Firms then must decide how to price their products along the product line.

We study firms' pricing strategies in such a young technology market: the eBusiness Service Providers market, where firms offer a product line of different versions of the same product. We find that both uncertainties about the quality of the good as well as the

existence of switching costs affect the way firms price in this market. Specifically, as often is the case, brand name in this market can substitute for experience. Firms with brand name in closely related markets can leverage their brand name and charge a premium in this market, as their reputation act as a guarantee for reliability. This is the "you never get fired for buying an IBM" effect. Interestingly, previous relationship in markets that are not as closely related to the eBSP market, do not provide sufficient confidence to allow for a premium. In addition, we find that since consumers' level of uncertainty regarding the quality of the product is relatively high, firms discount introductory contracts so as to allow consumers to experience the good and asses its quality. Firms then take advantage of switching costs and mark up top versions of their product. In contrast, a set of Specialists firms in our data set tilt prices in an opposite way: marking up introductory prices, while discounting the top versions of their product.

The theoretical literature offers two different explanations for these types of pricing strategies. Shapiro (1983) shows that whether a firm should "tilt up" or "tilt down" its prices depends on consumers' expectations with regards to the quality of the product. Alternatively, Bergemann and Valimaki (2006) find that in a mass market, optimal prices should decline over time, while in a niche market optimal prices should increase over time. Their definition of niche and mass market depends on the fundamentals of the industry. One should, therefore, expect to see different pricing policies across different industry, but not between firms within the same market. Based on their definition, pricing strategies in the eBSP market should likely follow pricing in mass market: Firms should discount introductory contracts and markup top contracts. While, indeed, many firms in this market follow this pricing strategy, there seem to be additional elements that affect firms' pricing strategy in this market. Specifically, we believe that consumers in this market overestimate the quality of the product Specialist offer. It is, therefore, optimal for these companies to "tilt up" their prices such that they markup introductory contracts and discount top ones.

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Table 1: Number of Contracts and Prices in the Products-Storage Space

Storage \ Product Slots	<25	26–100	101—500	501–10000	Unlimited	Total
<=50	17 *17.7*	29 *110.7*	7 *193.5*	5 *243.9*	45 *40.7*	103 *76.9*
51–150	24 *27.5*	11 *110.9*	10 *259.5*	15 *324.4*	57 *53.3*	117 *105.8*
151–300	24 *40.7*	12 *87.1*	4 *325*	13 *120.9*	54 *49.3*	107 *70.6*
301–2000	6 *43.1*	1 *64.95*	2 *325*	12 *259*	64 *102.6*	85 *125.3*
Unlimited		16 *134.5*	11 *285.9*	13 *416.8*	7 *55.3*	47 *236.2*
Total	71 *30.9*	69 *111.5*	34 *266*	58 *279*	227 *63.8*	459 *108*

Table 2: Descriptive statistics for carts

		Median Storage/Products Slots	Median Quality	Median Portfolio	Average Price
Locals:	**Akopia**	200/Unlimit	10	5	29.5
	Miva	250/Unlimit	7	3	82.8
	Kurant	200/500	9	4	249
	AlaCart	200/25	5	4	37.9
Specialists		100/500	7	3	126.8
Brand		75/150	4	3	141.8

