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Consumer Loyalty versus Propensity to Switch between Providers in Digital Product Markets

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How do software users decide on purchasing or replacing a software package? Software vendors, competing in a mature market, who want to increase their market share in a particular product niche, are interested in an answer. In this paper we explore the major factors of decision making, in regard to buying or upgrading software. We suggest a conceptual framework which reflects the decision making process, using the example of a specific group of software products – accounting software for small and medium enterprises (SMEs). The dimensions, identified as strategically important include price, software quality, switching costs and network effects.

Factors and conditions of commercial success affecting software acquisition, acceptance, and continuity of use have been of wide interest to the academic and industry communities. A comprehensive body of research has been developed, in many disciplines, investigating how software is being selected through the market, (Waterman, 1991; Varian, 1998; Macdonald & Sharp, 2000; Zheng Zhou et al, 2002), adopted (Davis, 1989; DeLone & McLean, 1992; Seddon et al, 1998), and how, with time, the perceptions of the system change shaping user intentions to repurchase software or switch to another provider (Karahanna et al., 1999; Bhattacherjee, 2001). Nevertheless, there is a clear need for a more integral approach, which incorporates multiple perspectives and their reciprocal influence on software development and acceptance by business customers.

Software markets fall in the category of digital product markets, which are a special case markets with quite distinctive characteristics (Shapiro and Varian, 1999). Switching costs, network effects, and customer lock-in mechanisms, in addition to price incentives, product utility and quality appear to be the factors
influencing both consumer choice and firms' competitive strategies in high technology markets, including, such as markets of software products.

According to (Klemperer, 1987a, b, c, and 1989), consumer switching costs (CSCs) may include transaction, learning, artificial and contractual costs. Transaction costs, as defined by Klemperer, are the costs that are incurred, by a consumer when ceasing a relationship with one supplier and switching to a rival brand. Learning costs occur when the learning undertaken by a consumer to use one brand is not applicable to other brands. The costs of switching, both in terms of lost productivity and money spent, may outweigh any perceived benefits. Artificial costs are created by firms in order to increase customer loyalty. Contractual CSCs are induced by contracts that commit consumers to buy a product or to use a service from a firm for a particular period of time or for a particular number of purchases.

The concept of the network effect has been established in the literature on infrastructure and utility sectors (Economides, 1996). The network effect is a positive externality that occurs where the benefit consumers perceive to be available from using a product, depends on how many others use it (Van Hoose, 2003). This concept has been applied to information and high-technology products in tandem with CSC (Farrell and Shapiro, 1988). In particular, Shapiro & Varian (1999) believe, that the challenge for firms seeking to introduce new technology, that is not compatible with existing technology, is to build network size and thus overcome the combined CSC of all consumers. This is particularly applicable to software product markets.

Generally, consumer lock-in is induced by a seller of good or service, and occurs where CSC are higher than the perceived benefit from using an alternate product (Van Hoose, 2003). Zauberman (2003), who also discussed this concept, concluded that consumer lock-in tends to decrease consumers' propensity to search and switch. Zauberman suggested further that lock-in occurs due to a consumer's preference to minimise immediate costs and an underestimation of the impact of future CSC. Shapiro & Varian (1999) categorised several types of lock-in, including durable purchases, loyalty programs, brand-specific training, the absence or insufficiency of tools for converting data into different formats, and others.

As long as market structures and competition are concerned, the majority of literature devoted to switching costs and network effects, has been dealing with oligopolistic markets that answer particular conditions. Market power is exercised by competitors acquiring their market shares and affecting market prices, while innovations, product variety or quality are not predominant competitive tools. Goods are assumed to be homogenous and each firm is assumed to possess some market power (e.g. Chen & Hitt, 2002, Elzinga & Mills, 1998, Farrell & Shapiro, 1988, Klemperer, 1987a,b,c, 1988, 1995, Valletti, 2000), allowing them to price at above marginal cost and obtain monopoly profits.

While these conditions are adequate for many markets, they do not include essential properties required for realistic analysis of digital product markets. As Odlyzko (2000) puts this, "the central paradox of information appliances is that
they are aimed for a mature market with a mature technology, but their wide spread will ignite an explosion of innovation that will destroy any stability that might exist."

