This is the published version (version of record) of:


Available from Deakin Research Online:  
[http://hdl.handle.net/10536/DRO/DU:30017795](http://hdl.handle.net/10536/DRO/DU:30017795)

Reproduced with the kind permission of the copyright owner.

**Copyright**: 2008, International Academy of Business and Economics
COMPETITION IN MATURE SOFTWARE MARKETS
Luba Torlina, Deakin University, Melbourne, Australia
Gennadi Kazakevitch, Monash University, Melbourne, Australia

ABSTRACT

A theoretical framework is built for capturing properties of competition in mature monopolistic digital product markets. Based on an empirical study of the market of accounting software for small and medium enterprises, a consumer choice model is suggested, where a rational consumer is already using a particular version of a software package and is considering to choose from the following three options: either to continue using it, or to upgrade to a newer version of the product, or to switch to a competitive product. Consumer decision is justified by software quality, and network effects, under the price and switching costs constrains. A modified consumer demand function is used for the model, and theoretical conditions are analysed for choosing from one of the three above-mentioned options. The results are applicable to a wide range of digital products.

Key words: Mature markets; Product Quality; Consumer Choice; Monopolistic Competition.

1. INTRODUCTION

How do software users decide on purchasing or replacing a software package? Software vendors, 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. A conceptual framework suggested here reflects the decision making process. The dimensions, identified as strategically important include price, software quality, switching costs and network effects. An example of accounting software for small and medium enterprises (SMEs) was used for this study.

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. Software markets fall in the category of digital product 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.

Consumer switching costs (CSCs) may include transaction, learning, artificial and contractual costs (Klemperer, 1989). Transaction costs 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 depends on how many others use the product. 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.

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). Consumer lock-in tends to decrease consumers’ propensity to search and switch and occurs due to a consumer’s preference to minimise immediate costs and an underestimation of the impact of future CSC (Zauberman, 2003).

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 & Hsiao 2002, Elzinga & Mills, 1998, Farrell & Shapiro, 1988, Klemperer, 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.

The rest of the paper is structured as following. Firstly, we suggest a conceptual model of digital product markets that incorporates essential properties for further analysis:

- The market is monopolistically competitive and mature. 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. Additionally, product quality and innovation, switching costs, consumer lock-in, and network externalities affect consumer decision; and
- Producer is aiming at high product quality. Additionally, switching costs, consumer lock-in, and network effects are essential factors for producer decision making.

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

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

2. A CONCEPTUAL MODEL

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 maximization. Willingness to supply the product is elastic and increases with increase in price. User's common objective is utility maximization. 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) Heterogeneous sources of value embedded in the product itself; (ii) Specific production cost structure - high fixed costs, negligible variable costs and zero marginal cost. Initial fixed costs include high marketing and promotion expenditure, which are sunk costs if a product fails; (iii) Extreme economies of scale - generally there are no limits to production of additional copies; and (v) Product valuation by potential consumers and consumer demand are key price determinants, not the costs spent on the production of the first copy.

(2) An assumption of the neoclassical model of monopolistic competition is reconsidered. The technology-based barriers to entry are low. 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.
The quality of software product is an important factor of the user's choice of the product variant from those available on the market. 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. Quality is considered as perceived quality that may include both real improvement as well as a successful marketing component. For the purpose of the model multiple quality characteristics can be aggregated into 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.

It is assumed that the costs of switching from the current provider to a different one, 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.

A majority of software markets become mature markets. A market is considered as mature if the number of users is not growing because all the users have acquired a "previous" version of a digital product from a chosen provider; and now are facing the emergence of a new generation of the product they are using.

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

- Not upgrading; Upgrading with existing provider; or switching to another provider. The user's strategy depends on the net benefits associated with each of the choices.

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 productivit 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 more interested in upgrading if 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. Generally costs of upgrade for a newer version of a product should be 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 the 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 characterized by increased, decreased or unchanged market share.

3. 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.

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 appears to be statistically significant and can be suggested to the providers of this kind of software for tuning up there production and marketing strategies. (The detailed list of the product-specific variables as well as results are omitted in this paper due to space constrains.)

**Table 1** Discriminant Classification Function Coefficients and Ratings of the Customers’ Aggregate Decision Making Factors

<table>
<thead>
<tr>
<th>Aggregate factors of decision making</th>
<th>Attitude towards upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-upgrading</td>
</tr>
<tr>
<td>Price factor</td>
<td>.366</td>
</tr>
<tr>
<td>Quality factor</td>
<td>11.875</td>
</tr>
<tr>
<td>Switching cost factor</td>
<td>1.385</td>
</tr>
<tr>
<td>Network factor</td>
<td>2.739</td>
</tr>
<tr>
<td>(Constant)</td>
<td>38.891</td>
</tr>
</tbody>
</table>

<table>
<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>
</tbody>
</table>

4. CONCLUSION

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


Karahanna, Elena; Straub, Detmar W.; Chervany, Norman L. (1999) "Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs". MIS Quarterly, Vol. 23 (2)


AUTHOR PROFILES:

Dr. Luba Tortina is Senior Lecturer in Information Systems at Deakin University, Victoria, Australia. The areas of her research interests are economics of digital products, management information systems, and knowledge management.

Dr. Gennadi Kazakevitch is Senior Lecturer in Economics at Monash University, Victoria, Australia. The areas of his research interests and publications include market structures, deregulation, competition, as well as economics of high technology and digital product markets.