Table 3: Price Regression Results

		I		II		III		IV	
		Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Type	**Brand**	0.56**	0.26	0.92***	0.32	0.63**	0.28	0.59**	0.28
	Specialist	0.07	0.24	1.19**	0.56	-0.35	0.57	-0.39	0.57
	Akopia	-1.03***	0.2	-1.46***	0.18	-1.57***	0.17	-1.53***	0.17
	Kurant	1.05***	0.196	0.8***	0.176	0.55***	0.15	0.56***	0.15
	AlaCart	-0.62***	0.195	-0.26	0.22	-0.29	0.2	-0.31	0.2
	Miva	-0.06	0.197	-0.45	0.17	-0.02	0.17	-0.03	0.17
Quality	**Quality**			0.17***	0.04	0.19***	0.035	0.18***	0.03
	PhoneSupport			0.13	0.098	0.16***	0.097	0.17*	0.096
	SpecialQual			-0.15*	0.09	-0.11*	0.062	-0.1*	0.06
	SpecialPhone			0.24	0.27	0.66***	0.21	0.64***	0.2
Product Line Pricing	**portBottom**					-0.066***	0.022	-0.08***	0.03
	portTop					0.088***	0.02	0.045*	0.03
	Position					0.097**	0.04	0.11**	0.04
	PortSpecialBottom					0.11	0.08	0.1	0.08
	PortSpecialTop					-0.18**	0.09	-0.17*	0.089
	PositionSpecial					0.52**	0.22	0.49**	0.22
	Notfixed					0.34***	0.11	0.34***	0.11
Competition	**numCarts**							-0.096*	0.05
	marketSize							0.01**	0.004
	marketSizeBottom							0.0037*	0.002
	marketSizeTop							0.0041**	0.002
Commodity Technology Attributes	**Constant**	2.35***	0.37	1.14**	0.49	1.57***	0.45	1.66***	0.47
	Log(ProductSlot)	0.12***	0.04	0.11***	0.04	0.07**	0.03	0.11***	0.04
	Log(Storage)	0.25***	0.05	0.25***	0.05	0.11**	0.04	0.08*	0.04
	InfProdSlots	-0.92***	0.36	-0.89***	0.34	-0.54**	0.24	-1.06***	0.32
	InfStorage	-0.76***	0.27	-0.81***	0.27	-0.034	0.24	0.05	0.24
		R^2 = 0.67 F(10,144) =32.3		R^2 = 0.7 F(14,144)=34.64		R^2 = 0.79 F(21,144) =77.8		R^2 = 0.79 F(25,144) =72.24	

SE = standard error
* = significant at the 10% level
** = significant at the 5% level
*** = significant at the 1% level

Table 4: Third-Party Carts' Pricing

Third-Party Cart	Cart Quality	Premium/Discount for Quality	Marginal Premium/Discount
Kurant	10	80%	151%
Kurant	8	48%	119%
Miva	7	32%	21%
Akopia	10	80%	-72%
AlaCart	5	0%	-35%

Table 5: Price Differences Regression Results

		I		II	
		Coef.	**SE**	**Coef.**	**SE**
Type	**Brand**	0.27	0.28	0.24	0.25
	Specialist	-0.03	0.17	0.04	0.15
	Akopia	0.21**	0.17	0.09	0.15
	Kurant	0.3	0.14	0.17	0.13
	AlaCart	-0.35**	0.17	-0.34**	0.15
	Miva	-0.15	0.16	-0.06	0.14
Product Line	**Portfolio**			0.23***	0.04
	Notfixed			0.09	0.13
Commodity Technology Attributes	**Constant**	0.74***	0.18	0.24	0.19
	prodDiff	0.05*	0.03	0.02	0.026
	storDiff	0.19***	0.04	0.032	0.05
	Inf	-0.07	0.13	-0.08	0.12
		$R^2 = 0.46$ $F(9,106) = 10.02$		$R^2 = 0.57$ $F(11,104) = 12.67$	

SE = standard error
* = significant at the 10% level
** = significant at the 5% level
*** = significant at the 1% level

Table 6: Quality Regression Results

		Coef.	SE
Type	**Brand**	-1.45*	0.8
	Specialist	-0.19	0.48
	Akopia	3.2***	0.46
	Kurant	2.23***	0.4
	AlaCart	-1.79***	0.43
	Miva	0.11	0.45
	Constant	6.79***	0.35
		R^2 = 0.69 F(6,106) = 39.84	

SE = standard error
* = significant at the 10% level
** = significant at the 5% level
*** = significant at the 1% level

APPENDIX

Table A1: Descriptive statistics

	Min	Max	Median
ProductSlots	10	∞	200,000
Storage	5	∞	200
Quality	2	10	8
numCarts	1	5	5
marketSize	1	63	44

Table A2: Dummy Variables:

	Description	**% with dummy=1**
InfProdSlots	InfProdSlots=1 if the firm does not limit the number of Product Slots	50%
InfStorage	InfStorage=1 if the firm does not limit the available memory	9%
Branded	Branded=1 if the firm has a brand name outside the eBSP market	3%
Relation	Relation=1 if the firm is an ISP	92%
Akopia	Akopia=1 if the firm offer Akopia Cart	18%
Kurant	Kurant=1 if the firm offers Kurant Cart	27%
AlaCart	AlaCart=1 if the firm offers AlaCart Cart	19%
Miva	Miva=1 if the firm offers Miva Cart	18%
NotFixed	NotFixed=1 if the firm does not fix the number of product slots and the available storage	28%