In this paper we suggest a conceptual model of digital product markets that incorporates the following considerations:

- The market is monopolistically competitive with properties redefined for mature digital product markets, where non-price tools are broadly used, and can be seen as prevailing in rivalry between competitors;
- Consumer behavior is based on utility and price consideration as well as on product quality and innovation, switching costs, consumer lock-in, and network effect; and
- Product quality, as well as switching costs, consumer lock-in, and network effects are essential factors for producer decision making.

Then we present aggregated results of an empirical study of the market of accounting software packages for SMEs, confirming the ranking and importance of the variables included in the conceptual model.

Finally, we formalize the suggested concepts in a simple theoretical model of monopolistic competition in mature digital product markets, which incorporates the variables of product quality and switching costs.

A Conceptual Model

A conceptual model suggested in this paper is based on and is a further extension of both the conventional model and the model of monopolistic competition in information product markets developed in Kazakevitch & Torlina (2003).

We consider a market for a software product that satisfies the conventional properties of monopolistic competition (See for, example, G. A. Jehle, 1991). The market consists of a number of providers. For the purposes of this study, the providers can be considered as mono-product firms. The product variants, produced by different providers are viewed by the buyers as close though not perfect substitutes for one another. Therefore, each of the providers can be considered as the monopolist of its particular product variant with a limited degree of monopoly power. Such a monopolist is enjoying a monopoly power and making economic profit during only a short period of time from the introduction of a unique product or technology until such a technology becomes available to rivals, or until a new "more innovative" product is introduced by a rival. Provider's common objective is profit maximisation. Willingness to supply the product is elastic and increases with increase in price. User's common objective is utility maximisation. User's demand is elastic and decreases with increase in price.
The model extends the economic theory of monopolistically competitive markets as follows.

(1) From the supply side perspective, digital products possess some distinctive properties. Those properties include: (i) Multiple and heterogeneous sources of value embedded in the product itself; (ii) Specific production cost structure - high fixed costs, negligible variable costs and, therefore, zero marginal cost. Initial fixed costs, including usually high marketing and promotion expenditure, in most cases are sunk costs, that cannot be recovered if a product fails; (iii) Extreme economies of scale - in the general case of digital product there are no natural or economically justified limits to production of additional copies; (iv) No direct interconnection between costs spent on the production of the first copy and product price; and (v) Product valuation by potential consumers and consumer demand are key price determinants.

(2) An assumption of the neoclassical model of monopolistic competition is reconsidered that the technology used in the production of all product variants is perfectly available to all the providers. We also see the digital product engineering technology as perfectly available to everyone wishing to enter the market as well as to the existing market participants. However, each portion of cutting-edge technological information spills over not immediately. Its availability, for the time being, may be restricted by commercial secret protection, patenting or licensing. Therefore, within each particular short-run period, each of the firms possesses some unique product-attributable elements of otherwise common technology. These unique elements of use of the technology are what make the product variants different. Those elements are also embedded in the unique cost structure of each of the product variants. The differences are viewed by the buyers as differences in several quality characteristics.

(3) The quality of digital products, in general, and software product, in particular, is an important factor of the user's choice of the product variant from the available on the market ones. Quality is a complex characteristic, which may include product content and functionality, user interface, ease of learning, warranty, service and support provided, and many other things. For the purpose of the model, "quality" is considered as perceived quality that may include both real improvement as well as a successful marketing component. In Kazakevitch & Torlina (2003) we show how multiple quality characteristics can be aggregated and the aggregate is used in the model as an endogenous scalar variable. Increase in quality can be achieved by a firm only through increase in the cost of the first copy or setting up the services of supporting the product. Each firm is characterised by its cost elasticity of quality.

(4) It is also assumed that the costs of switching from the current provider to a different one, embedded in the product and/or product support are heterogeneous, can be viewed differently by individual consumers, and can be aggregated into a scalar variable similarly to product quality characteristics. We assume that generally, imposing switching costs, discouraging consumers from switching to other providers, is not free to the provider. Furthermore, the
expenses incurred as the result of imposing the switching costs can be themselves accounted for as a component of the costs of production of the new product version.

(5) A structured definition of the mature market of software product is introduced. A market is considered as mature if: (i) the number of users is not growing; (ii) all the users have acquired a "previous" version of a digital product variant from a chosen provider; and (iii) now are facing the emergence of a new generation of the product they are using.

The conceptual model of software re-purchasing/upgrade in monopolistic markets with switching costs is shown on Figure 1.

**Figure 1. A Conceptual Model of Software Product Repurchasing/Upgrade in a Monopolistic Market with Switching Costs**

Customers-users are facing the choice of one out of three possible strategies:

- **Not upgrading the current version of software.** The user chooses this strategy if the opportunity cost associated with using a not upgraded software package does not exceed the cost of upgrading (with either the current or a different provider).
- **Upgrading with user's existing provider.** This is the optimal strategy if a positive net benefit is expected as the result upgrading, and the net benefit of upgrading with the current provider is greater than the net benefit of switching to another one.
Switching to another provider. Like in the previous case, the net benefits of upgrading should be positive. However, the net benefit as the result of switching to another provider is greater than of remaining loyal to the current one.

The choice of an upgrade strategy by users is generally based on the following factors:

Costs of not upgrading. If the users decide not to upgrade the current versions of the product, generally they may incur the costs that would not be incurred otherwise. In particular, those costs are due to lower productivity of the older versions; possible decrease in the communality with other users who opt for upgrading; downgrading the level of support of older versions by providers; inefficient work on or incomplete compatibility with a newer hardware; etc.

Quality of new versions. The user might be the more interested in upgrading the more improvement in the quality of the product is achieved by the provider(s). Therefore, investing in the quality of new version is the main tool by which the provider tries to retain existing users and attract new users, who have been previously using competing products.

Prices for new versions. The user is inclined to compare the prices for the new versions of competing products.

Switching costs of upgrading with the current provider and costs of switching to a different provider (embedded into the product). The user compares the switching costs of upgrading with the current provider versus the costs of switching to an alternative one. Those costs may include the costs of data conversion and other costs of implementation; the cost of training; etc. The provider includes the switching costs tools in its production and marketing strategies, insuring that unavoidable switching costs of upgrade for a newer version of its product are lower than the costs of switching to another provider.

Policies increasing comparative costs of switching for (locking in) existing users. Switching cost of upgrading are technically inevitable. Some time and work are required for replacing one product with another one; for adjusting certain settings, for converting/transferring data, as well as for training personnel. Meanwhile, the provider can actively affect the level of switching costs for their existing users, making transition to a different provider more difficult. For example they can limit convertibility of data, or just lock their users into a purchasing/servicing contract.

Policies decreasing comparative costs of switching to the new versions of their products by both existing users and “newcomers” (users coming from other providers). In particular, providers may wish to supply data converters and/or training for personnel. Such measures, however, are not cost-neutral.

Network effect. The network effect may impact on decision making. The more users decide to upgrade their product with a particular product, the more users may feel to be under pressure to do so. The provider, therefore may wish to invest in creating or upgrading an industry standard, such as data format or communication protocol, that is able to affect the magnitude of the
network effect. Further in this paper, we assume that network effect is associated either with the quality of the product or with the cost of switching to other providers.

Summarizing all the above-mentioned factors, increase in quality, cost of switching to other providers, and network effect can be generally attained only at additional costs. The providers are characterized by generally different cost functions. Therefore, the incremental cost of increase in quality differs from one firm to another. Each of the firms sets the price to cover the costs and to earn profit, depending on anticipated number of users. Different incremental costs allow them for different degrees of freedom in setting a minimum price, which covers the provider's costs and returns at least normal profit.

Therefore, on the users' demand side, relative increase in quality, as well as in switching costs, causes relative increase in demand for particular provider's product variant. Increase in demand is also amplified by the network effect. Relative increase in price causes decrease in quantity demanded. Firms' cost-quality and switching cost inducement decisions affect their relative competitive positions. Total change in demand for the product of a particular firm can be negative or positive and varies from one firm to another. Ultimately, in the mature market of software product, with the release of new generation (versions) of the competitive products, a new equilibrium position for each of the providers can be characterised by increased, decreased or unchanged market share.

Some Empirical Evidence

The importance of the above-mentioned factors of the consumer choice of software products was verified for the market of accounting software used by small and medium enterprises (SMEs). The data was collected by interviewing the representatives of 120 SMEs who are the current users of one of 11 accounting software products. A structured Likert scale questions were asked corresponding to 32 detailed factors identified as specific to this software product market. Based on the collected data, the factors are ranked within each of three groups of users who have chosen one of the above-mentioned product upgrade/no upgrade options.

The discriminant analysis has been applied to establish a relationship between independent variables (factors), in terms of their relative importance, and dependant variables (consumers' decision with regard to upgrade and loyalty). Generally, this statistical tool is designed for determining which variables discriminate between two or more groups of cases in the sample. It allows studying the difference between groups simultaneously, determining whether meaningful differences exist, and, identifying the discriminating power of each variable (Klecka, 1980). Classification Function Coefficients (CFC), obtained as the result of the discriminant analysis, are the actual coefficients of the Fisher's linear discriminant functions, ranking the relative
importance of independent variables for discriminated groups. The Wilks' Lambda indicates that there is a significant difference among groups across all independent variables, if the significance level is below 0.1.

Two variants of the discriminant analysis were undertaken – on aggregated and disaggregated variables. The aggregate analysis was conducted on the variables, combining the ranks of detailed variables in the following ones:

- Price factor
- Quality factor
- Switching cost factor
- Network factor

The discriminant CFCs and corresponding ratings of the customers' aggregate decision making factors (Table 1) demonstrate identical rating of factors by three groups of customers. The Wilks' Lambda Significance level (above 0.1) demonstrates insignificance of differences between the three groups with regard to the aggregate decision-making variables.

<table>
<thead>
<tr>
<th>Aggregate factors of decision making</th>
<th>Attitude towards upgrade</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Non-upgrading</td>
<td>Upgrading with the same provider</td>
</tr>
<tr>
<td>Price factor</td>
<td>.366</td>
<td>4</td>
</tr>
<tr>
<td>Quality factor</td>
<td>11.875</td>
<td>1</td>
</tr>
<tr>
<td>Switching cost factor</td>
<td>1.385</td>
<td>3</td>
</tr>
<tr>
<td>Network factor</td>
<td>2.739</td>
<td>2</td>
</tr>
<tr>
<td>(Constant)</td>
<td>38.891</td>
<td>-37.823</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Wilks' Lambda</th>
<th>Chi-square</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>.961</td>
<td>4.141</td>
<td>.941</td>
</tr>
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</table>

Out of those variables, the most important appears to be the Quality Factor followed by the Network and Switching Cost factors. The Price Factor appears the least important in decision making. This only confirms the key consideration of this paper that the market concerned is a mature monopolistically competitive with non-price tools prevailing in the rivalry between the competitors.
Insignificance of the difference, with regard to the aggregate factors between the three groups of customers, is an important result allowing for constructing a uniformed consumer demand function. Meanwhile the difference between the groups with regard to the detailed product specific variables\(^1\) appears to be statistically significant and can be suggested to the providers of this kind of software for tuning up their production and marketing strategies.

**An Attempt of Theoretical Explanation Using the Game Theory Approach**

Consider a market of a software product that satisfies the conventional properties of monopolistic competition (Jehle, 1991). The market consists of \(n\) mono-product firms. The products \(i \in [1, n]\) are viewed by the buyers as close, though not perfect substitutes for one another. Therefore, each of the sellers can be seen as the monopolists of its particular product variant with a limited degree of monopoly power. Following our earlier article (Kazakevitch, Tortlina, 2003), we assume, however, the simplest case where all the quality characteristics of each of the products \(i\) can be aggregated into the scalar quality characteristic \(q_i\). We also assume that, in the short run, the quality variable \(q_i\) depends upon the cost of the production of the original copy of product \(c_i\):

\[
q_i = q_i(c_i)^{2}; \quad (1)
\]

where

\[
\frac{dq_i(c_i)}{dc_i} > 0; \ c_i \in C_i \subset R^+ \quad (2)
\]

(2) means increase in the value of the quality variable as the result of increase in costs within a particular range of costs \(C_i\) for a particular firm \(i\). However, it does not say anything about comparison between the values of quality variables of two firms. They depend upon the differences between the cost functions of different firms. In other words, greater costs of firm \(i\) compared to firm \(j\) generally can lead to a lower of the quality variable of firm \(i\), as it is viewed by buyers. In the long run, the quality can be also improved using

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\(^1\)The detailed list of the product-specific variables as well as results are omitted in this paper due to space constraints.

\(^2\)Here and below, differentiability of functions within continuous intervals of independent variables is assumed.
technological innovations, which are not directly associated with the cost \( c_i \). In addition, we introduce cost variables

\[
s_i = s_i(c_i); \quad \frac{ds_i(c_i)}{dc_i} > 0; \quad c_i \in C_i \subset R^+ \tag{3}
\]

for switching costs from provider/product \( i \), imbedded in the product itself and/or its support.

The key assumption about software products is that the costs \( c_i \) associated with the first copy is the actual total cost of production of the first and any further number of copies:

\[
c_i = c_i(y_i) = \text{const} \tag{4}
\]

or, in other words, marginal cost is equal to zero.

The demand \( y_i \) for product \( i \) is measured in the quantity of copies. It is assumed that the same buyer does not simultaneously purchase two analogous products from competitive sellers. Therefore, it is possible to measure total demand for all the variants of the product \( y \) by adding together the number of copies sold by each of the firms:

\[
y = \sum_{i=1}^{n} y_i . \tag{5}
\]

We assume demand conventionally negatively depends upon the price \( p_i \) and positively depends upon the demand for the competitive products \( y_{-i} = \sum_{j} y_j \mid j \in [1, n]; j \neq i \). Based on (4), \( y_{-i} \) can be measured as

\[
y_{-i} = y - y_i . \tag{6}
\]

Furthermore, the total consumer demand in the mature market can be considered as limited to a particular number of sales/customers. We also assume demand positively depends upon the product quality variable \( q_i \) as well as upon switching costs \( s_i \) incurred by the existing customers of product \( i \), if they decide to switch to one of the competing products. Therefore, the demand for product \( i \), as viewed by a seller \( i \), can be represented as a function:

\[
y_i = y_i(p_i, y_{-i}, q_i(c_i), s_i(c_i)) ; \tag{7}
\]

or its inverse

\[
p_i = p_i(y_i, y_{-i}, q_i(c_i), s_i(c_i)) . \tag{8}
\]
Even though, non-conventional demand functions are assumed, we are using the model of such a market as a non-coalition game with profit as pay functions. In other words, each of the firms maximises its profit:

$$\Pi_i = y_i p_i (y_i, y_{-i}, q_i(c_i), s_i(c_i)) - c_i \rightarrow \max,$$ \hspace{1cm} (9)

or, considering (9):

$$\Pi_i = y_i p_i (y_i, y - y_i, q_i(c_i), s_i(c_i)) - c_i \rightarrow \max.$$ \hspace{1cm} (10)

We are also adopting the standard "Cournot-style" behavioral hypothesis. Firm $i$ makes its product/expenditure/price decision assuming the other firms' behavior will be unchanged. Then, in principle, the following two cases can be considered: (i) not everyone of the customers' population decides to upgrade; and (ii) eventually everyone upgrades. In case (i) the Cournot hypothesis means that provider assumes $y_{-i} = \text{const}$, while $y_{-i} + y_i < Y$, and the solution of the optimisation problem (10) closer follows the one for the standard model of monopolistic competition. Case (ii) implies $y_{-i} = y - y_i$, and there is a functional link between the market share of upgrade with the firm $i$ and its competitors. We adopt case (i) as corresponding to our empirical evidence. The first order equilibrium conditions for (10) appear to be more sophisticated than for the standard model:

$$y_i \frac{\partial p_i(y_i, y_{-i}, q_i(c_i), s_i(c_i))}{\partial y_i} + p_i(y_i, y_{-i}, q_i(c_i), s_i(c_i)) = 0; \hspace{1cm} (11)$$

and

$$\left( \frac{\partial p_i(y_i, y_{-i}, q_i(c_i), s_i)}{\partial q_i} \frac{\partial q_i}{\partial c_i} + \frac{\partial p_i(y_i, y_{-i}, q_i(c_i), s_i)}{\partial q_i} \frac{\partial q_i}{\partial c_i} \right) y_i - 1 = 0 \hspace{1cm} (12)$$

For obtaining interpretable results, let as assume the separability of the demand functions in the Cobb-Douglas form:

$$q_i = q_i(c_i) = c_i^{a_i}; \hspace{0.5cm} s_i = s_i(c_i) = c_i^{s_i} \hspace{1cm} (13)$$

and

$$y_i = a c_i^{a_i+s_i} p_i^{s_i} (y_{-i})^{a_i}, \hspace{1cm} (14)$$

where
Consumer Loyalty versus Property to Switch between Providers in Digital Product Market

Market structures and competition has been modified to include specific characteristics of such products and markets. In particular, quality and switching costs are included in the model as endogenous variables. This enables theoretical analysis of competitive strategies with possible outcomes for practice.

In the traditional monopolistic competition a partial monopoly power is achieved by releasing an innovative product. The monopoly power ends with rivals gaining access to the new technology and taking over some of the leader's market share. Meanwhile, the rivals' cost functions are not distinguished. In contrary, an essential feature of the digital product in general, and software markets in particular, considered in this paper, is different firms' cost as well as switching cost functions. This allows for deriving the key conclusion with regard to firm's business strategies. The survival and competitiveness of a firm operating in a digital product market depend on firms' ability to contribute to the quality of its product, as well as to the diversion from the rivals' products, with less than proportional increase in cost components affecting the product's minimum price.

Meanwhile, based on primary data collection, the empirical analysis of the accounting software for SMEs supports the choice of the variables explaining consumer demand in such markets.

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\[ \alpha_i > 0 \] can be interpreted as the cost elasticity of demand; it is positive because costs of the first copy of the new version of product contributes to its quality; 
\[ \beta_i < 0 \] is the conventional negative price elasticity of demand; 
\[ \gamma_i < 0 \] is the elasticity of demand for product \( i \) with respect to the demand for the competitive variants of the product; it is negative because within a given capacity of mature market, the demand for product \( i \) decreases, with increase in demand for competitive products; and 
\[ \delta_i > 0 \] is elasticity of demand for product \( i \) induced by expenditure for first copy of this product affecting product-imbedded switching costs from this product.

The inverse of (14) is:

\[
p_i = p_i(y_i, y_{-i}, q_i(c_i)) = \frac{1}{\alpha} c_i \left( \frac{\alpha + \beta_i}{\alpha} \right) y_i \left( y_{-i} \right)^{-\frac{\beta_i}{\alpha}} . \tag{15}
\]

Substituting (15) into (11) and (12), after some transformations, gives the following equilibrium condition:

\[
y_i p_i = -\frac{\beta_i}{\alpha_i + \delta_i} c_i \tag{16}
\]

Equation (16) appears to be the key condition for the understanding firm's situation in the market. It means that the firm earns a positive profit only if

\[
-\frac{\beta_i}{\alpha_i + \delta_i} > 1, \text{ or } -\beta_i > \alpha_i + \delta_i . \tag{17}
\]

Combining (17) with the interpretation of the elasticity parameters in (13) and (14) gives the following outcome.

The firm is able to make a positive profit, only if relative increase in demand, associated with combined increase in quality and switching costs, per unit of relative increase in the cost of production is not offset by relative decrease in demand per unit of relative increase in price. Otherwise, the know-how available to this firm's is not capable of delivering competitive combined levels of quality and diversion from switching per unit of its fixed costs.

**Conclusion**

The paper gives some insight into both consumer behaviour and competitive mechanisms in digital product markets. The traditional theoretical approach to


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